Public Documents of Maine:

BEING THE

ANNUAL REPORTS

OF THE VARIOUS

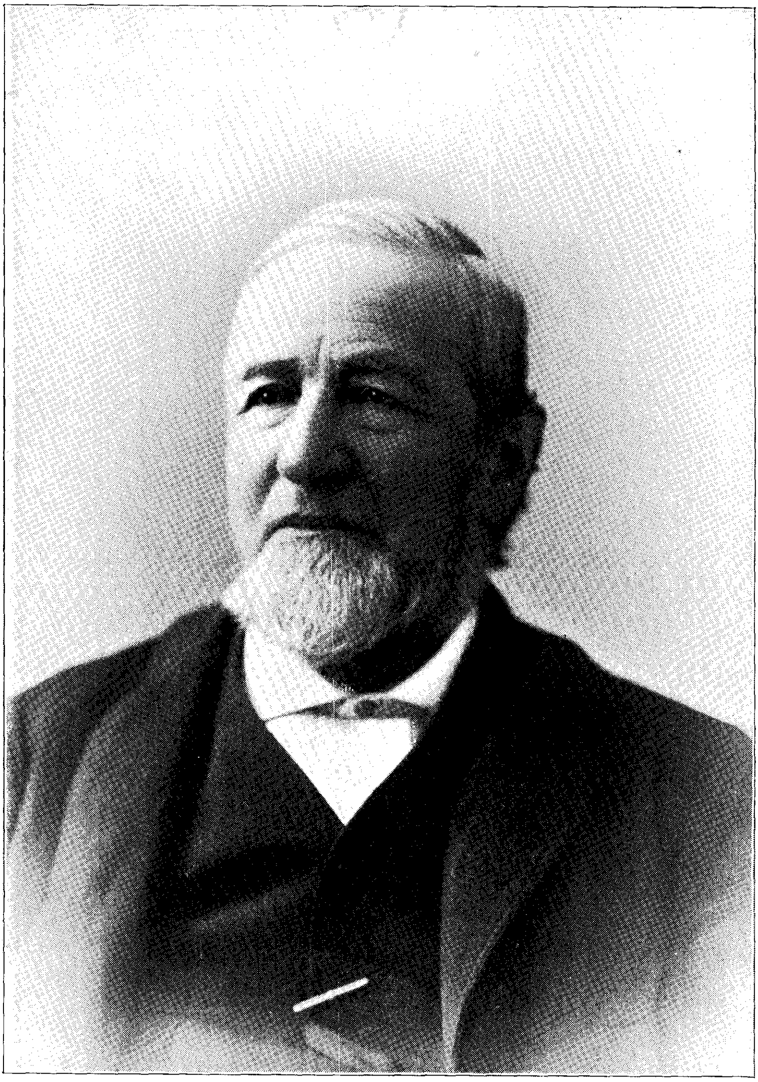
Departments AND Institutions

FOR THE YEAR

1898.

VOLUME I.

AUGUSTA
KENNEBEC JOURNAL PRINT
1900



STEPHEN LINCOLN GOODALE.
Secretary Maine Board of Agriculture from 1856 to 1873.

AGRICULTURE OF MAINE.

FORTIETH ANNUAL REPORT

OF THE

SECRETARY

OF THE

BOARD OF AGRICULTURE

FOR THE YEAR

1897.

PRINTED BY ORDER OF THE LEGISLATURE.

AUGUSTA
KENNEBEC JOURNAL PRINT
1898

STATE OF MAINE.

To the Honorable, the Governor and Council of Maine:

In compliance with the laws of the State, I have the honor to present the report of the doings of the Maine Board of Agriculture for the year 1897.

B. WALKER McKEEN, Secretary.

Augusta, May 1, 1898.

MAINE BOARD OF AGRICULTURE—1897.

OFFICERS.

J. W. DUDLEY, President.
W. H. MOODY, Vice President.
B. WALKER McKEEN, Secretary.

Members Chosen by County Agricultural Societies.

			Term expires 3d Wed. in January.
Aroostook County,	J. W. Dudley,	Castle Hill,	1898
Franklin "	C. E. Wheeler,	Chesterville,	1898
Knox "	E. E. Light,	Union,	1898
Penobscot "	George N. Holland,	Hampden,	1898
Piscataquis "	W. H. Snow,	Milo,	1898
Androscoggin "	B. F. Briggs,	Auburn,	1899
Kennebec "	W. G. Hunton,	Readfield,	1899
Waldo "	W. H. Moody,	Liberty,	1899
Washington "	A. R. Lincoln,	Dennysville,	1899
Lincoln "	John M. Winslow,	Nobleboro,	1899
Cumberland "	John J. Frye,	Portland,	1900
Oxford "	John F. Talbot,	Andover,	1900
York "	L. O. Straw,	Newfield,	1900
Somerset "	S. H. Goodwin,	St. Albans,	1900
Sagadahoc "	T. E. Skolfield,	Brunswick,	1900
Hancock "	Nahum Hinckley,	Bluehill,	1900

Members from the University of Maine.

Dr. A. W. Harris, Orono.
Prof. Chas. D. Woods, Orono.

Elected by the Board.

B. Walker McKeen, Secretary.

MAINE BOARD OF AGRICULTURE—1898.

OFFICERS.

W. H. MOODY, PRESIDENT.
E. E. LIGHT, VICE PRESIDENT.
B. WALKER McKEEN, SECRETARY.

MEMBERS CHOSEN BY COUNTY AGRICULTURAL SOCIETIES.

Term expires 3d Wed. in January.

Androscoggin	County,	B. F. Briggs,	Auburn,	1899
Kennebec	"	W. G. Hunton,	Readfield,	1899
Waldo	"	W. H. Moody,	Liberty,	1899
Washington	"	A. S. Farnsworth,	Pembroke,	1899
Lincoln	"	John M. Winslow,	Nobleboro,	1899
Cumberland	"	John J. Frye,	Portland,	1900
Oxford	"	John F. Talbot,	Andover,	1900
York	"	L. O. Straw,	Newfield,	1900
Somerset	"	S. H. Goodwin,	St. Albans,	1900
Sagadahoc	"	T. E. Skolfield,	Brunswick,	1900
Hancock	"	Nahum Hinckley,	Bluehill,	1900
Aroostook	"	Jonathan Benn,	Hodgdon,	1901
*Franklin	"			1901
Knox	"	E. E. Light,	Union,	1901
Penobscot	"	Geo. N. Holland,	Hampden,	1901
Piscataquis	"	W. H. Snow,	Milo,	1901

MEMBERS FROM THE UNIVERSITY OF MAINE.

Dr. A. W. Harris, Orono.
Prof. Chas. D. Woods, Orono.

ELECTED BY THE BOARD.

B. Walker McKeen, Secretary.

* Member to be appointed by the Governor.

MAINE BOARD OF AGRICULTURE.

ANNUAL MEETING, 1898.

The annual meeting of the Maine Board of Agriculture was held at the rooms of the Board, State House, Augusta, January 19 and 20, 1898.

WEDNESDAY, A. M.

Meeting called to order by W. H. Moody, vice president. Committee on Credentials, appointed by the Chair, Nahum Hinckley, John F. Talbot, John M. Winslow. This committee, after considering the credentials submitted to them, reported Jonathan Benn of Aroostook county, E. E. Light of Knox county, A. S. Farnsworth of Washington county, and W. H. Snow of Piscataquis county, duly elected members of the Board; but stated that on account of a peculiarity in the credentials of the gentleman from Penobscot county, these would be submitted to the full Board. This report was accepted, and the credentials taken under consideration, and after discussion it was

Voted, That the Board do not accept the credentials of Mr. Holland as a member of the Board from Penobscot county.

Committee to receive, sort and count votes, appointed by the Chair, W. H. Snow, E. E. Light, and A. S. Farnsworth.

Officers were elected as follows: President, W. H. Moody; vice president, E. E. Light; secretary, B. Walker McKeen; executive committee, W. H. Moody, E. E. Light, W. G. Hunton; member of Advisory Council of the Experiment Station, B. W. McKeen. O. O. Stetson was appointed messenger for the Board during the session.

Adjourned to 1.30 P. M.

WEDNESDAY, P. M.

Committee on pay roll, appointed by the Chair, L. O. Straw, T. E. Skolfield and S. H. Goodwin.

REPORT OF THE SECRETARY.

Mr. President, and Members of the Board of Agriculture:

The work of the Board of Agriculture has progressed along about the same lines the year just past, as formerly, and we have to note no very marked changes in any direction. There are certain problems which seem to confront the farmers of Maine, with more force than ever before. Principal among these, may be named the necessity for more economical production. The prices of all farm products remain low, and he who studies the cost of production the most carefully and keeps this very important factor where it should be, will succeed, while those who fail to take note of it will most assuredly be driven to the wall.

There is no question but that the farmers of Maine are still buying too much from outside their farms. They are looking too far for feeds and for fertilizers.

The true elements of success upon Maine farms to-day, are self-supporting crops, and carefully husbanded fertility. The advent of special money crops was a step in advance, we all admit, but when the entire resources of the farm are turned towards such production, and the owner is forced into the market to purchase his supplies for the home, he is making a mistake that must in time drive him from his business as a profitable producer.

Everything may go well as long as the markets are good; when they are hard and prices low the crisis comes, and he falls.

As we progress along lines of true prosperity we must necessarily depend less and less upon outside resources for our supplies, must produce more, while still holding the markets for our special crop.

The crops of our State for 1897, with the exception of apples and potatoes, were good. The stock feeder, generally, had at the beginning of the feeding season an abundance of fodders and could feel confident of a fair amount of success in his business. Those who were depending upon the selling of crops were sure of fair prices for their goods. With the partial failure of our potato and fruit crops there have come to us lessons which, if heeded, will be of value in the future. The potato blight must be controlled, and he who takes note of this fact and sprays for it as persistently and systematically as he does for the bugs will be rewarded with good crops. The apple crop of 1896 was so large that many did not get fair pay for their labor in harvesting, and consequently many bushels of apples were left upon the ground to become breeding places for insects and fungus diseases. With the exhaustion of the tree by its excessive bearing of last year came a favorable condition for the attacks of disease and the inability to bear fruit. The result was a small crop of very poor apples.

It would appear that there ought to be some plan devised to equalize the bearing and thus preserve the vitality of the tree, and we are inclined to the belief that thinning early in the season, as advocated by Mr. Pope, together with liberal fertilization, will in great measure prevent a recurrence of this very unpleasant condition.

NEW AVENUES OF TRADE.

We have noted with much interest the commendable efforts of Secretary Wilson to extend the sale of our dairy goods abroad, and feel that this is a step in the right direction. We hope the work may be continued until the foreign markets shall be supplied with quite large quantities of these goods. The same efforts are being made to find markets for the immense crops of corn from the West, and as markets are opened for this crop we shall find less competition along other lines of crop production in which we may excel.

THE GROWING OF SUGAR BEETS.

The experimental work which is now being done to ascertain if this country can produce its own sugar, is of much value. From a careful observation of the facts that have already been developed, we are quite sure that there is a large area in the Western and Middle states on which this crop may be successfully grown. This will increase the resources of the country and relieve the East from a measure of competition, a condition very much to be desired.

FARM PROSPERITY.

The study into the condition of our farmers begun last year has been continued, and we are pleased to again note the fact that there appears to be a continuance of prosperity.

It has cost self denial and hard labor in very many instances, and there have been moments of doubt and discouragement, but still there is that condition of plenty, together with a comparative freedom from the doubts for the morrow, that comes with but few other industries.

As a rule farm indebtedness has been reduced, the necessities and comforts of life have been obtained, improvements have been made and the average intelligent farmer has gone on to higher attainments and better living.

The finished product, that which represents skill, is in demand to-day, and there is a tendency to get our market articles as far removed from the raw material as possible. To this end education is necessary, and the work of our schools, institutes, agricultural institutions of learning and experiment stations, are of much value along these lines. It is only as we put learned, thoughtful labor into our work that we can compete with the immensity of the West. Only by adding well directed efforts can we hope to even up our conditions and help ourselves along in the great contest for commercial equality.

OUR LIVE STOCK.

We are somewhat pained to note a reduction in the numbers of some classes of our live stock, notably cows and oxen. This condition, may, however, be explained in part from the fact that while the prices of the dairy and other products of the farm have rated low, cows and oxen have sold for high prices. It is also encouraging to note that there is an increase in some classes of young stock, which will be growing up to take the place of the other animals sold out of the State. We take the following figures from the report of the State assessors for 1897.

Total number of horses, 132,480; three-year-old colts, 4,902; two-year-old colts, 4,263; one-year-old colts, 3,132.

Total number of cows, 141,522; oxen, 10,323; three-year-olds, 20,480; two-year-olds, 38,230.

Total number of yearlings, 43,594; sheep, 227,178; swine, 42,710.

Total number of horses and colts, 144,777; total number of cows, oxen, and young stock, 254,149.

Comparing these numbers of our farm animals with those for 1896 we note an increase of 146, or one-tenth of one per cent, in horses; a decrease of 2,391, or 32 per cent, in the number of three-year-old colts; a decrease of 1,722, or 28 per cent, in the number of two-year-old colts; a decrease of 525, or 14 per cent, in the number of one-year-old colts; a decrease of 4,522, or three per cent, in number of cows; a decrease of 5,150, or 33 per cent, in number of oxen; an increase of 446, or two per cent, in number of three-year-olds; an increase of 7,983, or 26 per cent, in number of two-year-olds; an increase of 1,170, or 2.5 per cent, in number of one-year-olds; a decrease of 49,208, or 17 per cent, in number of sheep and a decrease of 6,121, or 12 per cent, in number of swine.

We believe that a careful perusal of those figures will convince any thinking farmer that there is still room for an increased interest in live stock, and that there is no danger of an over production of any of their products for many years to come.

HEALTHFULNESS.

The question of the healthfulness of our farm stock is one of great importance to every farmer, and should demand his careful attention. He should be willing to co-operate in every way possible with the authorities in enforcing all rules which may be just and reasonable, to secure the healthfulness of his stock and its products, but he should guard jealously his personal rights. The farmer is, first of all, interested in this matter, as he and his family are the first ones to consume of these products. It thus becomes to him a question of the welfare of his family and the perpetuity of his home, as well as of commercial importance. His wishes should therefore be consulted and he should be considered above reproach until proved to the contrary. The question of tuberculosis has agitated the minds of the people for the past few years, and scientific men have made great advances in the knowledge of its nature and the best means for controlling it, but much remains to be learned in relation to it. I firmly believe that extreme measures should be discouraged until more is learned. The latest reports of specialists to the Massachusetts cattle commissioners would clearly indicate that in their judgment the danger from the disease has been very much overestimated.

One man makes the statement that it is as unreasonable to think of "stamping out" tuberculosis by killing diseased animals as it would be to think of stamping out typhoid fever by killing every one who has the disease and paying no attention to the causes of infection.

It is admitted by all authorities that pasteurization is sure death to the various disease germs which may possibly be present in milk. This process consists simply in heating the milk to one hundred and sixty degrees and allowing it to remain at that temperature for about fifteen minutes and then rapidly cooling it. The United States department of agriculture has issued simple directions for pasteurization, which were copied in the board bulletin for December. As the digestive properties of the milk are not injured, and as it will keep sweet much longer than untreated milk, and will make a better quality of butter, the process is to be commended. There is a large and growing demand for pasteurized milk and cream in many of our cities, and it is recommended by physicians.

The use of tuberculin as a diagnostic, brings to the front a question of law which has never been settled. Without thinking to take anything from the merits of this diagnostic agent, and admitting all that its originator now claims for it, it may be said that the question of submitting apparently healthy animals to an injection of a diagnostic drug, however useful or harmless it may be, is one that should be settled by the courts, as I believe no man or body of men have any right to make this demand against the wishes or without the consent of the owner. This fact is recognized by the Massachusetts law, in that it absolutely prohibits its use upon any animal, except upon the written consent of the owner. I believe that we have grave duties to ourselves, and the public as well, in maintaining the healthfulness of our herds and their products; we have also a duty of self defence to discountenance all false alarms or the passage of laws which might work harm to our interests and unnecessary expense to the State.

THE BLUEHILL CASE.

Early in May of last year the papers became filled with sensational stories of sickness and death in the family of Mr. Luther Bridges of Bluehill, caused, it was claimed, by drinking the milk from a tuberculous cow. It was said the animal was so far gone with the disease that her udder was badly affected. I wrote some of the physicians who had attended the children, and learned from the one who had been the family physician that in his judgment the disease was not tuberculosis but pneumonia induced by severe colds while recovering from the measles. The other physician, who had been called in later, said that in his judgment the disease was tuberculosis. A veterinary had been called to examine the one cow of the family. He had applied the tuberculin test and, getting the characteristic reaction, had killed her.

On June 6th, when the members of the board were at the college field day at Orono, it was thought that it would be well to make an investigation. The veterinary who tested the cow, a prominent member and official of the Maine Medical Veterinary Association, was interviewed, and he stated that the reaction was so marked and the condition of the cow, physically, was such that he had deemed an autopsy unnecessary, stating repeatedly that her udder was so broken down with the disease that he had milked pus from it; also making the further claim that he had examined the sputum of the sick children by the staining process and had got the discoloration indicating the presence of tuberculous bacilli.

After consulting Dr. Fellows of Bangor, to learn if it would be possible to distinguish between pneumonia and tuberculosis, if the children should be exhumed, it was decided to make a full examination of both the children and the cow. Mr. Hinckley, the local member, took steps to get the permission of the authorities and the parents to have the children exhumed, and on Friday, June 11, accompanied by Dr. Manning of Ellsworth, he went to the home of Mr. Bridges for that purpose. When he got there, he found that Dr. West, the veterinary of Ellsworth, who killed the cow, and Dr. Bailey, had exhumed the cow but had apparently taken away none of the udder. In fact neither of them had been able to find any tissue which revealed tuberculosis to the eye, notwithstanding the statement of the veterinary made to members of the board, that her udder was completely broken down. Dr. Bailey claimed that there was no disease whatever about the cow. Dr. Manning took portions of the lung and of the udder, looking as closely as he could for diseased tissue. He then went to the tomb and obtained the lungs of the children who had died. These were all forwarded to Dr. C. D. Smith of Portland, for microscopical examination, and he made the following statement which was published at the time.

Portland, June 19, 1897.

B. Walker McKeen, Esq., Secretary Board of Agriculture:

Dear Sir: I have the honor to submit report upon the pathological examination of certain specimens submitted to me by your board for examination to determine the presence or absence of tuberculosis.

On Saturday, June 12, I received from Dr. John F. Manning of Ellsworth, specimens labeled as follows:

A. Lungs of Bridges' child, deceased May 30.

B. Lungs of Bridges' child, deceased May 20.

C. Portion of udder of cow owned by Bridges said to have been tuberculous and killed May 19.

D. Portion of lung (one lobe) of same cow. All were in an excellent state of preservation, a condition highly favorable to the accuracy of the results of examination. Accompanying these specimens were two others, labeled as follows:

E. Sputum from Luther Bridges, now seriously ill from the same disease of which children died.

F. Sputum of J. Bridges, age six years, nearly recovered from disease of which his sisters died.

All these specimens have been examined for the presence of tubercle bacilli and the report in detail is as follows:

1. Sputum of Luther Bridges. Result, negative.

2. Sputum of J. Bridges. Result, negative.

Both, however, show the presence of large numbers of the micro-organism of croupous pneumonia, and in physical characteristics the sputum of the father is typical of that found in this disease.

3. Lung of the cow and scrapings from the bronchial tubes. Both results as to tubercle, negative.

The lung shows evidence of old pleurisy, the pleural membrane being adherent over a portion of the lung about three inches in diameter and considerably thickened.

4. Udder of the cow. Result, negative. Sections of the udder show some evidence of old inflammatory action and injury, traces of scar tissue being apparent.

5. Lungs of children. These may be considered together since in all essentials the pathological condition is the same in each.

No tubercle bacilli were found, nor do sections show the presence of any tissue changes which can be attributed to tubercular infection. The gross appearance of these lungs and the microscopical appearance of prepared sections show them to have been the seat of extensive croupous pneumonia.

I have considered the determination of the true nature of these cases of so much importance that I have verified the finding in each specimen by other methods of examination and the result has been the same.

My conclusions are:

1. That the children who died, died of croupous pneumonia and not of tuberculosis.

2. That the present illness of Luther Bridges and his son is pneumonia and not tuberculosis.

3. That no tuberculosis was present in the cow from which came the portions of lung and udder which I have examined.

Very truly yours,

CHARLES D. SMITH, M. D.

126 Free St., Portland.

The matter rested here and I believe the public accepted this as the correct version of the case.

EXECUTIVE COMMITTEE.

The executive committee has been called together but twice during the year, but has been fully consulted personally and by letter, and has rendered efficient work in assisting in arranging tne details of our meetings, particularly the meeting at the Maine State fair and the State dairy meeting at Bangor.

SEED AND FEED INSPECTION.

Acting on the suggestion of the Board and of the State Grange, the last legislature passed a law regulating the sale of seeds, and feeds. While this law was not as far-reaching as we at first desired, it covers the main points sought and we believe is accomplishing much good. Some manufacturers of mill feeds are taking advantage of the law to advertise the quality of their goods when exhibiting them elsewhere, as I have noted various brands of feeds bearing the tag of our Experiment Station outside of Maine. It was urged by some of our local dealers that dealers outside of the State would take advantage of the law to push their goods into Maine without analysis or inspection and at a lower price, and thus place them at a disadvantage, but from correspondence which I have had with several foreign dealers, I judge that the reverse is the case, as farmers have, almost universally, demanded tested and analyzed goods, sometimes going so far as to cancel an order given to a foreign dealer when they found the goods were not to be properly tagged and branded.

Prof. Woods will give the Board the working of the law somewhat in detail.

PURE FOODS.

A glance at the Statutes of our State will convince anyone that they are lacking in laws to prevent adulteration of foods. This is particularly true of some of the prepared foods, spices, etc., which go into the families of all classes. Vinegar is largely sold as pure cider vinegar which, undoubtedly, has not a particle of acetic acid, yet with our present law it is very difficult, if it is detected, to convict. With the large fruit interests of our State, and considering that on years of large yields, there must necessarily be a large quantity of cider vinegar made, it would seem that it should be afforded ample protection against the cheap acid vinegar, which can be sold at prices that entirely drive the pure article from the market.

CROP BULLETINS.

The publication of the crop bulletins has been continued, two more numbers being issued the past season than ever before. The circulation is constantly increasing, and we now have 7,000 names on our list.

The Loud bill now before Congress will, if it becomes a law, allow these publications to enter the mail as second class matter, thus relieving the departments from much expense and labor.

CATALOGUE OF THE WORK OF THE EXPERIMENT STATIONS.

The office of experiment stations at Washington has been for some time compiling a card catalogue of tne bulletins published by the various experiment stations of the country. This catalogue was sent gratuitously, only to experiment stations until recently, when the list was extended so as to include such boards of agriculture as were prepared to receive them. We received our first installment of 44,400 cards a short time ago, since which time several small lots have been received. These are all duly arranged in a cabinet and form a very valuable addition to the office.

OUR DAIRY AND CREAMERY INTERESTS.

Although it is somewhat discouraging to note the decrease in the number of cows in the State the past year, it is still a fact that our people are very much interested in all that pertains to the dairy. The quality of our butter is, we believe, improving, and there is an increase in the amount of creamery work done in the State.

The dairy meeting held at Bangor, was a most interesting and useful one, and the scoring of the butter was very satisfactory. The question of an interstate exhibit of butter to be held at some convenient point was freely discussed during this meeting and received with much favor by all. It was thought that an exhibit of dressed poultry, eggs, and poultry foods, might be added to advantage.

Those who have been in the habit of offering special premiums at these meetings, agree to put the same amount of money which they have placed in their specials, in the hands of the board to be added to what the board may offer, provided that no special premiums are offered. This will help out materially in the amount of premiums, and, without doubt, increase the exhibit.

Since the dairy meeting, the question of an interstate exhibit has been taken up by the Maine Farmer, and it has received many letters from parties within and without the State, favoring it. The matter should be pushed to a successful termination, if possible.

THE PRESS.

The department is still under great obligations to the press for extended notices of our meetings, as well as for general co-operation in our work and for free copies of papers.

The Maine Farmer, Turf, Farm and Home, Bangor Weekly Commercial, Lewiston Journal, Country Gentleman, Hoard's Dairyman, New England Farmer, New England Homestead, Mirror and Farmer, and The American Creamery and Produce Review, as well as several local papers, come regularly to the office, and are kept on file for reference and for binding.

INSTITUTES.

I wish to acknowledge the very efficient work of the members in arranging and carrying out the institutes in their various counties.

I believe the interest in these meetings has been fully maintained, and the effectiveness of their work has been increased. A two days' meeting was held in June, in Washington county, in which dairy subjects, chiefly, were considered. This meeting was fully attended, and proved very successful.

It would appear that there are many places in the State where two days' meetings might be held to good advantage, and I would call the members' attention to this matter.

We continue the permanent record of these meetings and their cost, and in addition to this record, we opened on October first, a complete set of double entry books, by which we are able to tell at a glance, the correct standing of every account.

The time reported, covers the board year, from the third Wednesday in January, 1897, to the third Wednesday in January, 1898.

The $3,000 appropriated for farmers' institutes has been expended. Forty-eight institutes have been held as follows:

Camden, Springfield, Charlotte, Roque Bluffs, Epping, North Sedgwick, Hancock, Alfred, Newfield, Cumberland Center, Union, Hope Corner, Richmond, Topsham, Growstown, Turner, West Minot, Canton, Manchester, Fairfield Center, Canaan, Houlton, Presque Isle, Fort Fairfield, Blaine, Milo, Sebec, Monticello, Hampden, Abbot Village, Hodgdon, Gorham, South Jefferson, Freedom, Thorndike, Unity, Monroe, Allen's Mills, North Chesterville, Chesterville, Bean's Corner, Temple, Phillips, Kingfield, Solon, North Anson, evening meeting at State Fair, Lewiston, and State dairy meeting at Bangor. The expenses of the State dairy meeting were $489.20.

In addition to these meetings, the board attended the annual field day at Orono, on June 6, at a cost of $74.76; and there has been paid for incidental expenses as follows:

Charles D. Smith, pathological work	$70 00
Library Bureau, case for card catalogue	35 00
F. C. Robinson, services as chemist	20 00
Nahum Hinckley, work on Bluehill case	14 65
Dr. J. F. Manning	50 00
Dr. W. H. Way	16 00
Press Clipping Bureau	53 33
Executive committee work	35 40
A. L. & E. F. Goss Co., tester, etc	26 90
F. L. Harvey, botanist and entomologist	25 00
James H. Ames, paper for bulletin	5 00
Lewiston Journal, advertising	6 00

CORRESPONDENCE.

The correspondence of the office is large, many people writing for information on various matters, and it is our purpose to answer all such requests as fully as possible. A copy of all letters written has been kept during the year and we find that they amount to 1,538 or 126 a month. This is, of course, exclusive of the correspondence in connection with the bulletins, this alone calling for the stamping, filling, and directing of about 8,000 envelopes each month.

AGRICULTURAL SOCIETIES.

The year just past was one of prosperity for the most of our local and county societies. The weather in most cases was favorable, and there seemed to be an interest manifested among the people, which led to fine exhibits in nearly all classes, and to good attendance.

I am pleased to note a desire on the part of the officers of these societies to fully comply with the State law regarding gambling and games of chance. From what I was able to learn from personal observation and from other people, I believe that the county fairs of 1897 were particularly clean in every respect. There was but one exception to this rule, and that society openly advertised that "everything would go" and fully carried out its programme. It was consequently cut off from receiving the stipend.

It is worthy of note that those societies which stick the most closely to the real intent of an agricultural society, depending upon the interest of the people in agriculture and in kindred pursuits for their patronage, are succeeding the best financially. I am firmly of the opinion that when special attractions become necessary to draw people to any fair, when it becomes purely a place of amusement, that fair should be cancelled. I append a summary of the business of the societies as returned to this office.

Number of horses and colts exhibited..............	1,579
Number of neat cattle exhibited...................	5,907
Number of sheep exhibited.........................	1,705
Number of swine exhibited.........................	673
Number of poultry (coops) exhibited...............	1,239

ANALYSIS OF AWARDS.

Total amount of premiums and gratuities paid....	$16,574 59
Amount of trotting purses.......................	20,932 15
Amount of entry fees for trotting purses..........	8,702 23
Actual cost of trotting purses...................	12,229 92
Per cent. of premiums and gratuities to total awards	44
Per cent. of entry fees.........................	42
Per cent. of decrease in awards..................	06

Respectfully submitted,

B. WALKER McKEEN,

Secretary.

This report was accepted and referred to a committee of three, appointed by the Chair as follows: Chas. D. Woods, W. G. Hunton, and John J. Frye.

REPORT OF THE EXECUTIVE COMMITTEE.

The executive committee of the Board met at the Bangor House, Bangor, June 8, 1897. All the members were present. The place of holding the next dairy meeting was considered, and it was finally voted that this be deferred until the meeting of the committee at the State Fair at Lewiston.

The matter of the analysis of vinegar was discussed, and it was decided that it would not be wise to push the analysis any farther.

The questions of the seed and feed bills were brought up for discussion and conference, and institute matters were discussed informally by various members of the Board who were present.

A meeting of the executive committee was held at the rooms of the Board, State House, August 30th. It was voted that the next dairy meeting be held at Bangor. No other business was transacted.

J. W. DUDLEY,
WM. H. MOODY,
W. G. HUNTON,
Executive Committee.

This report accepted and placed on file.

PRACTICAL WORKING OF THE NEW FEED AND SEED LAWS.

By Prof. Chas. D. Woods.

Mr. President, Gentlemen of the Board:

As I have already had the pleasure of expounding this theme to you at different times, I hardly know what it is best to say, or where it is best to begin. With your permission, however, I will reverse the order of the programme, and speak of the seed law first.

There is more or less of a misapprehension, not by the members of the Board, I think, but by the people in the State at large, in relation to the seed law. It is frequently spoken of as an inspection law. The seed law carries no inspection whatever with it. The gist of it is contained in section 1 of "An Act to regulate the sale of Agricultural Seeds," which reads as follows:

"Every lot of seeds of agricultural plants, whether in bulk or in package, containing one pound or more, and including the seeds of cereals except sweet corn, grasses, forage plants, vegetables, and garden plants, but not including those of trees, shrubs and ornamental plants, which is sold, offered or exposed for sale for seed by any person or persons in Maine, shall be accompanied by a written or printed guarantee of its percentage of purity, freedom from foreign matter; provided, that mixtures may be sold as such when the percentages of the various constituents are stated." That is practically our law. Section 2 defines the way in which the percentages of purity may be obtained, and the other sections provide penalties for violation of the law and impose certain duties upon the Director of the Station.

In order that the law might be as thoroughly known as practicable, a bulletin was issued last August and was sent, not only to the regular mailing list of the Station, but also, so far as the Maine Register indicated, to every firm that would be likely to handle seeds.

You remember that about a year ago some of us met, in this room, gentlemen who represented the seed trade of the State, the wholesale seed trade more especially. They came here very much up in arms. They thought that the bill was one which would interfere with their business. Possibly the bill which was first started would have done so, but those dealers whose judgment we prize the most are acknowledging that the bill which we have to-day is for their protection as well as that of the farmer. This law is not perfect, by any means. It is only one step, and I believe, a very short step, in the right direction; but it is a step, and it is about the first step of any importance which has been taken by any legislative body in any State in our country. It is a sort of pioneer work which we are doing along the line of seed legislation.

I do not know how far it may be due to our law, but judging from samples of seeds sent to us this year by dealers, for examination, we have in this State at the present time much better seed than we had a year ago. This may not be due to the law, it may be that last year was a year in which better seed could be grown; but we have examined seed, notably clover seed, which was better seed than I ever knew offered for sale. I do not know whether other states are getting as good clover seed, but apparently there is no excuse for any dealer to sell anything but first quality of clover seed this year. We examined a sample from eight car loads, which sample contained not a single weed seed. Timothy seed is showing almost as well; we have had some samples absolutely free from weed seeds, others which contained small percentages. I think that if a man wants to buy it *and pay for it*, he can be tolerably certain of getting a clean seed in our State this year.

Ques. In the samples of clover seed sent to you have you ever found any sorrel?

Ans. Not this year; but I have seen clover seed that had a great deal of sorrel mixed with it. Still, when we find a field that contains clover and sorrel it is not always true that the seedsman is to blame for the sorrel, although it is sometimes.

Ques. What grade of seed did this clean seed which was sent to you purport to be?

Ans. When it was sent to us it was not rated in any way. I think they are simply calling it prime seed, although from what we learned last year it would be rated in the market higher than prime seed.

There is one very serious defect in such a law as this. A man may have timothy seed that is 99.8 pure, containing only two-tenths of one per cent of weed seed, and that two-tenths of one per cent may be worse for the purchaser than five per cent of some other kind of weed seed. Our law is defective in that respect. It provides no guarantee as to the kind of weed seeds. However, in every case which we report to the dealer, we tell him each kind of weed seed that is present in the sample; so that, if you are dealing with a reputable man, one whom you can trust, and if his seed has been examined by our Station, you can learn from him whether the seed is safe to sow or not. We have no inspection, and cannot follow this out; we simply tell a man exactly what the seed is, when we have examined it.

While there is no seed inspection, I shall instruct our inspectors of feeding stuffs and fertilizers to report whether dealers are conforming to the law in labeling seeds. We have no inspection, but we have a right to use the funds which come to us from the National Government for purposes of investigation, and one of the things which we shall investigate this year is the quality of the seed which is sold in the State. While the law does not direct me, in person or by deputy, to draw samples, I hope to take from two to five hundred samples of seeds as they are sold in different parts of the State this year, and we shall study them to find out how well they are coming up to the guarantee; not as an inspection but simply as a work of investigation. The chief object in this is to study the character of the impurities. Of course dirt does not do any harm, except that if there are five pounds of dirt for every one hundred, you get five pounds that do not amount to anything. We intend to study the character of the weed seeds. When we find a weed seed that we do not know, we shall grow it in order to find out what it is. We desire to learn if it is possible to obtain enough, for the needs of the State, of grass seeds which shall be free from certain harmful weeds. If we find, for example, that it is possible to obtain all the timothy seed which we need that does not contain certain weeds, e. g., mustard or English plantain, I think there would be no great hardship to enact a law making it a misdemeanor to sell plantain or mustard seed in timothy seed. Before any law of that kind is enacted it is necessary to make an extended investigation into the character of seeds. It would be the height of folly to pass a law which should say that English plantain should not be tolerated in grass seeds if it is not possible to get all the grass seed which we need for our use free from English plantain. This would make both the consumer and the dealer bound to break the law. Therefore, before we can make a list of weed seeds that we will not tolerate, we must know pretty well what weed seeds we must of necessity allow; we must find out what, under present conditions, may and may not exist.

W. G. HUNTON—You said that you did not know whether the dealers of this State were buying any different seed or not. I have communications to show that they are buying the grade of seed "extra prime," which they have not before done to any extent.

Prof. WOODS—I had no question in my own mind but that it was being done, and that because of our seed law it was possible for us to get better seed this year. Better seed is being offered than in the past.

Ques. If I go to the store and purchase some timothy seed, and am told that it has all been inspected and contains 95.5 per cent of pure seed, how shall I know but that there may be in the remaining per cent something worse than a weed seed?

Ans. I do not know, sir. Our law does not provide for that at all. We have only taken one very short step. There is only one way that I know in which you could ascertain this, and that way would be to have the seed which you wished to purchase laid aside, and draw a sample from it, and send the sample, with a dollar, to the Experiment Station, charges prepaid. Unfortunately we cannot tell you without the dollar because we have no funds for doing that kind of work. Perhaps some of the members of the Board may not understand that the Experiment Station has not one cent of money that it can use for private purposes. We have $15,000 from the National Government, which must be used for investigation. We can do any kind of work for the public good in the way of investigation, but we have no right to examine any man's seed unless it will be of public benefit. We have funds which come to us from the feeding stuff inspection, and these are used in carrying out the law and doing the regular work of inspection. And we have funds which come from the fertilizer inspection, which must also be used for the control of the sale of fertilizers. Hence, when any one wants work done of a purely private nature, much as I dislike to do so, I have to write him a letter and call his attention to the above facts, and give him our price for doing the work. We have fixed our prices lower than the commercial chemists could possibly do, though we would not have done so if there were commercial chemists in the State. The kind of work which we have to do right along we agree to do for the citizens of the State, and even for non-residents, at exactly what it costs us to do it.

Ques. Would a simple inspection under the microscope by the farmer be sufficient?

Ans. It would, if he knew the kind of seed that he was buying; all that was not like this seed he would not want. But unless one is quite familiar with seeds he cannot tell whether he is getting seeds from a harmless or from a very harmful weed. I presume there will be a great deal of seed sold in the State this year, of which the dealers themselves will make their own inspection. It is not a difficult thing to ascertain the per cent of weed seeds, although they may not know the kind of weed seeds which they have. One of the largest dealers has asked us for a set of weed seeds, and some time we hope to be able to furnish such sets. Prof. Harvey is familiar with practically all of our weeds, recognizing them on sight. In the few instances that he can not name the seeds we shall save and grow them to learn what they are.

The law regulating the sale of concentrated feeding stuffs requires an inspection, and you are tolerably familiar with its provisions. It is formed along the lines of our fertilizer law. At first some men in the State thought the law to be unconstitutional; that it was class legislation and that laws of that kind could not be enforced. I am inclined to the opinion, from the fact that I have found no one standing out against the law, that they concluded that they were mistaken. If we had found such a case, we should have instituted suit, not necessarily a hostile suit, in order to have the matter decided by the supreme court. I doubt if it ever comes before the supreme court any more than the fertilizer law has. If there were any holes in this law the same holes would have been found long ago in the fertilizer law, as practically every state east of the Mississippi has the same fertilizer law that we have.

The sum and substance of this law is that all concentrated feeding stuffs which are by-products, with the exception of those which come from the milling of wheat and rye, shall be branded analogous to the brand which we have upon commercial fertilizers; only instead of nitrogen, phosphoric acid and potash, the percentages of protein and of fat must be guaranteed. The law says that each package must bear a statement of the number of pounds, the name or trade mark under which the article is sold, the name of the manufacturer or shipper, the place of manufacture, the place of business and a chemical analysis stating the percentages of crude protein and of crude fat. Upon consultation with the secretary of the Board of Agriculture, who, with myself, had charge of the enforcement of the law, it was decided that this statement can be printed directly on the bag, as is usually done in the case of fertilizers, it can be printed on a tag to be attached to the package, or it can be printed on the back of the inspection tag. Very many of the dealers are taking advantage of this, and placing it directly on the back of the tax tag. This inspection tag and the brand should be attached to every package before it is offered for sale. It is not sufficient that the tags be kept in the office of the dealer, and attached to a package when a man wants to buy it. They should be put on before he offers the goods for sale, because the law contemplates not only sale but offering for sale.

The inspection tax, as you know, is ten cents per ton. That will give us sufficient revenue, I think, for making a tolerably good inspection. It is probable that this first year we may run beyond the income from the tax, because in getting a law of this kind started, a large amount of work is necessary. For example, our office work has probably been doubled because of this law. We write, in addition to our general correspondence, from twenty to thirty letters a day that bear merely upon this inspection of feeding stuffs.

We did not begin the enforcement of the law in the same way that we would if it were a law to expire the first of next July. It seemed best to start the enforcement along broad and liberal lines, as we believe that we have a law, which, either in its present form or with slight modifications, will stand year after year. We began with a campaign of education among the dealers. There has been very little difficulty in getting the average country dealer to understand the requirements of the law; not that the average country dealer is any more intelligent than the average city dealer, but he has been willing to read and study the statements sent out. The city dealer has not been as willing to study. He has taken it for granted that he knew all about it; and so we have found, not willful violations, but cases in which men were not conforming to the law because they were ignorant of its provisions. The way in which the law is violated to-day more than in any other way is this: A man thinks that when he gets the inspection tag and puts it upon a bag of goods, it is all right. But that only shows that the inspection tax has been paid. The object of the law is not to give ten cents a ton to the Experiment Station. That is all that is indicated when the tag is attached. The object of the law is the guarantee of the quality of the goods, and the ten cents is for the Experiment Station to find out whether the guarantee is or is not lived up to. Some goods are being offered in the State to-day, particularly goods that were in the State before the first of last October, which bear this inspection tag but do not bear any analysis. Just as fast as those cases come to my observation I write the parties. The violations of the law will disappear in time, for two reasons: In the first place, the retail dealer is coming to understand the requirements of the law, and will insist that the goods which come to him are tagged and branded, in order to save him trouble. The wholesale dealer will thus find a pressure brought to bear upon him by the retailer, to furnish goods that are properly branded and tagged. Furthermore, most of the larger manufacturers are branding their own goods; so that, between the manufacturer who is complying with the law and the retail dealer who wants the goods that he buys all right, the middle man is in such a position that the quantity of goods which he will handle that are not in accordance with the law will grow monthly less and less.

During the first three months after the law went into effect we did not attempt to draw a single sample for analysis. Our efforts were directed wholly toward getting men to know that there was a law and to find out what the requirements of the law were, and then to place their goods in conformity with it. This month (January) we are taking samples of these concentrated feeding stuffs all over the State. We have twelve inspectors, and instructions are given them to draw samples, not more than two of any one brand, and usually not more than one. If the goods are widely scattered, and each inspector draws one sample, that means that we get twelve different samples of the same brand. And if the inspectors find goods used in large quantities and scattered widely over their own districts, my instructions are that they draw two samples. In some cases we get a large number of samples of goods manufactured by the same company. For example, the American Cotton Oil Company sends goods from quite a number of mills, and the goods from each one of those mills are considered a distinct brand. If their goods go into each of these twelve districts we shall have twelve samples of American cotton seed meal from each one of those mills. The same thing is true of Chicago gluten, although the samples of this will be less than of the American cotton seed meal, as the company makes a blanket label which covers the product of all their mills.

Ques. When a particular bag comes from the American Cotton Oil Company how do you know from which one of these mills it comes?

Ans. They are printing the brand on the back of the inspection tag, and they have a different brand for each mill, giving the name of the place where it was manufactured.

W. G. Hunton—Has any complaint been made to you that cotton seed meal falls short in weight?

Prof. Woods—I have not received that complaint. That is a matter that it is tolerably easy for the purchaser to ascertain. All he has to do is to throw the bag on to the scales.

W. G. Hunton—I find that there is such a complaint this winter for the first time, and the shrinkage is quite a serious one. It is claimed that in the case of one particular brand there are but ninety pounds in a bag.*

Ques. Is it expected that the manufacturer attach these tags?

Ans. No, Sir. Perhaps unwisely, but because of the trade situation, we decided something like this: Take, for example, Chicago gluten, for which Norton & Chapman of Portland, are the New England agents. From the various mills of the Glucose Sugar Refining Company, there are coming eastward a large number of cars. Some of those cars may be way-billed to a certain point, and from that point they will be re-billed, some coming to Maine, others going to other states. I have ruled that in such a case as that the Norton-Chapman Company could send to their consignee in this State the tags, to be attached when the goods are taken out of the car. The car comes in by freight, and the tags are sent by express. You understand that the Norton-Chapman Company never see the goods which they sell, and when the goods are started from the mills they do not know where they will land; it is impossible to tell whether they will go to Augusta, Me., or Middletown, Conn. They will go where the demand is. If they come to Augusta, Me., the Norton-Chapman Company send tags with the understanding that they shall be attached when the goods are taken out of the car. This arrangement is necessary because of the trade situation.

This inspection law is getting into operation so that by 1899 it will be conformed to everywhere. I think that we can congratulate ourselves upon the way in which the law has already worked. It is decidedly educational to the consumer. A large number of the people that use concentrated feeds in our State had never had their attention called to the differences in the quality, e. g., of corn meal, or cotton seed; or if they had, it had not appealed to them. This red label attracts their attention, and I get many letters asking what these things mean. Bulletin No. 39 was prepared to help answer the questions from farmers as to what makes a properly balanced ration, what they shall buy for feeding stuffs, etc. I am very confident that we

*This instance was investigated and it was found that the complaint was a mistake, the goods being full weight.—C. D. W should have been flooded with poor cotton seed meal if it had not been that we had this inspection law enacted when we did. The manufacturers have learned how to manufacture a cotton seed meal that, unless one is pretty well versed in the knowledge of cotton seed meals, will deceive him in its appearance. A very fine meal, of good color, is upon the market, which has only about one-half the value of ordinary cotton seed meal. We have examined cotton seed meals which have ranged from twenty to fifty-three per cent in protein. A man who is selling a cotton seed meal which contains fifty per cent of protein is, of course, giving you a much better bargain than one who is selling that which contains only twenty per cent. Furthermore, it is important for a man to know when he is making up his ration whether he is feeding cotton seed which contains twenty per cent of protein or fifty per cent. The gluten meals run closer; while there is a great deal of variation in the different kinds, there is not so great a variation in any one. But if you take the whole class of gluten feeds, as well as the gluten meals, you will get about as wide a range,—as low as twenty per cent of protein, and as high, perhaps, as forty per cent.

Another thing is coming about. The inspection will, to some extent, regulate the price of these feeding stuffs. A man who has a brand of cotton seed which contains fifty per cent of protein will charge more, and get more for his goods. While the man who has cotton seed containing only twenty-five per cent will find difficulty in unloading it at any price.

With the fertilizer inspection, in times past we have contented ourselves, because of the limited funds, in sending a man about the State to gather samples once a year, usually just a little before the time in which the fertilizers are sold. With the two inspections, we can devote more time and more money, proportionately to each than we could with either alone, as they work in together. After consulting with the secretary, and with the executive committee of the Board, inspectors were appointed in different parts of the State, with one inspector from the Station. The reason for appointing a Station officer was that we could thus note the effectiveness of the inspection by the chemist as compared with that of the local inspector. We have eleven local inspectors in different sections of the

State, and one inspector from the Station who is trying to do the work of inspection for three counties. I am disposed to think that on some accounts the local inspector has the advantage.

The instructions given the inspectors are simply to report things to me as they find them, and in each case of violation of the law which has come to my knowledge I have sent a personal letter—not a blanket letter to cover all sorts of cases, but a personal letter which met the particular case—and I believe that in that way we are arriving at the adoption of this feeding stuff inspection law by the dealers, with a minimum amount of resistance on their part, and with fully as great speed as I had any hope that we should when the law was passed, a year ago.

Ques. A dealer sells cotton seed meal with a percentage guarantee, in full conformity to the law, and after examination, the goods show great deficiency in protein; would the dealer be liable to the purchaser?

Ans. He would be liable to the purchaser under common law, but not under this law. It would be a violation of contract, and the man could be prosecuted by the purchaser for fraud. And he is also liable to be prosecuted and have to pay a fine of $100 or less, under this special law.

W. H. Moody—I went to Belfast last fall and stepped into one of the largest stores and asked the proprietor if his cotton seed was inspected. He said, "No, it is not now; but a man has been here inquiring into the matter and requesting me to send samples, and I have sent them and shall soon have the cards." The next time I was there, perhaps a month later, I noticed that his sacks did not bear any tags, and I asked him about that. I simply mentioned it in a friendly way. He said, "I have the tags here all right, and when I sell the cotton seed I put them on." They were plain tags, they did not bear any analysis.

Prof. Woods—If you will pardon me for speaking again, I will say that last week the inspector went through Belfast, and with the exception of two brands of poultry feed, at two different places, he found no goods that were not in conformity to the law. If a dealer had goods in stock when the law went into effect, in some cases he would not overhaul his piles to put the tags on, but I think that the majority of the dealers are affixing the tags when they unload a car.

Ques. Would it be advisable to print a weekly digest of the work of the Experiment Station in any of our prominent agricultural papers? I have a paper called the "Germantown Telegraph," and in that paper every week there is a digest of all the lines of work in the Pennsylvania Experiment Station, which is of great value and interest to those who take the paper. I know that our Experiment Station sends out bulletins which fall into the hands of many of the farmers, but perhaps if a weekly digest were printed in a newspaper it would reach more than the bulletins would reach.

Ans. I do not think that we could get up a weekly letter that would be of sufficient value to warrant us in doing it, but every time we send out a bulletin we send with it what we call a newspaper notice, which goes to every newspaper in the State, and to all other papers on our exchange list. These give a short digest of the contents of the bulletin and are very generally printed by the press of the State. Furthermore, whenever anything comes up of importance, we prepare a special newspaper bulletin, which is also sent to all the papers, and very generally printed. In this way we try to call attention to the publications of the Station, and give at once to the farmers anything which it is particularly desirable that they should know.

JOHN J. FRYE—I would like to extend an invitation to this Board to hold its next dairy meeting at Portland. I think we can make it of profit to us all.

E. E. LIGHT—I would like to refer to a matter and leave it before the Board for discussion. The scoring that Maine butter has received at the State Dairy Conferences, and perhaps in the State Agricultural Societies, has not been altogether satisfactory to all of the dairymen in the State of Maine, and it has been suggested by some that an interstate dairy conference, or something of that kind, be held, in which we should co-operate with other near-by states, perhaps New Hampshire, Vermont and Massachusetts. We are aware of the efforts that the State Board of Agriculture has made to assist our dairy interests, and it seems to me that there might be something in this suggestion that it would be well for us to consider.

Secretary McKEEN—Mr. President, Gentlemen of the Board: I outlined my ideas in relation to the matter in my report to the Board. As I understand it, Mr. Smith of the Crystal Spring Creamery was the first gentleman to mention that matter at the dairy meeting at Bangor, and after he mentioned it the matter was talked over by members of the Board and others, and received with much favor. I spoke of it to Secretary Bachelder, and he said he would like to look into it. I think, myself, that if we could have an interstate dairy meeting at which the different exhibits of butter should appear without any distinguishing marks whatever, it might be of much benefit. It will be my attempt to have the exhibit at our next dairy meeting, if we have one, arranged in that way. I shall try to have all the butter come in the same form, so that there shall be no distinguishing marks on it.

I feel as though an interstate meeting might be of interest, although I realize that we might lose premiums. I do not know how we should get at the details, or just what the practical working would be, but I believe it would be well for us to express our opinion upon the advisability of holding such a meeting if the details can be worked out satisfactorily. I think an expression of the Board in the matter would be of much value.

W. G. HUNTON—Very many of us who are practical dairymen, and others who attended the Bangor dairy meeting, have become interested in this subject through the comments of the press, and if there is any way that such an exhibit as this would lead us to understand more of Maine's distinguishing mark on butter, the want of flavor, I think we would heartily endorse the movement. An idea has been conveyed through the newspaper talk that if butter from different states could all be exibited together, we would soon have an opportunity to know whether Maine butter was really lacking in flavor or not. I am very much interested in this question, although I do not know the best way to get at it.

Voted, That the executive committee take this matter under consideration, and report in the next session as to what action, if any, the Board should take at this time.

S. H. GOODWIN—A suggestion was made by Mr. McKeen, I think, at Bangor, which I thought a very good one for this Board to consider, as to whether some method could not be devised to assist the dairymen of this State in the marketing of their butter. There seems to be a great prejudice against Maine butter. This has been brought to my attention more particularly by my friends in Massachusetts, from their observations there. I am one of those who believe that our butter is just as good, practically, as the Vermont or New Hampshire butter, and I would like to ask Secretary McKeen if he has ever considered the question, whether it would not be wise for this Board to look into the matter of assisting the dairymen of this State in the marketing of their butter. I do not make the suggestion because I am personally interested, as it would not help me materially; but there certainly is need of assistance in that direction. At our institutes we have taken up almost every point except this one of finding a market, and I think the Board ought to consider this.

SECRETARY MCKEEN—I have no doubt but that it is a perfectly legitimate line of work for the Board to attempt to find a market for our goods, particularly for butter. It is a subject to which I have given considerable attention, but just how we can accomplish it I do not know. I have talked with men in Boston, not only those who have judged our butter but others, and I find that there is an active demand for dairy products of all kinds, and I know of no better way to extend the market for our goods than by convincing the consumers in some way that they are of good quality. I fully realize the dissatisfaction and the inconvenience that come from the lower scoring of our butter as compared with New Hampshire and Vermont butter. Still, I am not willing just yet to lay it to any prejudice in the minds of the persons who are scoring the butter. We might particularize a little in our own State. Look carefully into the scoring of our butter at our dairy meeting, and you will find that in almost every instance the butter which comes from creameries where no sweet cream is sold scores higher than that coming from creameries doing a large business in sweet cream. Some of the creameries whose butter scored 90 are doing a large sweet cream business, and putting all their best goods into the market as sweet cream. The State of Maine has sold very much cream from its creameries, and I have no doubt but that the best cream that our creameries have collected has been sold as cream and not made into butter. Vermont has not caught on to the cream trade; nearly all of the cream in that State is made into butter and goes into the Boston market. And Vermont has been known in the market as a butter producing State for a great many years. Then, again, a large per cent of Vermont butter is made in the summer, while in Maine a large per cent is made in the winter, and I believe Vermont butter has an advantage in the way of flavor on this account.

I do not know of any better way to call the attention of the market to our butter than to seek to improve its quality, and get it before the people in a competitive manner, as we propose in this interstate exhibition.

MR. GOODWIN—The Department at Washington has seen fit to press the sale of our butter in English markets, and the question is, whether Maine men could not do this in Boston markets.

DR. A. W. HARRIS—You think that it is not because of prejudice that the butter does not suit the market?

SECRETARY MCKEEN—I think there may be a measure of prejudice, but the commission men are sharp, and I have no doubt that if the same quality of butter goes from Maine as from Vermont, it sells for all it is worth. At the State Fair, a certain dairyman of the State, who is famous for making good butter, exhibited some butter that scored very high and was very palatable Some of the commission men had a taste of it, and afterwards sent to this party for a shipment, and he immediately sent them quite a large amount. Having got that butter by their earnest solicitation, they were unable to sell it to the customer for whom they bought it, and were obliged to job it. The butter was not as good as that exhibited at the Fair. It was later in the season and the chances were more against the dairyman.

DR. HARRIS—You say that our conditions are practically the same as those of Vermont, and they make their butter in the summer. Why is this?

SECRETARY MCKEEN—We sell more cream and we have been teaching the practice of winter dairying more in Maine than has been done in Vermont. And they have still their fresh pastures, way to the tops of the hills, which we do not have.

Another point which is to the advantage of Vermont butter is that it is nearly all made from separator cream, and made the day after the milk is milked from the cows. As Prof. Gowell and I went through the State of Vermont two years ago we talked with the butter-makers, and the best butter-makers were unanimous in their opinion that they would not work in a creamery where it would be necessary to make butter from gathered cream.

E. E. LIGHT—Have you any information in regard to the scoring of our butter in June?

SECRETARY McKEEN—Unfortunately we have never had an opportunity to have our butter scored in June. The New England Fair is the earliest opportunity in the season that we have had to score our butter.

L. O. STRAW—I notice that the dairy meetings in other states are held earlier in the year, in October or November. I would suggest that it might be well for us to hold ours a little earlier.

Adjourned to 7.30 P. M.

WEDNESDAY EVENING.

Meeting called to order at 7.30 by the President.

Ten-Minute Talks by Members.

WHAT PARTICULAR BRANCH OF FARMING NEEDS ENCOURAGING?

By B. F. BRIGGS, Auburn.

Mr. President, Gentlemen: In Washington it is good-naturedly said of Senator Stewart that he never speaks on any occasion without mentioning the free and unlimited coinage of silver at the ratio of sixteen to one. And in joking him about it one day Senator Evarts remarked that he would rather ride a horse than a hobby, for one can get off a horse.

So now at the risk of being considered on a hobby, I wish again to call the attention of the Board to the subject of stock raising, and again to suggest that this subject be still more prominently brought to the attention of our farmers; and that, through the wise direction of our Board, they may be taught to breed and rear more scientifically and with a more perfect knowledge of the ever increasing demands of a critical market.

I am constrained to again call your attention to this matter for the reason that we are now about entering upon a period when farmers will engage largely in the raising of various kinds of stock. During the recent business depression farmers all over the country have seen prices for all kinds of live stock decline, and the scramble of everybody to turn unprofitable stock into money has at last produced a shortage, and we see the price of cattle, sheep, swine and horses advancing.

The western ranches are being replenished with breeding stock. The Ohio farmers who, three years ago, were falling over one another to dispose of their sheep at 75 cents per head, are now just as eager to replace them at $4.00 per head. With the increased volume of business that is everywhere in evidence, prices will continue to advance, and this return of prosperity to the breeder will encourage farmers to embark in new ventures, and that they may avoid past mistakes it should be the province of the Board of Agriculture to constantly supply them with information, and assist them in forming correct conclusions.

I therefore suggest that in laying out the work for the coming year special attention be given to the study of the various animal industries; that special investigations of the demands of the market be made, and that the most up-to-date methods of breeding and raising stock of all kinds be discussed and brought prominently to the attention of the farmers.

I wish to read extracts from the "Chicago Horseman," in regard to one of the industries, namely, the horse industry.

"Chicago, January 8.

Commenting in the Record on the outlook in the horse market, Marsh & Kenyon say:

'In the general revival of industries, in the higher values of agricultural products and domestic animals, the horse trade has been favorably affected. There is a rift in the cloud which for five years has cast a black, discouraging shadow over the great horse breeding industry of America, and intelligent breeders and dealers see unmistakable signs of a wider and more urgent demand for horses in all the avenues of commerce which national prosperity develops.

'The princely prices of 1865 to 1892 paid for horses stimulated over-production. Not over-production of the useful classes, but a surfeit of small, undersized nondescripts, whose only recommendation was kinship to illustrious ancestors. The craze for speed was contagious and nearly every farmer had a track and was wasting his time developing a trotter that never had speed enough to draw a hearse. It made but little difference if the animal was spavined, blind and knock-kneed, if he had a cross of Hambletonian, Wilkes or Mambrino he would command a fabulous price for breeding purposes.' "

"THE ERA OF LIQUIDATION.

Horses that cost breeders $26,000 through the glamor of a great ancestral pedigree shrunk in value to less than $500. When the public, the true appraiser of values, desired a horse for consumption and exacted soundness, size and elegant individuality the mirage faded. Then followed the era of liquidation in which great breeding establishments were disposed of in closing-out sales. The western range horses also swarmed like Egyptian locusts and glutted every market. When they could not be sold for cash they were traded singly and in herds for anything of material value. In this state of affairs the adoption of the cable and electric motor by nearly all the street car companies of the principal cities of America diverted a million of useful horses from the channels of trade and precipitated them in one stupendous avalanche into the markets.

From buyers of 150,000 horses annually the street car companies became the principal dealers. The public was nauseated with horses, and the useful streeters were everywhere offered at compulsory sale. About this time another calamity overwhelmed breeders in the advent of the bicycle, which prostrated the livery business and disastrously affected the light harness horse business.

The above events following in rapid succession shook the very foundation of the horse industry. Values fell so fast that dealers were ruined and breeders forced into bankruptcy. It was a period of clouds, thick darkness and general disaster to horsemen. A colt that was appraised at $5,000 at four months old, sold when four years old for $85. That is the way that fortunes melted like snowflakes on the water. It was an era of universal discouragement; prices fell below the cost of production and farmers discontinued raising colts."

"GROWTH OF THE EXPORT BUSINESS.

In the interim of the last five years the great mass of nondescripts has been eliminated from the market, and breeders have profited by studying the public taste. A new element has appeared in the trade in the foreign demand for American horses, which commenced with a few trial orders, but now promises to develop into illimitable proportion. In intelligence, docility, conformation, action and endurance the American horse meets every requirement of the European standard. England, Ireland, Scotland, Germany, France, Austria, Russia, Belgium, Italy, Guatemala, Mexico and Japan are annually making heavy drafts on our horse supply. For the first quarter of the current year England imported 8,407 horses from America, and if to this number are added the horses that were taken by other foreign countries the wonderful magnitude of the present export movement can be appreciated."

"THE BREEDER'S OPPORTUNITY.

It remains for the breeder to grasp the situation and be ready to take advantage of the higher prices which have already set in. The farmer knows there have been but few colts raised during the last five years, and the entire country is menaced with a shortage. The improved business conditions incident to returning prosperity, augmented by a rapidly increasing foreign demand, promise within the next two years to consume the already diminished supply, and the country will be called on to face a horse famine. In many sections farmers will be forced into the market next spring as consumers instead of producers of horses, as a shortage is reported in some agricultural districts.

The general tone of trade the last year has shown a gratifying movement over the dull inertia of 1896, and on all arrivals of expert quality there has been an encouraging advance in prices. The volume of trade under the stimulus of a more urgent domestic and foreign inquiry has expanded beyond the expectations of the most sanguine dealers, and the new year opens brilliant with the premonition of an active market."

The tendency of the farmer, or any one else as to that matter, after a time of depression like the one through which we are now passing, is to become discontented with his business and give up a business that is safe and rush into something new. I believe that the farmer that is well established in the dairy business should think twice before he decides to exchange it for other ventures that he may think will pay better. Therefore I think the Board of Agriculture should keep in mind this fact, and, while encouraging the animal industry, hold in check this tendency.

THE MARKET OUTLOOK FOR MAINE CROPS.

By John J. Frye, Portland.

Mr. President, Gentlemen: It is a pleasure to be here with you this evening, and I am reminded how fast time has past. It does not seem possible that one year has passed since we were here in this room, planning for the work of the year which was to come. We are now entering upon the work of another year, and we are to consider for a few moments the outlook of the market. If you will go with me we will visit the markets, and then you can judge the outlook for yourselves. The prices which I shall quote will be those actually received in the markets to-day.

We find hay, pressed, selling at from eight to ten dollars; loose, from eight to twelve dollars; potatoes, by carloads in Portland, from $2.35 to $2.50 per barrel. This is the price realized by the jobber when he sells to the trade. Apples, $3.50 to $4.50 per barrel, and scarce at that; squash, $35 to $40 per ton, a good article to raise this year; onions, $2.75 per barrel; parsnips, $1.50 per bushel; beets, $1.25 per barrel; turnips, ruta bagas, 75 cents to $1.00; celery, $1.00 per dozen.

As we view the poultry market, we find it to-day full of western chickens, selling at from 14 to 16 cents. On the 21st, 22nd, 23rd and 24th of November the farmer realized 24 to 28 cents per pound for chickens from his cart. Now they are selling at 12 to 14 cents, and eggs at from 21 to 23 cents.

Now we come to the question that so much interested us in our last dairy meeting, that of butter and cheese. We find our market crowded with butter from all sections of the country. We ask where it comes from, and they tell us from Michigan, from New York, from Maine, from Vermont. As I looked over the dairy products at our dairy meeting I could but say, How is this? I have never seen better butter than this at any of the Vermont or Massachusetts fairs, and yet we fail to score with them. Gentlemen, if we ever hold another dairy convention, which I hope we shall do, I hope that we shall have our butter all scored by number, and have Vermont and

Massachusetts butter brought in, so that we may know whether we are really low in quality.

But we must hurry on. We want to visit the steamers, and one of the most beautiful elevators of our country. As we approach the wharf we find six or eight of those fine English steamers, a sight that a few years ago would have dazed our eyes, as only eight or ten were to be seen for a season. What do we find to-day? Up to the present date, January 19, fifteen steamers have already arrived and departed during the month, and during the months of January and February thirty-five of those enormous steamers will be loaded from our port with products raised largely in our own country. This reminds us how rapidly time is passing, and what rapid progress has been made. Look back a few years, and we find that our cars from the West brought but 350 bushels of grain per car. To-day they are bringing 1,000 bushels. The engines that travelled our rails were only from thirty-five to fifty tons; to-day they average from sixty to one hundred tons. Let us think of it. Are we keeping pace with all this?

I want to call your attention to a few figures which I received only yesterday from the Grand Trunk Railroad, giving the actual amount of grain received in the year 1897, and consumed in our own State. These are facts, gentlemen, and I think they should startle us. The amount of wheat brought into the State was 37,850 bushels; barley, 80,410 bushels, part of which went to New Hampshire, we can imagine for what purpose; oats, 2,905,000 bushels, consumed in our own State; corn, 2,368,300 bushels; flour, 183,750 barrels.

These are the figures which represent the amount of grain that has been brought into our own State and consumed, for the past year, and should they not cause us to look about ourselves, and consider whether we cannot raise these crops on our own farms.

WHAT NEW ORGANIZATIONS ARE NEEDED BY MAINE FARMERS?

By Nahum Hinckley, Bluehill.

Mr. President, Gentlemen: What few thoughts I may give you upon this subject may not be of value or interest, but, nevertheless, I will speak of a few ideas that have occurred to me. It is true that the farmers need to perfect some plan whereby they may increase their business and find a cash market for the products of their farms. I will first speak of the product of the dairy. If the farmers are located upon a line of railroad, or a daily line of steamers, it would seem that by organizing and co-operating they could select some one of their number of suitable intelligence—and who is more intelligent than the up-to-date farmer—to take charge, for a fair compensation, of a station for receiving and separating the cream and making it into butter, or shipping the cream to some suitable market, which could undoubtedly be found in our cities. He could, without much cost or loss of time, make a trip to the markets of New England, and enter into contract with some commission house or wholesale dealer for the sale of butter or cream, the process being simplified, as it is at this time, by the invention of separators, which a fairly intelligent person can soon learn to manage. The cost of separating, shipping, and commission could be deducted from the gross receipts, and the balance divided equitably; and the milk taken back to the farm for feeding to swine and calves. In this manner the farmer gets all there is, after deducting expenses, and cannot claim that others get the best end of the bargain. A well known dealer in butter in Boston has been quoted as saying that so strong was the prejudice against Maine butter that the only way he could dispose of it was to brand it as coming from Vermont or New York. That being true, there is something wrong. The people of this State must have shipped poor butter to that market.

Now it seems to me that the remedy in this case is simple. Educate the dairymen up to the standard of A No. 1 butter-makers. One trouble, in the section where I live, is poor pastures and a lack of ensilage for feed. And there is a remedy for poor pastures. Clear up the bushes and get in some new grasses for the animals to feed upon; and, in many cases, some portion of the old fields can be turned into pastures, at a profit. It is a mistake to attempt to deacon your apples, potatoes, cream or butter. It is a true saying that you can fool some of the people some of the time, but not all of the people at all times.

That valuable paper, the "Rural New Yorker," says: "At the present stage in the development of city dairy supplies, no product will allow of as much improvement as the cream supply, for consumption in private families as well as for manufacturing purposes." The family trade of New York demands a separator cream, and I presume that the same rule will apply to Boston and our near-by markets.

It seems to me that the same co-operative plan could be carried into the raising and marketing of crops, such as early or late peas, beans, corn, and all small fruits; each farmer to gather such as he may be able to raise, and transport them to the co-operative station, there to be received and packed with the product of other farms and shipped to the best market. It might be best to designate one or more days in the week on which these products should be taken to the station. With the amount of skill possessed by many farmers, the marketing of poultry, lambs, sheep, eggs, etc., could be added to the business. The small farmer would thereby receive the advantages obtained by large individual shippers.

I wish to say a few words in regard to farmers enrolling themselves with some agricultural society. If there is none in their vicinity, organize a farmers' club for the purpose of holding a fair some time in the months of September or October. And I am of the opinion, and have agitated it for some time, that at each fair there should be an arrangement made to hold an auction at an advertised time, on one or more days, for the purpose of selling neat stock, swine, poultry, etc. By establishing this as a feature of our fairs, the buyer could accomplish in a few hours what he otherwise would be obliged to spend some days and a great deal of travel in accomplishing. A small commission could be charged to defray the expense of feed and the employment of an auctioneer. In connection with this, the farmers should see that our agricultural fairs are not transformed into circuses. Having for some years been secretary of a fairly successful agricultural society, located at Mountain Park, Bluehill, I have seen with regret the growing tendency to introduce many of the performances of the circus. What I think will pay best in the long run is to stick to the old fashioned cattle show and fair.

IMPROVEMENTS IN FAIR MANAGEMENT.

By W. G. Hunton, Readfield.

Mr. President, Members of the Board: Brother Hinckley has given me an admirable send-off on this fair management business. There probably has been no time in our recollection when the subject of fair management has been so thoroughly talked over and criticised by the people generally as it has for the last two years; and I am sorry to say that an opportunity has been given them in the State to criticise fair management. That part has been well discussed previous to this meeting.

I wish to call the attention of those of you who have been connected with fairs, as Brother Hinckley and several other members of the Board have been, to the magnitude and number that the fairs of the State of Maine have attained in the last few years. Originally a fair meant a cattle show; to-day, I am sorry to say that in a great many localities it means almost anything else but a cattle show. When a fair meant a cattle show, when it meant an exhibition of neat stock, sheep, swine, poultry, and the products of the field and garden, it was entirely managed by the producers of that stock and of those products. Now farmers have always shown a disposition to feel that people engaged in other occupations were not particularly interested in their occupation. We who are farmers all know this. We can hardly understand how a man from the city can so much enjoy coming out and looking over our farms (if we keep them in any respectable manner), and yet I believe that farmers have that important fact to learn,—that persons who are not engaged in agricultural pursuits will enjoy looking over the work of the farm, looking over the products of the farm, for a day or even three days, as much as we enjoy going into the cities and looking over the large manufactories and the wonderful products of those manufactories. With a feeling that outside people would not be as much interested in the simple exhibition of stock and products, those men who have been in the habit of managing these fairs have endeavored to introduce those other features, which are provided for entertainment in the city, and I believe that in doing this they have made a great mistake. Years ago our fairs were cheaply run, and in a manner were successful. It is almost within my memory when few, if any, fairs offered cash premiums, except the large State fairs and a few county fairs. The first preference, or the second preference, was honor enough for the farmer to induce him to take his stock and products to the fair, and exhibit them to those who cared to see them. But soon the feeling drifted in, that if I exhibit my stock I must have some pay for it, and then the question arose, how shall we get the money to pay the farmers? We who are interested in fair management know that for the last ten years it has been exceedingly difficult to obtain from the simple exhibition of that stock and those products enough funds to pay the premiums that we have felt obliged to offer. Seeing this need, our State legislature, which has ever been free to assist us, offered the State stipend. I find by looking over the law that this law in regard to State stipend was first introduced in this State in the year 1856. Since then it has undergone many changes, and the amount has been much increased. You can readily see why the disposition has come in to obtain money by introducing these features which the farmer would naturally feel were the most favorable ones with which to get the money from that class who comes to see his products; but I believe that the tide is turning now. I believe that those people who are not farmers, who are interested in the management of our fairs, and the farmers also, are beginning to see that the people engaged in other occupations are willing to come and pay their money to look at the products of the farm. I believe that it is reasonable to expect that the well established fairs in the State of Maine will be able in the future to pay equally as large premiums, with the assistance which they get from the State, as they have in the past, from their exhibitions.

Brother Hinckley spoke of the character of the entertainment offered at the fairs. We who visited the fairs last fall had a grand opportunity to see how much that class of entertainment interested the people. We visited fairs where a very little of it was presented to us, and we visited fairs where very much of it was presented; and those who visited fairs of the latter class could easily draw their own inference as to which were the most profitable; perhaps not the most profitable for the day, but there is something beyond the day of the exhibit. I am secretary of a fair that has held sixty-seven annual consecutive exhibitions. There is but one fair, I think, that has a better record than the Kennebec County Fair. And I think that I am safe in saying that there is not a fair in the State of Maine that has adhered more closely to the first principles of an agricultural fair than the old Kennebec County Agricultural Fair. She has drifted farther than I want her to drift, but I believe that she comes nearer to it than any other. I believe that she is the only fair in the State of Maine that has an annual address delivered upon her grounds, of agricultural interest. We have never yet missed a year of having such an address. Some years, I am sorry to say, the attention has been more largely given to some other things on the grounds, but a fair amount of interest has been maintained in that particular entertainment of the day. She has ever kept in mind this: that the exhibition which she gave meant more than the dollars and cents which she would obtain for that day. Just think for a moment of the result of conducting a fair on the principles on which some of the fairs of the State of Maine are conducted, attempting to do everything for the sake of a ready dollar. Here is a man in an adjoining town that is a good farmer, an influential citizen, a man in an agricultural community to whom the whole community look as a man of good morals and of good judgment. We say to him, "Are you going to the Readfield fair to-day?" "No, I am not going. I was there last year and it is not a respectable show; I am not going this year." Now that fair has lost not only that man's twenty-five cents, but it has lost the reputation which it ought to have in that man's mind, which is of more than twenty-five dollars value to that institution. Any fair that attempts to found itself upon the principle of giving people, and a certain class of people, just what they want to see, is sure sooner or later to meet defeat and death.

There is just one more point that I wish to speak of, and that is the growing inclination in our State to establish more fairs than can be maintained. It was reported here that our State stipend was divided among forty-five fairs, these fairs beginning the middle of August and not extending later than the last week in October. I do not think it is reasonable to expect the State of Maine, with its number of inhabitants and its valuation, to sustain any more fairs than it has at present, to speak within bounds; because I believe that one fair, well managed, run strictly on the lines of an agricultural fair, is of decidedly more importance than three fairs that are sparsely attended, that are constantly pushed for money, and cannot possibly offer good premiums or obtain for the judgment of the exhibit competent committees. It has become, to-day, absolutely necessary for fairs, whether small or large, to have the agricultural exhibits judged by competent, disinterested persons. We who have been contending for years with committees taken from the same town or county in which the fair is held, have constantly met with trouble and difficulty in obtaining satisfactory judgment upon the exhibits. The same problem that is involved in the school question comes up with regard to the cattle, sheep, hogs and poultry. When committees are selected in that way there are too many aunts, uncles and cousins that are interested in that particular exhibit. We must constantly endeavor to get back to the old lines of fairs. We must endeavor to interest the people in that for which the fair is founded, the exhibition of agricultural products.

THE DAIRY OUTLOOK.

By E. E. Light, Union.

Mr. President, Gentlemen: After ten years of agitation Maine seems to have settled down to her normal dairy gait, so that now she has well established lines of dairy industry. In all these years of agitation, discussion and persuasion the cow population has not considerably increased, and the present condition of things does not indicate a further marked increase, because the large surplus of fine butter produced in the West in summer, transported so quickly, cheaply and safely to our eastern markets, competes disastrously with our product, as it goes into cold storage, to appear later in such perfect condition as to hold back the advances we formerly obtained, thus injuring our winter dairying. So large a surplus of fine creamery butter has caused the price of this product to reach a basis corresponding approximately with other food products.

But I apprehend no further settling of prices because successful efforts have been made to export our surplus of fine butter without further reduction of prices; while the increase in domestic consumption is constant, and the different uses that are continually being made of milk will overbalance all increase in production.

It seems to me that Maine never can compete equally with the West in butter-making, any more than she can in beef raising. Her only advantage is in supplying near-by markets with those perishable products that are beyond the reach of western facilities. In these, Maine dairymen have opportunities that promise reasonable returns, and a market that will absorb all present or prospective yields. I refer to the local demand of our cities and villages and summer resorts, for fresh, fine butter, sweet cream, ice cream, etc. Condensing purposes will absorb some milk, and I believe that Maine should make the cheese used within her borders. The trade in sweet cream that goes out of the State is assuming large proportions and promises much to some localities. One feature of that trade seems paradoxical to me, which is that Maine cream is in such demand in Massachusetts markets, while Maine butter is discredited there on the score of flavor. It seems to indicate prejudice, or a distorted imagination, to say the least.

Another adjunct of dairying that we believe holds out much inducement for the Maine farmer is the raising of good cows for the milkmen of our cities and villages and for the Brighton market. The farmer who has a herd of good cows, producing milk or cream for the factory, or who makes butter for local consumers and feeds the skim milk to well bred heifer calves, will find as remunerative a business as any branch of stock husbandry. He needs to produce all his coarse fodders and as much of the nitrogenous feeds as possible, and in this line I believe clover offers the most encouragement.

Our factories should develop their opportunities in the cream trade, and in fine print butter, and should combine cheese-making if practicable. And our dairymen should hold fast to their fine butter-producing herds, their silos, and their improved rations, producing all of these rations possible, and their prosperity, I believe, will be as marked in the future as at any time in the past.

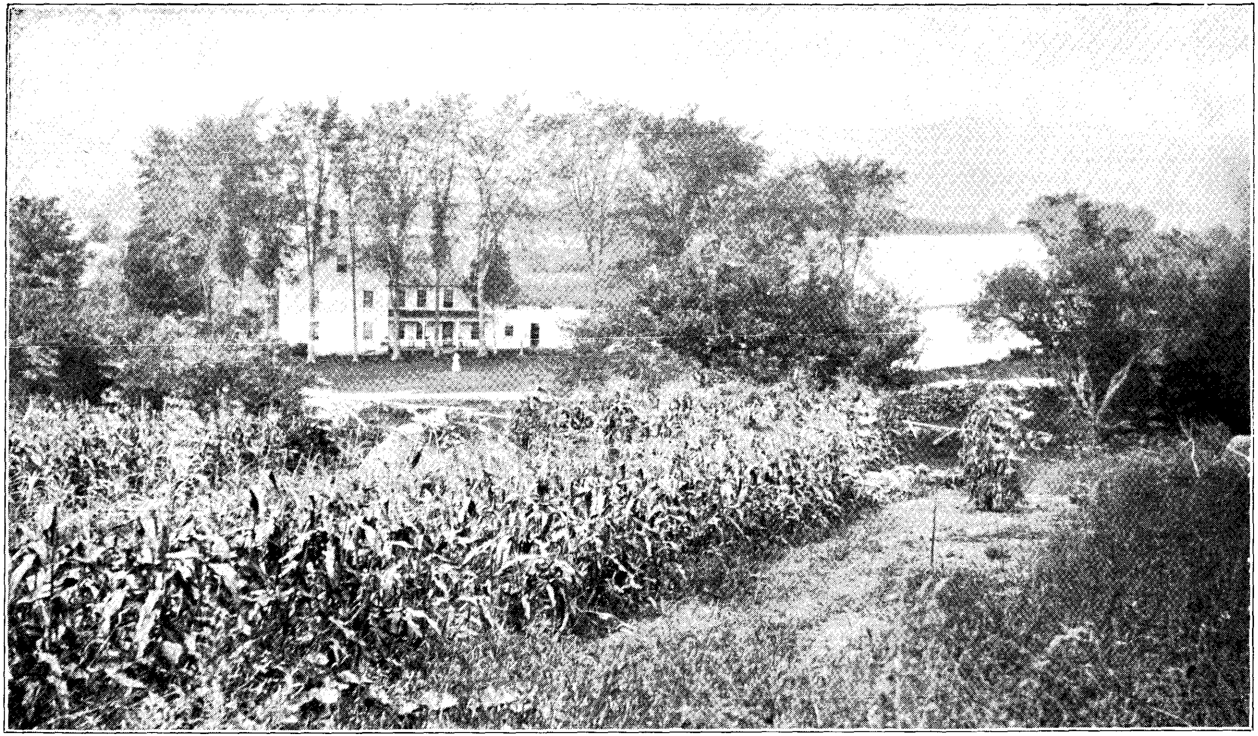
Other branches of stock husbandry are offering more inducements than in recent years, and they will draw many to enlarge in them, which will improve the chances of the dairyman who is well established in his business, and encourage him to stick to it.

FARM MANURES OR COMMERCIAL FERTILIZERS, WHICH?

By JOHN M. WINSLOW, Nobleboro.

Mr. President, Gentlemen: I am aware that with a subject of this kind it makes a great difference from what standpoint we talk. I shall talk from the standpoint of the farmer who has to live on his farm and try to get a living, and make some money if he can, from that farm. There are a great many kinds of farmers, and a great many kinds of farms in the State of Maine. And I would say in the beginning that I believe that no farmer should buy commercial fertilizers until he has completely exhausted his own resources on the farm. I believe that we are buying too much commercial fertilizer. For instance; if a farmer intends to buy fertilizer this spring, one ton or two tons, or much more than that, as many do, at the wholesale price, which would be, for a standard fertilizer, $28 or $30, let us look at it for a moment and see what he could do at home with that amount of money. Suppose he takes the $28 or $30, which the fertilizer would cost him at wholesale, and uses it to keep another cow. The $28 or $30 would pay for the keep of a cow, at the present prices of hay and grain, if the farmer has good pasturage for her. Two and one-half tons of hay, at $7 per ton, for which we can buy plenty in the barn, would cost $17.50, leaving $10.50 with which to buy grain. And at the same time he has increased his farm dressing by two or three tons at least. I am simply using my judgment in the matter, but it would seem to me that a cow could be kept for this amount. Now as a rule farmers think it extravagant to buy hay. If they feed all the hay they have, and have to buy more in the spring, they think that is altogether wrong, but they must have the commercial fertilizer to start their crops. We will suppose the profit from that cow to be $25; this will nearly buy a ton of commercial fertilizer, and the farmer has increased his farm dressing at the same time.

Ques. Suppose he were to keep another cow with the $25?



FARM HOME OF W. E. LONGLEY, GREENE.

Ans. That is sound reasoning, the profit from that cow would very nearly keep another cow, and I do not know where the end would be.

That is the very thought that I wish to bring out, that the farmer may enlarge on his own business, rather than to think that after he has fed all his own hay and stock fodders on the farm, he must buy commercial fertilizers. I have done this same thing, and believe it is right to a certain extent, but at the same time, while we may not get along as fast as by buying commercial fertilizers, if the farmer raises up a cow and adds to his herd he will increase his farm dressing and the profit from that cow will very nearly keep another. And yet I do believe that there are certain crops that it is not profitable to try to raise without the use of commercial fertilizer. I would not attempt to raise potatoes without commercial fertilizer, I feel that I must have it. I know that I can raise two or three times the potatoes, on the same ground, by the liberal application of commercial fertilizers, than I can by using any farm dressing that I have ever used. And I believe that it is wise to use a little commercial fertilizer in starting our corn crop and other hoed crops; but I do not think that a man who is making a business of farming can afford to use commercial fertilizers on his grain and grasses. There are men who make farming a kind of side issue, and have a business that pays them pretty well outside, that can with a pencil figure out a good interest on money invested in raising hay with commercial fertilizers, and selling the hay, but I believe we have sold too much hay. *I would rather sell butter at ten cents a pound than hay at seven dollars a ton.* I think there would be more profit in it.

I am aware that this is a question that might be enlarged on, but I will leave it for you to consider.

SHALL WE INCREASE OUR LIVE STOCK, AND ALONG WHAT LINES?

By JOHN F. TALBOT, Andover.

Mr. President, Gentlemen: While our secretary has given me this question to speak on this evening, he has already answered it in his report much better than I can answer it. I have gathered a few statistics, which I will give you. In 1890 we had $15,747,468 worth of live stock in Maine, while in 1897 we had only $11,819,317 worth, making a loss of $3,928,151. The shrinkage in numbers has been 167,300 head. On the 65,000 farms in the State of Maine there has been a loss of sixty dollars per farm. While we have been losing at this rate in live stock we have been gaining in population; and any one of us who has looked into the report from the secretary of agriculture at Washington, compared the figures and seen the constant shrinkage from year to year, can form his own opinion, and see conclusively that we must increase this live stock in order that there may be food enough for the increasing population. We find that we have increased only in horses. The State of Maine had seventy-five horses more in 1897 than in 1890; but the number of sheep is a great deal less.

The remainder of the question says, "Along What Lines?" I do not see how we can lay down any rule that shall apply to all sections of the State. Certain parts of our State are amply adapted to the raising of sheep. There are other localities where dairying is the most profitable business; and there are large pastures to-day in Oxford county where there used to be large herds of cattle, in which there are hardly enough to make the feed good. The feed grows so rank that it is not profitable for cattle to eat, they do not do as well as they would if the pastures had more stock in them. While we cannot lay down any rule that shall apply to all sections, yet all the farmers have intelligence enough, if they put that intelligence to work, to adapt their farming to their situations and surroundings. In our section in Northern Oxford, we are selling cream that has to be carried by private teams twenty miles before it gets to the railroad. That, for many, is laboring at a great disadvantage, and it is more profitable for us in that vicinity to raise young stock. We should get more Durham and Hereford cattle and raise beef. Years ago large droves were driven down the Androscoggin river. To-day a man comes up from Bethel and gathers the veal calves, but only occasionally are there any droves driven through the vicinity. Last fall, and a year ago last fall, 2,000 sheep, gathered in Franklin county, were driven through to the town of Bethel, where they were shipped for market; but the sheep industry has been crippled a great deal. I think that the farmers of Oxford county especially, should raise young stock and sheep, and then they would feel much better satisfied with farming than they do under the present conditions.

BEST WINTER WORK FOR MAINE FARMERS.

By W. H. Snow, Milo.

Mr. President, Members of the Board: It used to be considered, and I do not know but that it is so considered to-day by a certain class, that the farmer, after his work was done in the fall, his crops harvested, did not have anything more to do until spring, except, perhaps, to get up fifteen or twenty cords of wood and work it up in the warm April days. But the man who farms it successfully, it seems to me, is almost as much driven with work in the winter as in the summer. The most of us are engaged in mixed farming, and I think that with the care we ought to exercise in looking out for everything, our time will be pretty nearly occupied. The farmer who puts much time and care into his business, will always find a market at a fair price for whatever he has to sell.

Perhaps it would be well to have a sort of a program for each month. I think that if a great many would form the habit of looking over their tools when they laid them away in the fall, and seeing what was needed, it would be to their advantage. If a bolt was needed, or a plow point, they could attend to it at once, and not wait until they got out into the field in the spring. The same with all kinds of farming tools. I think that if some men would take a day, more or less, and fix their harnesses in decent shape, so that they would have better teams, it would be a good idea. There are men who will wear out horses and harnesses without ever knowing whether the collars fit the horses, or anything of that kind. If they would take an interest in looking out for those small things, I think that they would gain a great deal in the end. I do not know that I can suggest anything more. The looking out for all of these small matters will make a great difference at the end of the year's work.

IMPORTANCE OF RAISING SMALL FRUITS AND POULTRY FOR OUR SUMMER MARKETS.

By T. E. Skolfield, Brunswick.

Mr. President: About a week ago I received a letter from the secretary saying that he had put me down for this talk, but I laid it away and had not thought of it again until to-night, so I have nothing specially prepared. There is always a great demand for berries of all kinds, blueberries, raspberries, blackberries and strawberries. Our fruit comes a little later than the western fruit, and so we do not have to compete with that. But there is great difficulty in my section in raising fruit. Strawberries are not a sure crop. About one year in four is as often as we can raise them with much profit, and many years there is no profit in them at all. Once in a while there is a year in which there will be a great profit. A few years ago one of my neighbors got over $250 in cash from a little over a quarter of an acre of strawberries, but since then I do not believe that he has got fifty dollars a year, and he is about discouraged in the strawberry business. No other small fruits are raised for our summer people, in my section. I think there would be profit in this business if the farmers would go into it, but at present they do not seem to think so.

When we come to poultry for summer people, I can dispose of that very soon. It puts me in mind of a remark which I heard when Mr. Terry was here this fall, advocating the raising of potatoes in a dry season. Some one said, "What is he doing that for? I could not get on to my potato piece this year without getting my ankles wet."

Poultry has been so low, and can be bought so cheaply in Boston that we cannot compete with the Boston market. Not long ago a man took some poultry to Bath and could get only a little over four cents a pound. In August my boy took some chickens to a summer hotel, and they told him that they would give him one cent more than for fowls from Boston, which would be about twelve cents. I should not want to advocate the raising of poultry for summer people, because it would take a very large amount and the prices would be so low that no one would care to go into it.

WHAT CROPS SHALL WE RAISE?

By S. H. Goodwin, St. Albans.

Mr. President, Gentlemen: This subject is a grave one for the farmers of Maine to consider, and I wish I felt myself capable of solving the problem for them. No general rule can be laid down, of course, as to what crops farmers shall raise in Maine. The location of the farm, the size of the farm, the character of the soil, and all of the circumstances that surround each individual case make up, to a great extent, the basis on which the farmer must determine what he shall raise for crops. There is no doubt in my mind but that there is quite a portion of land in the State of Maine on which farmers are attempting to raise crops in the way of general farming, which is covered with granite boulders, land that is well adapted to orcharding, where it would be very much better if they would turn their attention to the raising of apples. Near the cities and large villages of course there is a chance for farmers to make some money in the raising of garden crops and small fruits. But I apprehend that the point which the secretary wished me to take up is that which applies to the average farmer, and the large majority of farmers in this State. Our land is such, generally, that we must depend upon some system of stock husbandry, I believe, to keep up the fertility of the soil. There are individual cases, of course, where cash crops can be raised and sold without feeding to stock and made to pay much better, but in a general way I think we have settled down to the conclusion that the most of us must depend upon stock husbandry to keep up the fertility of the land.

Now, then, what shall we raise upon our farms with which to feed the stock? I would say, in the first place, that Maine is a State in which grass can be easily raised. While our pastures are growing poorer, still for a long period of years ahead I think we ought to depend, and will depend, upon the pastures for grass for the stock. Soiling will not come in vogue here to any great extent very soon. This is a point to be looked after carefully, and which the Board of Agriculture can well take up occasionally,—how we can best renovate the pastures. Of course when the feed gets poor in the pastures we must supplement it with soiling crops, perhaps oats and peas early in the season, then sweet corn fodder; and Hungarian is rapidly coming into favor as a supplemental food. I think, however, that it will be a good many years before Hungarian will take the place of timothy hay.

In feeding stock in winter, I should first speak of hay; and by hay I mean timothy and red top, and as much clover as we can raise. If it turns out that we cannot raise the red clover, we certainly can raise alsike. I believe that a mixture of the grasses which ripen at about the same time makes a better hay than timothy alone.

Corn is now being grown in large quantities, and will, I believe, continue to be, and the farmers, I think, are gradually coming to the conclusion that they can raise their corn cheaper than they can buy it in many cases, taking the value of the fodder into consideration. I would name corn as the second crop; whether sweet corn, ensilage or yellow corn, to be determined by the farmer. There are places where sweet corn will do better; it depends on the location, the distance from factories, and the character of the soil.

Now we have the hay and the corn, what next? In raising hay our custom has been to seed the ground at the time we sow grain,—oats or barley. I presume this custom will prevail for a good many years yet, although some are coming around to the point of seeding without the intervention of grain, seeding between the rows of corn. For grain we shall raise, of course, oats and barley for stock food. If you have kept along with me, you will see that we are lacking in the nitrogenous foods. We hear a great deal about balanced rations, and the farmers have come to the point where the practical feeders believe in a balanced ration, and practice it. The point is, what crops we shall raise to make up a balanced ration for all classes of stock, and avoid paying out so much money for western feed. If we can succeed in raising clover we have gone a long way towards securing the nitrogenous food, so far as the bulky foods are concerned. I am aware that raising red clover is somewhat difficult, but I do not believe that the difficulties are insurmountable. I believe that if the farmers study the conditions of their soil, and experiment in this direction, they can surmount the difficulties which have seemed to surround the raising of red clover. And I think that the Board of Agriculture can well direct its efforts towards encouraging the farmers to try by every possible means to raise more red clover. Assuming that we can raise that, and do raise it, we would seem to lack a concentrated nitrogenous food, or one containing protein. I should say, from the best estimate I can make from what I have read and from experimenting, that Canada peas, or some kind of peas that would ripen at about the same time with barley and oats, sowed in connection with barley and oats, forming what we call a mixed grain, or sowed separately, would come the nearest to supplying this lack, of anything that we can produce here. If we can produce plenty of hay—and when I say hay I mean timothy and red top, with some clover—and an abundance of clover, with the corn crop, the barley and oats, and a large percentage of peas,—from these various foods which can all be produced on the farm we can make up a ration which is adapted to any kind of live stock which we have on the farm. I believe that this is practicable. I believe there is nothing in this routine which is very difficult except the raising of clover, and I think that the difficulty in regard to that can be overcome.

Roots are valuable, but they cannot take the place of peas, or even oats or barley. They are valuable to keep up the condition of the stock. So far as cow peas are concerned, various forms of beans, alfalfa, and other crops which perhaps in the

Southern and Western states can be produced to advantage, our farmers should fight shy of them except by way of experiment, and confine their attention to the crops which I have mentioned. I believe that the Board of Agriculture should assist the farmers in every way that we can in directing their attention towards a better system of raising the crops which I have mentioned. The production of clover, the corn crop, and more particularly Canada peas in connection with oats and barley, would save not only in the purchase of foods, but it would save largely in the purchase of fertilizers. Clover leaves the land richer in nitrogen, and the resultant dressing from clover hay is very valuable in nitrogen, and supplies the demand for that article which costs the most in our fertilizers.

I am aware that I have told you nothing particularly new, and I wish that I might point out some crop that the general farmer could raise for a cash crop, which would take the place of the crops which I have mentioned, but I do not know of any, and have had to fall back upon these crops, which can be produced upon our farms, thus enabling us to avoid the payment of so much money for western foods.

NEEDS AND ADVANTAGES OF OUR COAST TOWNS.

By A. S. Farnsworth, Pembroke.

Mr. President: One thing we need in our coast towns is more institute work. There is no location in Maine which needs this work so much as the coast towns, for this reason: a large percentage of our citizens have been following the sea nearly all their lives, and their fathers before them. Now that industry is about gone, and their attention is turned to farming, and in many cases with but very little experience.

Institute work has already done a great deal in improving our stock. We do not have any special branch of farming, yet I think the crop that brings in the greatest income has been potatoes.

We have a great amount of waste land, land that is really of no value as it is at the present time; this, with but little expense, could be made the very best pasture land. Now what we want

FARM HOME OF R. P. BENSON, KENNEBUNKPORT.

is to have this land utilized to the best advantage, and in order to do this our farmers must be made to believe that the dairy business is what they can get the most money out of, as they are situated.

Mr. President, our advantages over other sections of the State are somewhat limited. We can get marine fertilizers very cheaply. Many farmers can get all the rockweed and kelp they can use by simply going to the shore and hauling it, the shore making one side of the field. This is surely an advantage. We can get pomace, the average price being about eight dollars a ton. With this you can raise almost any crop, and it will last for grass three years sure, and in many cases longer. The whole herring is used for grass fields near the coast in Washington county to quite an extent, and it is considered one of the best and cheapest forms of dressing we can use. There are times when these fish can be bought very cheaply and in great quantities.

Let the institutes for the present year confine their work to the dairy, as they did last year; it had a good effect on our farmers because the speakers were practical men, and not only that, but they were men of our own State. I believe such men do more good than speakers from the Western States. These will tell you how you should farm in Maine, when, in one sense, they know but little about it. The way to conduct one of those large western farms and the way to manage one of our small farms in Maine are quite different things. They do not understand our soil, our climate, or what our markets call for, as well as the prosperous, practical farmers of Maine. Give us home talent from Maine men and the farmers of Washington county will listen, and be interested, and will go home and put in practice what they hear from such men. Have as much of the most improved dairy machinery as would be practicable, run by men who understand it and can explain its workings clearly. With such institutes as these, you will touch the farmer along the coast in the right place and best educate him; get him interested first, so that he will listen to you and take stock in what you say.

Our secretary's bulletins are doing excellent work. They seem to be just the thing to touch a certain class. The report of this Board is another good work for the farmer. The last one is the best I have ever seen; it is meat clear through. I wish more of them were printed. Every farmer in the State should read it. The Maine Agricultural Experiment Station is sending out all over the State its bulletin and it is received and read by thousands who declare it to be indispensable and greet it with pleasure, for every copy touches the reader in a new place, and sets him to thinking and asking questions that draw out new ideas from the very men it is intended to reach.

There is another way in which I think the farmers of our whole State could be benefited, and that is by looking into our agricultural fairs more than they do, especially those that are drawing stipends. This money is paid out on conditions. Are those conditions carried out? I do not know whether they are or not; perhaps some of you do. I am of the opinion that it would be a good plan to have some member of this Board visit every society that draws a stipend, with power to look into the secretary's and treasurer's accounts, as well as to observe the doings of the society, and make his report to the Board. I am a member of one of the oldest agricultural societies in the State, if not the oldest one. It was organized in 1841, and has held its catttle show and fair every year except one (in 1863). It has paid its premiums dollar for dollar, every year.

I believe the presence of a member of the Board would tend to make the exhibitions far ahead of what they are now. I am aware that some will say we cannot conduct a fair without allowing games of chance; that is a mistake, you can have a better fair without them. Have as many games and attractions of the right sort as you can, and shut out all others.

There is work to be done to encourage agriculture along the coast of Maine, especially in the growing of those crops and products which will be wanted by the summer tourists. A class of men who fish a little and farm only when they cannot do anything else needs encouragement and assistance before they can be made to see that the dollars in the future are sure to come to him who tills and toils in accord with the demands of present conditions and circumstances.

Hemmed in by the rocks, shut out from direct communication, there are still great compensations for the farmer on the coast who follows the light of to-day and makes the most of his acres.

HOW SHALL MAINE FARMERS ECONOMIZE?

By L. O. Straw, Newfield.

Mr. President, Members of the Board: I have had but very little time to think how farmers may economize, but will try to give you a few thoughts upon the subject.

The rigid practice of economy is necessary to success in any business. Neatness and comfort are not extravagances. Many may think that in order for a farmer to economize it must be on the side of saving, and that he must earn before he can save. This is not so altogether. He may economize in caring for his farm implements; he may economize in caring for his farm buildings; he may economize in many ways around his farm. But the greatest economy, as it appears to me, comes from an intelligent and thoughtful care in relation to the production of the farm. Farmers are not spendthrifts; they are not generally extravagant in their outputs, and yet many of them do not come within the possible economical limit. It is not economy for a farmer to persist continually in raising those articles which the market does not demand. It is not economy for a farmer to raise steers that are not called for by the fancy buyers of the day. It is just as cheap to raise a yoke of good steers as it is to raise a yoke of poor steers, and a yoke of good steers will sell for good money at any time, while a yoke of poor steers will not sell for any considerable amount. It is the same in the dairy business. Too many of our farmers persist in keeping in their dairy herds those animals that are not productive, those animals that are hardly worth the keeping in the production of stock and are not worth the keeping in the production of butter fat. It costs no more to keep a good cow than it does to keep a poor cow, and a good cow will furnish you with from ten to fifteen pounds of butter per week, while in many cases two cows are only furnishing ten or fifteen pounds of butter per week, and possibly farmers are keeping three cows that do not furnish any more. It is economy for the farmer to study how much he can realize from the cow that he keeps, from the steers that he keeps, from everything that he keeps on the farm. The more good stock he takes pains to keep the more money he receives from those animals that are kept on the farm. Farmers to-day are neglecting a very important thing in the line of study. But very few farmers study economy. They think but little of how much it costs to raise an acre of corn, to raise a cow, in fact, to raise anything that the farm produces. They simply go along from year to year doing as their fathers were wont to do, and never thinking in what way they can improve the farm and bring to themselves more dollars. They plant a little of this and a little of that, and reap just enough to sustain the family. The farmer who makes a specialty of some one particular thing, and at the same time raises enough of the other products of the farm to support his family, is the farmer who makes a stride ahead. It is the specialty that counts. No man ever became a great lawyer, a great physician, a great professional man in any line, or a great business man, unless he paid special attention to his avocation, to his profession. This is illustrated again and again in history. Farmers as a general thing neglect that part of the farm that is capable of producing for them the best results. I am glad to know that they are realizing this fact, and that they are improving in this particular. The waste places are being improved. Farmers are cutting away the bushes where profitable grasses may grow. They have become aware that it is unprofitable to cultivate the knolls again and again and receive no benefit or profit therefrom. The more we improve our farms in this way the more they produce, and consequently the more we get out of them.

There is another important feature in our farming. But very few farmers take any pains to raise those fruits which will make the farm valuable and which are luxuries to the family,—that is, the small fruits. There is not one farmer in ten, I presume, and I do not know as they will average one farmer in fifty, that can show you a garden that produces anything except the few vegetables that he may plant in the spring. He has no small fruits of any kind; he has no pears, no peaches, no plums, no currants, no cherries, nor anything of that kind. It is the duty of every farmer not only to increase the fertility of his soil in the raising of those crops of which we have spoken, but it is his duty to improve his farm in all the ways possible, to aid him in furnishing his family with certain things, and in furnishing other people with certain things. His farm is made more valuable by paying attention to small crops. He must take particular pains to raise more and buy less; and by raising more he will be in a condition to buy less. A farmer, in order that he may raise his crop of corn economically must make a study as to whether it is policy for him to buy fertilizers, or whether it is policy for him to raise it in some other way. It is a question of saving, in this particular.

Two years ago I thought I would experiment a little in the raising of corn. On the old farm where I am now living my father used to raise excellent corn, I thought, with simply yard manure. When I went back to the farm I followed the ways of my neighbors and bought fertilizers, and used both. I said to myself, I am going to find out whether there is any money in buying fertilizer or not. I selected a piece of land of uniform soil and texture, and I planted on one side of it a few rows of corn with fertilizer alone, a few rows with yard manure alone, and a few rows with both. I hoed and cared for them alike, harvested the corn and kept it until it was thoroughly mature, and shelled and weighed it. I discovered that I could raise with fertilizer alone corn at the rate of forty-five bushels per acre, with manure alone, seventy-seven bushels, and with fertilizer and manure, eighty-one bushels. I had been buying four or five hundred pounds of fertilizer to the acre, and using it with the manure, and I discovered that I got only four bushels of corn to the acre more by using the fertilizer. I said to myself, it is throwing my money away to buy fertilizer and use it in this way, and since then I have never used any fertilizer with the manure, for my corn. Last year I thought that I would try using fertilizer alone, on a piece of land. I grew as good corn on the land with the fertilizer alone as I have grown on land that has been manured with yard manure. I do not give all the credit to the fertilizer, but a part to the care of the soil. This piece of land, about an acre, was thoroughly cultivated. We went over it again and again, lengthwise and crosswise. I used two kinds of fertilizer on this piece, one kind which cost me $23 per ton, and another kind which cost me

$31. I cultivated it all alike, and I got just as good corn on the land where I used the fertilizer costing $23 as on that where I used the $31 fertilizer. I remember that when I was a boy my father used to cultivate that same piece of land with an old fashioned cultivator, harrowing it with a spike tooth harrow, and I venture to say that we did not get at the rate of ten bushels to the acre, while last year I raised at the rate of fifty bushels to the acre.

It is economy to use discretion, to study the needs of our farms, to read what others have done and apply it to our own lands. I believe we can economize more in this direction than we can in the saving of the few cents which we have over and above what the family requires. It is pretty hard to get blood out of a turnip, and it is pretty hard for farmers to get much money out of what they may raise, over and above what the family needs. Farmers, as a general thing, are too liable to drift with the tide, as we say. They make no effort to increase the value of their farms, and for that reason our farms to-day are worth no more, except in a few instances, than they were years ago. And in those few instances the men have made a thorough study of the needs and requirements of the farm, and have been reaching out, gathering a little here and a little there, and adding to the value of the farm. They have spent more time on the farm than they have at the corner grocery; and I believe that if more farmers would spend more time, not only in working on their farms but also in studying them, they would reap a greater reward from the farms. We complain a great deal, but when we compare our condition with the condition of those men who are working in the mills and the factories at from ninety cents to $1.25 per day, the difference is too great to mention. Everybody knows that it is almost impossible for them to even pay their honest debts. In short, every farmer should study to produce the most possible on his farm at the least cost.

EDUCATION FOR THE FARMER.

By Dr. A. W. Harris of Orono.

Mr. President, Gentlemen: When I notice the hour, and remember how many times I have talked to very nearly this same audience upon related subjects, I think that it would perhaps be best if I were to follow the remarkable example of our honored president. I will at least try to reverse the old saying and prove that the last in this case is least.

My subject is "Education for the Farmer," and the first thing that I propose to say to you is that, if observation is correct, there is a general consent to the fact that education for the farmer is legitimate. A few days ago I visited Prof. Atwater, and I remember that when he advocated the first experiment station in the United States, another member of the faculty of the university with which he was connected, and a teacher of science as well, objected to the experiment station lest somebody might get an idea that the college had an agricultural course. He believed it would be a great disadvantage to the institution if anybody thought it tried to teach farmers. Today a professor in the scientific department in that university has been granted a year's leave of absence in order that he may go to Germany and study; and he writes that he has found very great interest in visiting some of the German universities and investigating their methods of making butter. And he is interested in this simply as a matter of scientific investigation, not as a farmer or as one who teachers farmers. I believe that the legitimacy of agricultural education has been recognized for several reasons. The first is the wonderful development that has been made in it. When we first began to teach agriculture we taught that thing that has been criticised so much recently in New England. We tried to teach people to plow and harrow, and men imagined that that was the whole of the knowledge of agriculture, or a great part of it. We recognize that it is not so. The farmer must understand botany, and a botany that is just as truly scientific as that which is studied by the student of pure botany; he must understand bacteriology; he must know something of political economy.

Another reason why agricultural education is better thought of than formerly is due to the very important investigations it has conducted in the experiment stations, and the credit they have had in the scientific world. Another is the fact that it has been the leader in the great change in general education. I heard a story a short time ago which I think I will tell to you. Three English girls were talking together; one was the daughter of a curate, another the daughter of a rector, and the third the daughter of a bishop. The daughter of the curate said, "Oh, girls! I have a hen, and to-day she laid an egg." The daughter of the rector said, "I have a hen and she laid two eggs." The daughter of the bishop said, "That is nothing at all. I have a father who laid the corner stone of a cathedral to-day."

The egg of agricultural education has gained in dignity by the corner stone of scientific education which is related to it. We have come to understand from the success that agricultural education has had, that it is a proper province of education to prepare men for doing their life work and earning their living, not only in agriculture but in every pursuit in life, including business.

Education for the farmer ought to involve two different things. First of all, it must be a technical education, which is an education that takes hold of the very things that he must do, the ideas that he must develop, the things that he must handle. And those things and those ideas are very many. He must know, for instance, something about the diseases of plants and the diseases of animals; he must know something about the principles of machinery; if he would conduct a dairy he must know something about the intricacy of bacteriology; he must know something about chemistry if he would properly nourish his fields, and I might go through almost every line of science and show you that it has a bearing upon his education. But we will not question the necessity of a technical education.

Agricultural education involves a second thing,—general education. The educated farmer must be a man who has been trained not only in the things that he must do on the farm, but in the thinking that he must do upon the farm. He must see what is going on about him, in his own fields, in the markets, and in the fields and on the farms of his neighbors. He must know how to keep his accounts. He must know which cow pays, and which is a loss, what crop pays and what is a loss. He must find out where the leaks are, and how to economize.

And he must keep his ears open. He must know how things are selling. If a man is going to get the best price for his wheat he must know something about the crops on the other side of the world, something about the price wheat is bringing in India. And then I would sum up this kind of education in the very words I used at first,—he must know how to think, and that comes more largely from a general, broad education than it does from a technical education.

This subject does not distinguish between the man, the farmer of to-day, and the boy. How shall these two get their education? The farmer, the man, will not go to school very much, but I believe that there are many opportunities for a farmer who is in the active pursuit of his business to keep on educating himself. I think it is a very poor farmer who has not an agricultural paper, to begin with, and the better farmer will probably have two or three agricultural papers; and he will not confine himself to agricultural papers, he will have some other papers so that he will know what is going on in the world outside of the limits of his farm. He will get a great deal out of the institutes, he ought to get a great deal out of the grange, he ought to read his station bulletins, and he ought to take the short course at Orono once in a while if he gets a chance.

Suppose we take the boy, how is he to get his education? I believe he had better get it in the old fashioned way. I know of no patent way or short cuts to real success. I would send my boy to high school. I think a great many of us make a mistake, and take our boys out of school too soon. I believe that the bright boy earns more money by staying in the high school than by going into the field or shop. If you have a good hoe give it a good sharpening, and be sure that the time you put in with the file is not wasted.

And then I would send my boy to college, for the same reasons. This is an age of combinations. You may not like trusts, but I believe trusts have come to stay, and we must reckon with them. The business of making a good living, or any great success in life, will grow more and more difficult as the years go by for the man who has an inferior preparation for it. If you want your boy to do the best, give him the best fit. It is the only way in which he has a real chance. You may say, there has not been a great success in college education in agriculture. That is so. When I came to the State I had great hopes of building up our agricultural course rapidly. I am not so sure now of rapidity, but I mean to be patient, for success along this line is sure if we will only give it time. And I believe that this is so because it is necessary. Take the farmer who has nothing but a common education; why should he expect to make very much? He has his farm, and in times past when money was easy to make, and when he had virgin soil, of course he had an easy time; he could scrub off of his farm the very farm itself, and use up what he ought to have left for posterity. That time has gone by, and what he has now is the interest on the little capital invested, and his own muscle. And what is muscle worth? About $1.50 a day, and if there are no brains put in he ought to be content with a little more than $1.50 per day, for it is all that his work is worth. The farmer who makes much must make much of himself.

In the way of résumé, the education of the farmer must first of all be a special education; he must not shoot at too long range, but must handle the tools himself. In the second place, it must be a deep education, one that teaches not only rules but reasons; and again, it must be a broad education, one that enables him to think and to apply old methods to new problems. And last but not least, it must be an unending education. It must go on as long as the farmer goes on. Alas for the farm when the mind of the master, its most important equipment, ceases to grow!

The executive committee, to which was referred the matter of a joint dairy exhibition, reported by offering the following resolution:

Resolved, That this State Board of Agriculture endorses a joint dairy exhibition, and pledges its official and individual assistance in organizing for such an exhibition; and would urge upon the members the importance of agitating the question, as a means of increasing the dairy interests of Maine, improving the quality of the products, and establishing the same in the great markets of New England. And the secretary is instructed to obtain the necessary information to accomplish this object.

This resolution was adopted by the Board.

Adjourned to 9 o'clock Thursday A. M.

THURSDAY, A. M.

Records of Wednesday's meeting read and approved. Report of committee on pay roll presented and accepted. Committee to consider the report of the secretary report in favor of printing the same, with a few changes, and also recommend the annual appointment by the president of a finance committee of three, whose duties shall be to supervise the expenditures of the Board. This report was accepted and adopted.

Voted, That the secretary be instructed to furnish each of the members of the Board with 100 sheets of letter paper with printed headings, and envelopes for same.

Five-Minute Talks by Members.

KENNEBEC COUNTY.

W. G. HUNTON—Mr. President, Gentlemen of the Board: From my experience in the State for the last year I learn that the recommendations which were adopted at the last annual meeting in regard to scattering our institute work more, and holding institutes in places that we had not reached before, have worked admirably, but there is still room for improvement in that direction. I think that even last year we sometimes took more speakers into a county than was necessary, we did not scatter them enough, and in too many instances we held all day meetings in one place when it would have been better to have held but two sessions, or even one. Farmers all have something to do besides attending institutes, some necessary work each day, and it is almost impossible to get them to attend a three session meeting, however interested they may be in it. Our attention has largely been directed for several years past, ever since I have been a member of the Board and for the years immediately preceding that, towards pressing the dairy interests of the State. This was necessary, it has done a good work, it is doing a good work. There is room for lots of that work in the State to-day, because, with all our efforts, to our chagrin we find that the number of cows in the State is falling off. We have pressed the line of dairy work for the last three years particularly in the direction of butter-making, and it was well. There is no product that the farmer can sell that will deplete the farm so little as butter; but at the same time I believe that the immediate future offers other inducements in dairy lines, and people are interesting themselves to a certain extent in other branches of husbandry. I have held but one institute in my own county for the past year, but we are arranging for a series of institutes to immediately follow this meeting, and I find that in the several localities, where dairying is the chief interest,—and, in fact, you cannot find a place in Kennebec county where the interests are not largely along dairy lines—they are requesting something else besides dairy topics. There is a growing interest in the seed and feed questions, there is a growing interest in the subject of the obnoxious weeds that are coming upon us, as farmers wish to know more about them and how they can be avoided, and there is a growing interest in stock raising, even in Kennebec county.

Therefore I think it is well for us at this time, in mapping out our work for the year, to consider if there is not an opportunity to better do our duty to the tax payers of the State by encouraging, with the dairy interest, some other interest, more than we have been doing for the past two, or three, or five years.

WALDO COUNTY.

W. H. Moody—The great trouble that we have always found, wherever I have had anything to do with institute work, is to get an audience. Unless he has had experience in the work, it would be hard to make a man believe that when you put out fifty large bills in a territory comprising half a dozen miles, and print 200 postal cards and send out as special invitations, you would not get 100 persons to attend the meeting, in this day, after they have listened to so many good speakers and have been benefited so much by the work. I think it would be hardly possible for a man to do more work in that direction than I have done. I have been very careful to see that all of the postal cards were directed to people that I thought would be likely to have the most interest in the meetings, and still, while the meetings have been fairly satisfactory, they have not come up to what they ought to be.

In regard to splitting meetings, we did that in our county last year and it worked well, because, while the audiences were not large, we could reach more people, as it seems to be hard to get them to come a great distance.

I agree with Brother Hunton in another thing. In the five years that I have been on the Board we have been pushing the dairy interest. Before that time, eight or nine years ago, Brother Light and I got an institute at our place, in the interest of dairying, and from that has grown a large dairy business. He started out in the line of associated dairying, and I started out in the line of private dairying, and we have built up quite a large business. That institute did a great deal of good. But when I contemplate that the neat stock and the swine are falling off all over the State, even in my own county, it seems to me that something ought to be done in a different line. We ought to have some talk at the institutes encouraging the raising of more stock. I think that in my section the stock interest was injured by the bringing in, twenty years ago or more, of a poor strain of Durham stock. It was a long legged, miserable strain, and whoever tried it was beaten. In twenty years, of course, a great deal has developed in the breeding of stock, and I think that some effort which would assist in that direction would be well. While there are places where not much interest has been taken in the dairy business, and work in this line might be needed, still I believe that the institutes should be diverted somewhat from dairying to the breeding of stock, and if we could have the same kind of speakers in that line that we have had in the dairy line, men who are acquainted with the business and can speak from experience, it seems to me that it would be an excellent thing, and I believe it is the thing to do.

WASHINGTON COUNTY.

A. S. FARNSWORTH—Mr. President, Gentlemen of the Board: I do not know how we can improve the institute work in Washington county. I know that the institutes were a success last year, and I do not know of any beter way than to carry them out nearly as they were carried out at that time. I must differ somewhat with Brother Hunton, in regard to one meeting, or perhaps two, in a day, being enough. I noticed that in one place in Washington county, at which he was present, where we had a meeting of two days, three sessions a day, every meeting was well attended, and at some of them the house was crowded, and the steps outside, as well. And I do not believe that there was an institute held in the State that was more interesting than that. Perhaps that would not be practicable as a rule, but so far as Washington county is concerned, we do not hold institutes enough there.

The institutes are doing a great deal of good and I hope that this year we can have more time. It takes a long time to get into Washington county and a long time to get out of it, and if much time is spent in the county, no week that has not more than seven days is long enough for the institutes. The speakers like to be at home Sundays, although I think that our Secretary expressed the idea that another season he would not object to remaining down in Washington county over Sunday, and I hope that we may have more time; the work has been rushed through too much. The dairy question is the principal subject that we need in that section, and it is well to include the feed question, I think. The territory that we cover is so large and the distances between the places so great that it is impossible to reach all parts of the county and hold meetings without loss of time in traveling, and I hope that this Board will be willing to put in time enough the coming year so that we may hold meetings in those towns where they are needed and have not been held before.

LINCOLN COUNTY.

J. M. WINSLOW—I have not thought of anything new that I would suggest for institute work. I have had some thought that perhaps it might be well for the Secretary to send into each county, if he could not go himself, some man to hold evening meetings during these winter months, thoroughout the week, going from one place to another and holding meetings in the schoolhouses, or wherever he could get a convenient place, speaking on something that would suit the condition of the people, and getting up some enthusiasm. I think that, in my own county, that would be one of the best ways to expend the institute money for the coming year. I do not know how that would meet the mind of the Secretary. The people need enthusiasm. A good deal of knowledge and no enthusiasm does not amount to much. One the other hand, a good deal of enthusiasm and no knowledge perhaps would not amount to much; I do not know but one is about as good as the other if you must have it alone.

CUMBERLAND COUNTY.

JOHN J. FRYE—I am in hearty sympathy with this work. Brother Moody remarked a short time ago that it was hard to get many to attend these meetings. That has been the trouble in my own county. There has been a lack of interest. I think the custom which has been adopted of sending out advertising for these meetings has been a great help.

I am in sympathy with the bringing in of some one from the West, so that we may imbibe new interest, and learn new modes of working the soil. I think this is beneficial to our people. In regard to the dairy interest, as we are not all dairymen I think we should advocate other lines of work also. We cannot interest every man in dairying; we may interest some in stock raising, and some in other lines. Let us not make a hobby of one thing and ride it into the ground. I think, too, that the holding of three meetings per day is the most beneficial. I think the most of the people where I have had calls for institutes want to put in the day. The idea of three sessions strikes me the best, and I hope we may work along this line.

OXFORD COUNTY.

JOHN F. TALBOT—Mr. President, Members of the Board: I will say for Oxford county that our people are interested in this institute work, but you will see by the report that we have had but very few institutes in Oxford county. When Brother Stetson was on the Board I think he held only one or two institutes during the three years of his administration. A good many of the towns have been writing me lately in regard to this institute work, asking when they could have an institute. The town of Waterford has had the promise of one for three years, and I hope to be able to supply their wants this coming winter. The subject which they wish taken up in the upper part of the county is dairying, more than any other. Through the southern and middle portions of the county, dairying is engaged in largely, and also the raising of fruit. The towns of Paris, Waterford, Sumner, and others, have large orchards. They are also interested in dairying, there being a creamery at Waterford and one also at Bethel. The northern portion, as it is too far from the creameries for the cream to be carried to them, is better adapted to the raising of stock, the keeping of sheep and young cattle. For the last few years farmers in our section, if they heard of another section of the State where money was being made by keeping cows, have gone into this rather blindly, neglecting a business that would pay them much better; but they are beginning to realize that they must go back to their old methods and adapt themselves to their circumstances, rather than try to ride a new horse.

The line of institute work which I would recommend in our section would be dairying, orcharding, and the raising of stock, —young stock and sheep. In some sections of our county there are nice markets for small fruits and for poultry. Quite a number of the towns are situated near summer resorts, so that those interests would be beneficial to the farmer. The raising of poultry is much different with us from what Brother Skolfield reported last night. We can always sell early chickens for broilers, and can always sell fresh eggs. In our own vicinity there are not enough eggs produced to supply the demand.

Our soils are well adapted to the raising of grain and hay. I think that what we need is more institutes. We have not had our proportional part, but I hope to be able to hold some the coming winter.

YORK COUNTY.

L. O. STRAW—Mr. President, Members of the Board: I think our institute work in York county has been very successful. The only trouble is that we have not been able to get enough of it. Our county seems to be divided. The upper part, and the lower extremities are the parts in which we have to hold our institutes, to hold them most successfully; these are the parts where the farmers are engaged more extensively in dairying and stock raising. This makes it a little difficult for us to hold our institutes, as we seem obliged to hold an institute one day in one part of the county, and then ride quite a distance to another town where we can hold a successful institute. I have thought that if we could have a little more time the difficulty would be less. I will leave this for the consideration of Mr. McKeen. I can see that the people in York county are becoming very much interested in the institutes. Last fall we held an institute at our village. I have steered clear of my town, as in some way I got it into my mind that an institute would not be very acceptable there, but we held one of the most successful institutes in our village that we have ever held in the county. The people were thoroughly enthusiastic, and the only trouble was that we did not have time enough. If we had had another day, or a part of a day, I think we could have done more and better work. The farmers are improving considerably in the care of their stock, and they are increasing the same. There is nothing else that I know of that we can do in York county except to advocate an improvement in that direction, the raising of better stock and the caring for it better than we have been in the habit of doing.

The dairy business is increasing and improving there, and I am glad to say that the farmers are improving in their selection of cows for dairy work. In parts of the county but very little dairying is done, the farmers being engaged in the raising of stock. They take quite a good deal of pride in this, and make quite a specialty of it. I think there is nothing more that I can say in relation to the work for York county.

SOMERSET COUNTY.

S. H. GOODWIN—Mr. President, Gentlemen of the Board: I feel somewhat like renewing the request made last year, in regard to institute work in Somerset county, that we should have at least one institute devoted to the sheep industry.

I will say now that, so far as our county is concerned, the all day meeting, three sessions, works admirably. Prof. Woods will tell you that we had a splendid audience at Fairfield, and he was kind enough to go with Brother McKeen to Canaan, where they had a very large meeting. At Solon the institute occurred on the day of a large snow storm, which interfered somewhat with the arrangements. That was to be a sheep institute. Prof. Gowell could not get there, and Brother McKeen talked partly on sheep raising and partly on dairying. I understand that they had a very successful meeting, with a large attendance in the evening. I could not get there on account of the storm. Secretary McKeen also delivered a lecture at North Anson that evening, to a crowded house. So you will see that we have had good audiences, and I would recommend an all day meeting.

In our county, so far as the sheep industry is concerned, I have felt that we ought to have some one from abroad, who is thoroughly posted upon the breeding of sheep as bred in other states where a success is made of marketing sheep, to talk to us upon the subject. Not that we do not have good sheep men in this State, but I know of no man in the State so thoroughly qualified as some out of the State, and I think that, considering the small amount of money that has been devoted to that industry by the Board of Agriculture for the last ten or fifteen years, we are entitled to at least one as good speaker as we can procure anywhere within a reasonable distance. Mr. Ellis agrees with me perfectly, and I have talked this matter up in our granges and find that the people wherever I go want the institutes devoted more to sheep raising, and stock raising, instead of pressing the dairy business any farther. I think that, with the condition of our soil and our hilly farms, there are many reasons why we should take more interest in the raising of sheep, and also stock raising, and now is an opportune time to present these subjects. The dairy interest predominates in some sections of our county, and, of course, it has received a good deal of attention and we have been benefited by the institutes devoted to that interest; but, in my opinion, the time has come for a change. I can only reflect the wishes of the farmers in my county. These are not my own private ideas in the matter, particularly, I am simply speaking for the farmers in the county as they have expressed themselves to me.

I believe that other counties in the State would be benefited equally with us by giving attention to the sheep industry. Possibly it would not do any harm to take a speaker on this subject into Aroostook county. I do not know about that, but I do know that in Franklin, Oxford, and portions of Somerset county the sheep industry should be encouraged, also stock raising and orcharding. I have no fault to find with the institute work in Somerset county. Brother McKeen has brought good speakers, and we have had good audiences, and good results have been obtained.

SAGADAHOC COUNTY.

T. E. Skolfield—Mr. President, Gentlemen: I do not know that I can say very much more than I said last year. I think perhaps the dairy interest has been talked about enough in Sagadahoc county, and some other subject, as stock raising or small fruits, might be better. We have held seven or eight institutes in that county since I have been on the Board, and all the subjects that I have heard of have been discussed. The ones that the people seemed to take the most interest in were small fruits and stock raising. I think that in two years from now, perhaps not next year but the year after, there will be more stock and more sheep raised in Sagadahoc county than there were last year. We are well situated in Brunswick, in regard to markets and shipping facilities. It seems as though we have had enough institutes, but people do not seem to take the interest in them that they should. I think perhaps one of the best ways to reach the people is the sending out of these bulletins. There are a few people who read and understand what they read, and they will read the bulletins and get better ideas than they would from the institutes; and, of course, many of them do not attend the institutes.

I am inclined to agree with Brother Hunton, in regard to all day meetings. I think it would be full better not to hold an all day meeting in my county, but to hold one or two sessions in one place and then go to another place. We had Mr. Terry last fall, and we have always had fine speakers, but I think that at Richmond in the afternoon there were not over fifteen or eighteen. There is a man here who says he can get up a large meeting in Sagadahoc county, but I have never seen one. I did not attend the meeting which was held at his place, but he says that it was a fine meeting with a large audience, and we are going to have another in that place. In the vicinity of Brunswick and Topsham there is very little interest taken in institute work. I think the sending of bulletins from the State College and from the Board to people who will read them will do fully as much good as the holding of institutes, although I do not want to give up the institutes.

HANCOCK COUNTY.

NAHUM HINCKLEY—Mr. President, Gentlemen of the Board: I will say that the institues in our section have been very profitable. They have been well attended, and have set the farmers to thinking. I think it would be well to divide up the time a little more among the towns, and instruct the farmers in dairying and stock raising. I notice that the Iowa Experiment Station has succeeded in raising calves from milk run through a separator which at the expiration of eight months, weighed 548 pounds. So it would not seem to be necessary that the calves should have very much butter fat in order to make good, strong, healthy cattle. Our town used to be a great town for oxen, but they are decreasing, we lack a good market. Perhaps the lack of interest in the institutes in Mr. Skolfield's section is for the reason that they are pretty near a large market. We are deprived of any market. A year ago an attempt was made to establish a creamery, and the farmers signed a paper stating the number of cows they would keep. Some of them who have been keeping perhaps three cows agreed that if a creamery could be established they would keep ten. But they need instruction, and are anxious to get it, in regard to separating the cream and shipping it to Boston. Perhaps we are a little out of the way for a creamery, as the local market for butter would be small and also for the milk after it was separated. The creamery at Ellsworth is doing nicely. Mr. Gordon runs a very nice creamery, but his local market is good. He is on the line of the railroad and can ship two or three times a day to Bar Harbor. But we are fourteen miles from Ellsworth, and need something different. I hope that we shall have an institute this year, and I think we can get out a very good audience.

AROOSTOOK COUNTY.

JONATHAN BENN—Mr. President, Gentlemen: I am a new member of the Board, and shall not have much to say. I think the institutes have been a benefit in our county. I am in sympathy with the gentleman from Somerset, in relation to the sheep industry. I think we need encouragement in that, especially in regard to better breeds of sheep. I do not know whether speakers would do us more good than some better breeds of sheep sent in. We have run largely to potato raising and neglected the raising of stock and sheep very much. I think we need better breeds of stock and sheep sent in, and then we need institute work to teach the farmers to keep more stock and take better care of it. The dairy interest has been talked a good deal, but I do not think it has been hurt. There are no creameries established, although there is a great deal of private dairying done all over the county. We haven't a very good market, and there seems to be a prejudice against Maine butter in Boston. Even Aroostook butter does not show up first-class. One trouble has been, I think, that we have not had facilities for shipping butter through the warm season. It has been kept over until the weather became cool, and, of course, was then second class butter.

I think, also, that the subject of raising our own feeds needs considerable discussion. The institutes in our county appear to be fairly well attended, and if the Secretary will appoint a good number there this year I think we shall have good audiences.

KNOX COUNTY.

E. E. Light—Mr. President: I have been very much interested in the remarks of the gentlemen, and I commend much that has been said. In Knox county the institutes are not generally attended as well as I wish they were, not as well in some localities as they formerly were. I believe a little change in methods of holding the meetings would be well. In some localities one session would be better than two. In other localities perhaps a two days' meeting would be profitable.

In regard to subjects, the dairy subject has been well ventilated, and with the information that the farmers are constantly receiving from the dairy papers, the influence of the Board bulletin, etc., I think that subject is kept before the people all that is profitable. I am firmly convinced that in Knox county there should be an increase in all kinds of stock, in the dairy if it is desired, but especially in steers, oxen and sheep. And I believe that this will hold true in every part of the State of Maine. I think that more stock would mean more prosperity. While we have had a great deal to say about balanced rations for cows, so far as I am aware, nothing has been said about balanced rations for steers or sheep. I think the rations for that class of stock could receive more attention with profit, and that the raising of good stock, good sheep and steers, in many localities in Maine, could be engaged in with great profit. I believe that the influence of this Board should be used more than ever before for the increasing of this class of stock. We will not give up the dairy, but give more of our attention to other kinds of stock raising. Also the production of all that is consumed on the farm should be encouraged, as far as it is practicable.

From my observation in my own county I believe that speakers from our own State, generally, for the cost, are more profitable and successful than those from out of the State.

PISCATAQUIS COUNTY.

W. H. Snow—I do not know as I have anything in particular to offer. I think we have had our part of the institutes, and we have had some very good ones. We held two in the county last fall, at which we had some excellent speakers, and a large amount of interest was manifested. I like the arangement of sending around postal cards very much. I sent quite a number into the edge of Penobscot county, and I got a first-rate delegation at one of our meetings held near the line. We are in about the same situation as the other counties; we need a great deal more attention paid to stock raising of all kinds, and also to the raising of small fruits. This is a point which has been neglected very much, and which I believe would be one of the best things, perhaps, in that section,—the raising of small fruits. I have been very much interested in the remarks which have been made, but do not think of anything new to suggest.

Dr. A. W. Harris—I have only a word to say. It has occurred to me, as we have spoken so frequently of the inferiority, or supposed inferiority, of Maine butter, that it might perhaps be profitable for the secretary, at some of the institutes, to exhibit butter from Boston which was regarded as the very best, for the purpose of present comparison.

Prof. Chas. D. Woods—Mr. President: I have been very much interested in the remarks of the members in regard to institute work. I thoroughly believe in institute work, not so much for the information which the people get when they attend the institutes as for the inspiration which they get to work and study. I believe that we should talk along lines in which the people are interested. The institute is not for the purpose of amusement, it is for the purpose of education. It is not to teach men the rule of agriculture, because there is no such rule. It should be, however, the aim of our institutes, it seems to me, to develop interest, and try to encourage the farmers to work out the problems for themselves. There is one feature about our farm life in Maine that strikes me very forcibly. There are comparatively few men in the State who take farming seriously, as a business. The farm is largely a home; and that is right, it should be a home, and I believe that in our institutes we should try to encourage the developing of the farm along those lines. But I do think that if we could make men believe in farming as a business, and if they devoted themselves to farming as the means for obtaining their living, their farming would be more successful. I find it true all over the State that when a man who is a farmer wants to earn a little money he does something else. I think that is a great drawback to the development of agriculture, pure and simple. I do not know that it would be wise to change this, but I think it is one of the reasons why agriculture is not more successful in our State.

I think the local member should do all that he possibly can for the institute work. Of course there are different conditions and surroundings. There are some counties in which the people feel the need of this work, and others in which they do not. In the counties in which they do not, the local member has a great burden upon him, if he holds an institute at all, in advertising and securing a good audience. He must give a good deal of his time and a good deal of his enthusiasm, and if he has no enthusiasm he should simulate enthusiasm, or else not accept the position as a member of the Board. A man should believe in agriculture, and believe in the success of agriculture, if he is to be a member of the Board, and should try to push these things. I am not making accusations; I think all the members are interested, and the difference in the institutes is largely due to the localities. In localities where we do not get a good attendance we must work for it.

I think that we ought to give some attention to the improvement of home life on the farm, at our institutes, because that is what we are all getting, practically *all* that we are getting,— our living. The farm garden comes in in this connection; good roads come in in this connection, and we may ignore it as much as we please, but some time or other we must catch up with the procession or be left badly behind in the movement for good roads.

There are many other topics that might be discussed at the institutes. I think that sheep raising, not from the old standpoint but from the new standpoint, will be a valuable industry in our State if it is properly introduced. Sheep must be well cared for, and we must get fine breeds, breeds that mature early, breeds in which there is no difficulty in getting early lambs, if we would get the most money out of the business. In the poultry business we are not doing as much as we ought, and in the dairy business, in many counties, we are not doing as much as we ought. In Aroostook county the difficulty in the dairy business is spoken of as a lack of outside markets, but I have never yet seen Aroostook butter on a hotel table in that county.

There are also the subjects of weeds, fungi, our insect enemies, etc. If those of us who grew potatoes last year had known enough to use Bordeaux mixture early and often, we would have saved thousands of dollars. We want to study these things, and learn lessons from the past, and we should inspire men all that we can to study, and work out these problems for themselves.

One thing I wish to mention, in regard to speakers from our own State. I am not pleading for myself, because I have so much work to do otherwise that I do not like to go out to farmers' institutes, but I think we make a great mistake when we read of a man in the Rural New Yorker, or some other place, and because he is at a distance put a halo around his head, and try to bring him into the State. We have just as good men in Maine to talk to us upon these subjects as we can find outside of the State. It was a good idea to bring Mr. Terry into the State, that we might get some inspiration from outside, but I believe that, in the long run, we spend our money best when we spend it to get speakers here at home, who only cost us their expenses. The man who talks simply because he has a message to the farmer is a better man than the man who talks because he is paid to do so.

I also quite agree with other things that have been suggested. I think that we should not try to crowd too much into one place, particularly if it is difficult to get out an audience. Perhaps simply one evening meeting would be best in such an instance as that.

I hope, brethren, that in the year upon which we are entering we shall do all that we can in our respective counties to develop an interest in agriculture for agriculture's sake.

Mr. SKOLFIELD—I would like to hear a few words from Mr. F. S. Adams of Bowdoin, who is right in the center of the dairy interest in Sagadahoc county.

F. S. ADAMS—Mr. President, Gentlemen of the Board: I think that the reason why Brother Skolfield is not able to get out a crowd at the institutes held in his section is that the most of the men are retired sea captains, who have plenty of money and are not interested in farming. In the northern part of the county we have to get our living out of the soil, we are interested in farming; and if speakers are brought into a community that is interested, the people are bound to come to the meetings, we cannot keep them at home. A few years ago we had an institute on a very stormy, cold day, and we had an attendance of seventy-five. We have a good grange and that helps. In my judgment, the best place to hold an institute is right out in the country. In the city the people have other interests, but when you get into the country pure and simple they are all interested in farming and you will get a good audience. This is the case in the northern part of Sagadahoc county. Down in Brunswick and Bath they are interested in other business, and when they want a little money they go into the shipyard, or go fishing, they do not depend on the farms.

I agree with the remark of the gentleman from Hancock county, that dairying and stock raising should go hand in hand. They must necessarily do so. We have the refuse product from the dairy, the skim milk, on which to raise the young stock, and there is no better young stock that we can raise, at present prices, than good heifer calves. They sell as well as steers, when they are a year old, and perhaps better if you have the right kind. I have a neighbor who has no trouble in selling all of his heifer calves as yearlings or two-year-olds, for $35 or $40. But you must have the best tools to work with. The day of the old brindle cow has gone by, and if we are interested in dairying we must have the special breed for dairying, which is the Jersey. If we are interested in beef raising we must have the special beef breeds, which are the Herefords and the Shorthorns.

I think the sheep industry should be given more attention. We have a grand opportunity for this industry in the State of Maine, as the people are learning that mutton and lambs are the healthiest meat which they can obtain, and, especially in the cities, are willing to pay good prices for these products.

Another important matter is the marketing of our products. I find nowadays that the most successful farmers are the best market men. I think it is easier to raise farm products, under present conditions, than it is to market them at good prices. This is a question that might be discussed at our institutes. It is astonishing to see what home markets we have, if they can be developed. It has been only four years since the people in the city of Bath knew that sweet cream was good to eat, and now all the market men, from twelve miles around, carry sweet cream into the city, which they sell at twenty-five and thirty cents a quart. This makes a very nice supplementary product. Our home markets are the best markets. There are plenty of people in the cities who are willing to pay a good price if they can get a good article, and they are beginning to learn that there is nothing better than good sweet cream.

Brother Skolfield is somewhat discouraged about the poultry industry, but we have a man in our town who is making more money than any other farmer in the town, and doing it solely by the poultry industry. Broilers can be sold in our local markets for thirty-five cents a pound in May, generally, when they will weigh about two pounds. That is a good business. At the present prices of grain a chicken can be raised to the weight of two pounds and sold at a price which will return more than fifty per cent on the capital invested. This is better than railroading or banking. Farmers do not realize their opportunities until they try to develop them.

Adjourned to 2 o'clock P. M.

THURSDAY, P. M.

STEPHEN LINCOLN GOODALE:

His Life-Work in Behalf of Maine Agriculture.

By SAMUEL L. BOARDMAN, Ex-Secretary.

It has been a pious and reverent custom for the people of all nations, for societies, associations and individuals to perpetuate the characters and eulogize the heroic deeds of the soldiers, statesmen, poets, philosophers, inventors and philanthropists of all ages. The custom is one that appeals to the finest human sentiment, and finds a response in the heart of humanity. But while doing honor to the more conspicuous, why overlook the less noticed? If the great soldier deserves an eulogy for deeds that have cost thousands of human lives, why not the benefactor whose life has led him along more quiet paths, and whose triumphs have been those in the peaceful fields of agriculture rather than upon the field of carnage? Those who have devoted their lives to the improvement of the agriculture of a nation or state, deserve well of their fellows. If we may believe with Farmer Washington—for that Washington was a real farmer there can be no question—writing to William Pearce, whom he wished to secure for an overseer of his estates, in October, 1793, he says: "As I am never sparing, with proper economy, in furnishing my farms with any and every kind of tool and implement that is calculated to do good and neat work, I not only authorize you to bring the kind of ploughs you were speaking to me about, but any others the utility of which you have proved from your own experience—particularly a kind of hand rake which Mr. Stuart tells me are used on the eastern shore of Maryland in lieu of hoes for corn, at a certain stage of its growth; and a scythe and cradle different from those used with us, and with which the grain is laid much better. In short I shall begrudge no reasonable expense that will contribute to the improvement and neatness of my farms—for nothing pleases me more than to see them in good order, and everything trim, handsome and thriving about them—nor nothing hurts me more than to find them otherwise, and the tools and implements laying wherever they were last used, exposed to injuries from rain and sun;" or if we believe with this great man and good farmer that "agriculture is the most healthful, most useful and most noble employment of man;" or if we accept with Farmer Webster—for the great expounder of the constitution was a practical farmer—amid all the perplexities and cares of state at Washington throughout his public career Webster did not write a letter to his head farmer, John Taylor, that he did not talk about oxen and steers, telling him how to feed them, tell him what fields to plow, when to kill the hogs, and to have all the tools ready for spring's work—if we accept with him the fact that "agriculture, manufactures and commerce stand together like pillars in a cluster the greatest in the center and that greatest agriculture; for without agriculture we should not have manufactures and we could not have commerce;" or if we believe with another philosopher—for philosophers and business men often teach farmers sound practical truths—that old English wit, scholar, poet and preacher, Dean Swift, that the man who can make two ears of corn or two blades of grass to grow on the spot where only one grew before, would deserve better of mankind and render more essential service to the country than the whole race of politicians put together—if we believe all these, then it must be true that farmers are among the real benefactors of the race, and that those who have devoted their lives to its improvement, or have given us better methods, or more economical processes of cultivation, or improved tools and machines, are among the civilizers of the world whose lives and deeds are worthy or perpetuation. Hence it is fitting that this State Board of Agriculture should reverence the memory of one who was its secretary for a far longer term than has ever fallen to the part of any preceding or succeeding official, and whose life work in behalf of Maine agriculture was conspicuous for its high character, its scientific value and its practical worth—Stephen Lincoln Goodale,* who died at Saco, November 5, 1897, at the age of eighty-two years.

We may better comprehend the conditions under which Mr. Goodale begun his long official service in connection with Maine agriculture, if we first glance at a few facts and dates leading up to his commencement of that work.

The first recognition of agriculture by the laws of this State is found to have been in 1832. There had been organized effort in its behalf forty-five years earlier than this, in 1787, but at this later date, 1832, we find the first legal recognition and encouragement of practical farming by the State. And it is by no means a slight compliment to the men who framed that early law, that almost its exact language was retained in our statutes down to its modification under new conditions at so

*Stephen L. Goodale was born in South Berwick, August 14, 1815. His father was Enoch Goodale. In 1816 the family settled in Saco, where Stephen spent his subsequent life. His father engaged in business and erected the building on Main street where C. L. Percy's drug store is now located; here he sold books and chemicals. From his earliest youth Stephen Goodale was surrounded by a scientific atmosphere, and brought into contact with the physicians and teachers who visited his father's store. He entered Thornton Academy in March, 1828, and continued his studies there until 1831. Among his classmates were some who afterward became distinguished, among them, Hon. George F. Shepley, United States circuit judge, John Shepley, Thomas M. Hayes and the late Captain R. F. C. Hartley. Instead of going to college, as most of his classmates did, he followed his peculiar bent and went into business with his father. In 1837 the store was relinquished to him, and he continued to conduct the business then until 1855, carrying on meantime special studies connected with pharmacy and agriculture. He married in Bangor, September 23, 1838, Prudence Aiken Nourse. In 1841 he bought the place on North street, Saco, where he resided until his death. The extensive grounds he devoted to scientific horticulture and arboriculture, and he had one of the finest collections of trees and shrubs in the State. For forty years he carried on experiments in the application of science to plant life, agriculture, forestry, fruit and flower culture, and artificial fertilizers. He was Secretary of the State Board of Agriculture from 1856 to 1872, and was the author of a number of scientific treatises. For ten years he was Trustee, for ten Vice-President, and for more than twenty years President of the Saco and Biddeford Savings Institution. He was one of the seven men who incorporated York Institute in 1867, only two of whom survive. He retained his interest in Thornton Academy and was a member of its alumni association. He leaves five children: Prof. George Lincoln Goodale, Director of the Botanic Garden of Harvard University, Cambridge, Mass.; Miss Caroline Hopkins Goodale, Benjamin Nourse Goodale and Dr. Walter Temple Goodale, Bowdoin College, 1874, of Saco; and Alfred Montgomery Goodale, University of Maine, 1875, Superintendent of the Boston Manufacturing Company, Waltham, Mass. A large number of friends were present at the funeral of Stephen L. Goodale, Sunday, November 8. The last rites were performed at 1.30 P. M., at the residence on North street, and the interment was at Laurel Hill. Rev. Philip H. Moore conducted the funeral service, which was simple, without any singing. There was a great many beautiful flowers in the room when the service was held. Among those present were representatives of most of Saco's prominent families, and many business men.

recent a date as 1852. The main feature of this early law was the payment of a State bounty to agricultural societies which was to be offered in premiums "for introducing or improving any breed of useful cattle or animals, or any tools or implements of husbandry or manufacture; introducing, raising or preserving any valuable trees, shrubs or plants; or, in any way, encouraging or advancing any of the branches or departments of agriculture, horticulture or manufactures."

The movement which secured the passage of this act originated in this grand old county of Kennebec. Indeed, tell me, pray, what movement for the benefit of the agriculture of the State of Maine was ever started in those early days, that did not originate in this very spot? When there were but three agricultural societies in all North America, one of them was down here in the woods of Maine in old Pondtown, (now Winthrop); when but three agricultural journals were sending the light of intelligent farming over the United States one of them was brightly burning in old Kennebec, in the pages of the Farmers' and Mechanics' Journal, published at Gardiner five years before the establishment of any other agricultural newspaper in Maine; forty years before Justin S. Morrill had thought out his congressional endowment grant in aid of colleges for agricultural and mechanical education, a college had been chartered by the State of Maine, located down here in old Kennebec, which was giving a practical and scientific education to our young farmers and mechanics along the exact lines of the Morrill land grant colleges; when farmers all over the country were threshing grain with flails, a Winthrop farmer invented the first power threshing machine ever used in North America; when more than half of our country was made up of woods and the great western desert, Winthrop farmers were sending to the Black Sea for seed wheat, and when farmers generally were breeding, feeding and milking ordinary cattle and keeping scrubby sheep and common hogs, the farmers of Hallowell and Winthrop were importing and introducing Shorthorn, Hereford and Jersey cattle, Dishley sheep and Messenger horses.

"Hold up," said the captain of a Spanish vessel in the English Channel, to his crew, devoutly crossing himself the while, "here is where the heroes of the invincible Armada under the

Duke of Medina Sidonia, perished beneath the waters, 200 years ago." So we, my friends, in historic old Kennebec, cradle of improved farming in the eastern part of the continent of North America, may well stop a moment to pay a word of eulogy to those pioneers of agricultural progress in the New World who accomplished so much for Maine farming and Maine farmers. Benjamin and Charles Vaughan, Samuel and Elijah Wood, William Richards, and—noblest Roman of them all—Ezekiel Holmes. Standing a hundred years from some of them, let us hope that some one standing a hundred years from us, will not forget their services to American husbandry.

Between 1850 and 1852 the statute which was in force, provided that no person to whom a premium was awarded by any of the twenty-six then existing agricultural societies in the State, should be paid such premium until he had first "delivered to the society, a statement in writing, specifying the kind and quantity of dressing put upon the land, the course pursued in cultivating the same, the kind of soil cultivated, with such other circumstances as may be considered useful." If the premium was on stock, the party to whom it was awarded was obliged to make a similar statement of "the breed or stock, and of the advantages thereof for labor, the dairy or fattening, or any other purposes, together with the mode and expense of rearing or treating the same as compared with the usual methods, with any other useful remarks." The Secretary of State was authorized to transmit these statements, and the reports of the awarding committees to the legislature to be submitted to a committee on agriculture, which was given permission to publish extracts from the same, "and such essays relative to the subject as they may think adapted to the advancement of agriculture and horticulture." This was the beginning of the publication of our annual volume of reports on the agriculture of the State. Previous to the year 1856, at which date the reports of the secretary of the board of agriculture begun to be published, there had been issued four volumes, containing the transactions of these societies for the years 1850 to 1855, inclusive. These volumes contain reports of committees, statements of exhibitors and the addresses given at the agricultural fairs. For a period long before the recognition of agriculture by the State, one of the main features of the cattle shows was the annual address. And what a feature it was! The occasion gave opportunity for clergymen, editors and politicians to speak to large audiences of farmers, and many of these addresses contained excellent advice and sound information for their hearers. It cannot be doubted that the intellectual part of the cattle show embraced in the annual address was a great agency in the mental improvement of the farmer at a time when agricultural papers were few, and when there were no free agricultural reports as now. I often wonder if our farmers, to-day, prize the government and State reports and bulletins, as highly as they ought, and I also often think that the experimental has so taken the place of the practical, that our farm methods in actual practice, are far below what they should be. I believe if we need any change in our agriculture to-day, it is in something that will make better farmers and better farming—for there is, even in this age of colleges, boards of agriculture and experiment stations, too much poor farming. But the annual address! It has had its day, and so far as I know is now only recognized by two agricultural societies in this section of the country—that of the old Essex society in Massachusetts, and the old Kennebec—parent of all the cattle shows in the State—in Maine. Far be the day when the custom shall have been abandoned by either.

An act of the legislature approved by Gov. John Hubbard April 23, 1852, created a state board of agriculture consisting of one member from each of the incorporated agricultural societies in the State. This organization had its origin in a "legislative farmers' club" which for several winters had been kept up among the members of the State legislature during its annual sessions, the discussions of which were published in the columns of the Maine Farmer. But there is no record in any of the published volumes of the agriculture of Maine previous to 1856, that it ever held a meeting, or that it ever had any members. Yet by law it was to consist of one member from each local society, and was to hold an annual meeting on the third Wednesday of January annually—as it has been held ever since. The board did, however, hold a meeting in 1853, as empowered by the act, which was in fact almost the only power conferred upon it. Yet it charged the board to devise and recommend to the county societies, and to the farmers of the State, "facts, discoveries, improvements," etc., while it made no appropriation for carrying on the work.

Dr. Ezekiel Holmes, the real father and master of our enlightened, intelligent, progressive agriculture—in whose praise too much can hardly be said—was chosen first secretary of the board. Another meeting was held in 1854, the only record of which is that a report was made "recommending the introduction of the study of agriculture in our common schools; that a text book for the purpose be adopted, and that a professorship of agricultural chemistry be established in connection with the then proposed normal school." Thus early did the farmers of Maine go upon record in behalf of agricultural education. In 1855 the annual meeting was held in accordance with the statute. This meeting resulted in the reorganization of the board of agriculture; the adoption of a plan for more fully defining the powers and duties of county agricultural and horticultural societies, and the organization of the State Agricultural Society—measures which were submitted to the legislature for legal approval. As reorganized the act establishing a board of agriculture provided for one member from each incorporated local agricultural society in the State, the membership of which should be divided into three classes—those holding terms for one, two and three years respectively; and the act carried an appropriation of $1,700 annually for defraying its expenses and provisions, the salary of the secretary being $800 per annum.

No record of the meetings of the board is published in volumes which are entitled "Agriculture of Maine," and were edited by the secretary of the board between 1850 and 1856, and one has to search the files of the Maine Farmer newspaper for what facts can be found regarding its doings. It is presumed, however, that Mr. Goodale was a member of this original board. The first meeting of the reorganized board did not take place until 1856, at which time it consisted of twenty-three members—one from each of the local agricultural societies in the State. But two of the original members of that board are now living, Calvin Chamberlain of Foxcroft, and Hon.

Charles J. Gilman of Brunswick. The member from the York county society was Stephen L. Goodale of Saco, and that gentleman was chosen secretary.

Mr. Goodale was at that time forty-one years of age, and was at the very height of his mental and physical powers. He was not a college man, but was not without a peculiar fitness by natural tastes and education for that part of his life work upon which he so late entered—for at the present day, when men have made fortunes in business and retired at forty-five, it would seem a late age to be entering upon a new profession at forty-one. Aside from three years' study in the famous Thornton academy, Mr. Goodale had the benefit of practical training in a book store and apothecary shop. Thus he was surrounded by books and chemicals and was brought into contact with physicians, teachers and thoughtful, studious men. At the age of twenty-two he had mastered all branches of the business and succeeded his father in full control of the establishment. His chemical and botanical studies needed in pharmacy, he extended and applied to gardening, plant growth and crop production. Inheriting a love for the open air and the work of the florist, gardener and farmer, he made himself acquainted with all the details of practical agriculture and advanced horticulture as then carried on.

In 1840 or 1841, he established a garden and nursery on the place which he then purchased in Saco, (to which town his father removed when he was an infant), and where he ever afterward made his home. He early became interested in the work of the York County Agricultural Society and had published, in a pamphlet of its proceedings, a few years before becoming secretary of the board, an essay on grapes and grape culture in Maine—a subject with which horticulturists and gardeners were then experimenting with to a considerable extent.

These were the natural tastes and acquirements which Mr. Goodale brought to the discharge of his duties when called to the position of secretary of our board of agriculture. Wishing to more fully equip himself for his new office, one of his first acts was to issue to the farmers of the State in the spring of 1856, a circular letter making inquiries regarding the agricultural practices among farmers in all the counties. Massachusetts had two years before established a board of agriculture of which Mr. Charles L. Flint had been made secretary, and in Mr. Flint's first report was a similar circular letter embracing similar questions to those which Mr. Goodale had asked the Maine farmers, and upon which he wanted facts and experiences. It is no disparagement to the latter gentleman that he based some of his thirty questions—as one will see from examining the two lists—upon those of Mr. Flint. Mr. Goodale wanted information from all sources that would assist him in his work and he went to good sources for it. In the very first interview that I ever had with Mr. Goodale which was in his library at Saco, two years after he was chosen secretary, he remarked to me that the only way to reach and help the farmers of Maine was by first knowing what they were doing and what they wanted, then one would know intelligently how to meet those wants. This could be done by two methods—that of sending them questions to answer; and that of visiting them at their farms and homes both in summer and winter, studying their methods, seeing their practices, noting their errors, and by this means preparing one's self to suggest improvements, correct errors and lead them to a better way.

That very year the first agricultural excursion I ever made was in company with Mr. Goodale and at his invitation. We went by team through portions of Kennebec, Somerset, Franklin and Oxford counties visiting farms and orchards, observing stock and gardens and making constant notes. I owe to him my first inspiration for a desire to visit and study farms, which in the course of the next five years led me into every county and more than half the towns in Maine; and it is to him that I am indebted for my first knowledge of Arthur Young, Sir John Sinclair, James F. W. Johnston, John C. Loudon and William Cobbett—those writers of later English agriculture, and of M. de Lavergne, that eminent Frenchman who wrote the best treatise on the rural economy of Great Britain ever published. The method employed by Mr. Goodale of sending out questions on all sorts of farm topics to be answered by farmers themselves has never been improved upon as a means of obtaining practical knowledge of real farming, and it is the same method that is now employed in so successful a manner by the present secretary of the board.

Mr. Goodale's, first report was a model of excellence and reached a high level in practical and scientific value. One who loves husbandry can read it to-day as he would read the Georgics of Virgil, again and again, without becoming tired. It is the only agricultural publication in this State, possibly in any state, that ever went into a second edition—the first, having been inadequate to supply the calls for it from our farmers. It presented a somewhat minute survey of the condition of our farming and of individual practices among the best farmers of more than forty years ago, that is profitable to read to-day, showing as it does many good old customs from which we have departed to our loss. Subsequent reports were devoted to more special subjects, this one having been evidently designed to lay the foundation for a broad general knowledge of the agriculture of the State.

The report for 1857 shows that changes had been made in the statute creating the board, which reduced the number of members to one from each county, instead of one from each society,—there having been then but fourteen counties in the State—and had also made the Governor and Secretary of State ex-officio members. This last feature was patterned after the Massachusetts law, but while their statute remains unchanged to this day, the Governor and Secretary of State being members ex-officio, our law having this provision remained in force but one year. During that year Hannibal Hamlin, President Lincoln's vice president, was president of the board. As some of the members had been chosen by the societies after the change in the law, the board of 1857 was made up of fourteen members termed "statute members"—one from each county—with eight "honorary members," who were entitled to sit with the board but received no pay. These "honorary members" served but a single year, and had no successors.

As a young fellow I remember very well the meetings of the board at that early date. It held one session annually of two weeks' duration. The room assigned to its use for meetings was in the north basement, under the present office of the land agent. On the opposite side of the narrow stairway was an offensive water-closet. The sanitary arrangements of the State House were then so defective that to reach the main room of the board was anything but agreeable. Mr. Goodale's private office was what is now committee room No. 16—a small, poorly lighted box, under the senate chamber in the northeast corner of the north wing. In the large room where the meetings were held was a continuous table on three sides, with a raised platform and desk on the remaining side or end, for the president. In the center of the hollow square thus formed was the secretary's desk, while upon the outside of the tables were the members' seats, assigned by counties. A special messenger was in attendance upon the room and the members during the sessions of the board. What would those old members of the board in its earlier days think, could they now revisit our new State House and find the agricultural department occupying one of the largest and most attractive rooms in the building? Surely, they would believe that the farmers were being made of and appreciated as they never were in the days when its meetings were held in an unattractive room down cellar.

The board was a deliberative, dignified body, and in the rules adopted for its government were the following:

"When a member speaks, he shall rise and address the president.

"No member shall interrupt another while speaking, except to call to order, or to correct a mistake.

"When a member makes a motion he shall put the same in writing if requested by the president.

"When a motion is made and seconded, it shall be received and considered by the board but not otherwise."

Papers were read three several times, the same as with bills and resolves in the House of Representatives. They were first read by the individual member and accepted by the board; on another day they were read or partially read by the secretary, discussed, criticised or amended; and finally, read a third time by title and adopted—so that when published they went before the farmers of the State as the deliberate, unanimous and official opinion of the board of agriculture. In the work of suggesting changes, or correcting the views, language or opinions of the members in their papers, the ripe judgment and good scholarship of Mr. Goodale was laid under heavy contribution. There was rarely a paper presented that he did not improve, and when it went to the public in print some of the members were, no doubt, surprised to find how able and valuable an essay they could write. Members were assigned subjects at one session upon which they were to prepare papers during the interim to be presented at the opening of the succeeding session. Thus their work was in a nature continuous throughout the year, and when the annual meeting assembled the reports or papers were called for, these papers forming the programme of the meeting. Mr. Goodale was not a public speaker—he could read a manuscript, but he could not make a speech. He took little part himself in the proceedings of the board meetings, his best quality being that of a good listener. After the papers had been read and discussed, however, the faces of all members were turned toward Mr. Goodale for his opinion. A brief remark from him often punctured the strongest argument in a long paper; while a brief commendation showed that the essay read had contained few errors.

In his report for 1857 Mr. Goodale gave an account of the agriculture of Aroostook county which he had that year visited. At Houlton he saw on Mr. Cary's farm thirty acres of wheat sown April 17-12, which was the last of July full in milk, free from the midge and promising a heavy yield. The growing he said, was as rich as that in Orange county, N. Y., "Nor can I conceive sufficient reason," he says, "why Aroostook butter and cheese may not be profitably exported to large extent, and by the application of proper skill in manufacturing be made to rival that of Orange county and command as good a price." If that suggestion had been only followed—what a garden the garden of Maine would have been to-day!

In 1858 the board consisted of twenty-three members; in 1859 of twenty-six, and in 1860 of twenty-seven—but in 1861 a change in the law was again made which limited representation to one member from each county, sixteen, which law remained unchanged for a period of ten years.

In the report for 1858 Mr. Goodale took up the subject of the dairy and obstacles to fruit culture; in 1859, the grasses, and in 1860 appeared that original and profound work "The Principles of Breeding," or glimpses at the physiological laws involved in the reproduction and improvement of domestic animals. This was published at Boston in 1861 as a separate volume, and was one of the first treatises on that important subject ever published in the United States. It was for several years used as a text-book at some of the State agricultural colleges, and is to-day regarded as a standard work. I prize among my choicest books a finely bound copy of this work with an autograph presentation from the author.

As I go over in review the work of these years there are many things to which I would like to refer, showing Mr. Goodale's wide and far reaching interest in the agricultural problems of that time, if the same would not overburden this address—but one thing must be glanced at.

Hon. Justin S. Morrill, then a representative in Congress, from Vermont, had introduced in the lower house of Congress December 14, 1857, a bill authorizing a donation of public lands by the general government to the several states for the purpose of endowing colleges to encourage agriculture and mechanic arts, (which became a law in 1862) and at the suggestion of Mr. Goodale resolutions were passed by our board of agriculture at its next meeting, expressing that the passage of such a bill would have "a most auspicious influence upon the agricultural interest of our State," and earnestly appealing to the agricultural societies of the State and farmers generally to at once petition Congress for the passage of such bill, and urging the press of the State to aid in creating a public spirit in its support.

It is commendable to the legislature of Maine that it inaugurated a scientific survey of the State in 1860, and carried it on for two years while the State and country were suffering from the first throes of the great rebellion. From the fact that the reports of this survey were published in the annual agricultural volume, the space given to the work of the board for those years is very much less than for any other volumes of the entire series. But Mr. Goodale carried on his studies and investigations with the same care and thoroughness as in other years. In 1861 his work was given to the subject of marine manures, with special reference to fish offal and its use; in 1862 he devoted still more time to the subject of Maine dairying and discussed the matter of the "farmers' college"—that was what

Mr. Goodale called it—which was to be established under the Morrill endowment act of July 2, 1862. Mr. Goodale's remarks in the volume for this year upon the prospects and duties of the farmer in view of a gigantic rebellion of two years' duration which had threatened our national existence are noble and commendable. "Our sons and our brothers," he says, "have exchanged the harvest field for the battle ground. In place of the plow and the scythe, they handle the musket and the sword. And we who remain, although we share not their perils and hardships, have not less weighty responsibilities resting upon us. * * Those thousand and more regiments in the field, from being producers have come to be consumers. Every man of them must be fed and clothed—fed and clothed from the productions of the earth. While we would trust, with undoubting confidence, that the Great Ruler of nations will do all things well and crown the right with victory, it behooves us to strain every nerve and muscle, to put forth every energy and faculty to secure the end desired. We who go not to the battlefield, must do our utmost to support those who do, as well as those who must always be cared for at home. We must lay our plans for the coming season so that every hour of the time, and all the means at command, be employed to the best advantage. Cherish those organizations by which so much has been accomplished, and which, if ever useful at all, are more useful now than ever. Help one another. Encourage one another. Be of good cheer." These are but a few crystallized sentences from several pages of an appeal to our farmers in time of war, as noble in its way as any that ever emanated from a leader to his forces on the eve of conflict.

The subject of the State College received a great deal of attention, and to it Mr. Goodale devoted many pages of his annual reports. His writings upon the subject of agricultural education had much to do in determining the character of the new institution. Besides this, he wrote most excellent treatises upon questions of uppermost importance to the agriculture of Maine, or that were being debated by leaders of agriculture in other states. Among these were the manufacture of cheese; fruit culture—an exhaustive treatise including descriptions of varieties adapted to Maine; beet roots as a source of sugar;

influence of forests on climate; the cattle plague; cultivation of the hop; chemistry of manures; wheat culture, and culture of the potato. No hasty or superficial work was put into any of these papers. They are each able, comprehensive, and treated with special reference to the conditions of Maine agriculture. They evince the result of wide reading, close study and a clear comprehension of the adaptability of our agricultural resources and the spirit of our farmers, that had only been gained through accurate observation of our needs and how their requirements could be met. In all this work Mr. Goodale was nothing if not thorough, devoted and conservative—in no case was he over-enthusiastic upon any subject, and in few instances only was he mistaken.

The years 1869 and 1870 were conspicuous for more marked changes in our agricultural institutions than any which occurred during Mr. Goodale's entire term as secretary.

For some time previous to the first named date there had been a growing feeling on the part of leading members of the board that in two particulars at least, changes should be made. Down to this time the board had held one session annually of two weeks, at the State House. It was a very unusual occurrence for farmers in general to attend its meetings. A few of the farmer members of the legislature sometimes went down stairs to the board room for a half hour, but generally they preferred to be present at the legislature or were obliged to attend the committee hearings. Other members of the legislature would occasionally look in upon its meetings, but it was frequently the case that they ridiculed its proceedings and belittled their value and influence. There were good reasons for taking its meetings away from the State House, and there were better reasons, why, if farmers would not come to its meetings its officers should carry their meetings to the farmers.

There had been at different times during the existence of the board rumors that the legislature was likely to abolish it entirely—as was done one year in Connecticut when its legislature abolished the board in that state. And the attendance of representatives at one of its rather dull, formal meetings would be likely not to strengthen their support of its legal existence. Hence, if for no other reason than to get the board out from under unfavorable State House influence, it was an advisable thing to make a change in the nature of its meetings. Moreover there was a conviction on the part of a few members, led by the secretary himself, that there was need that new life should be introduced into the personnel of the board; that while the practical side of the farming interest was well represented among its members, a new element, the scientific, should be introduced to give higher character to its deliberations and more authority to its published proceedings. The establishment of the State College, which had opened its doors to its first class the year previous, strengthened this feeling. If the college was to teach scientific farming it was necessary that the board should represent that element which promised to be an essential feature of the agriculture of the future—the scientific. Consequently as a result of several conferences of committees of the board, a bill was formulated, which became a law March 1, 1869, entitled "An act to secure harmony of action between the board of agriculture and the State College of Agriculture and the Mechanic Arts." The title of this bill was an erroneous one. There had never been any friction or want of harmony between the two bodies, as the title implied. But the fear of some was that the college would supersede the board as the medium of official agriculture before the people, and that it was necessary to prepare the way for this expected change. Although Mr. Goodale had been a previous member of the board of trustees of the college, and although no man in the State had been so much consulted or advised with regarding its establishment, curriculum and policy, the first line of the new act made the secretary of the board of agriculture, "ex-officio, a trustee of the college." Other provisions of the act were that in addition to the county members of the board, the governor should appoint five members at large (two of whom were to be members of the faculty of the college); and instead of one session a year there were to be two sessions of not exceeding four days each, "one of which was to be held within such convenient distance of the State College as would enable the attendance of students and faculty in order that they might have the advantages of the addresses and discussions before the board, the other to be held at such time and place as the board might determine."

As will be readily understood this act made a radical change in the character and individuality of the board as well as in the policy which had governed it for fifteen years. There were those who opposed the change both among the members of the board and the farmers at large. And this opposition was more manifest when, among the executive appointees under the new law creating members at large were two professors from Bowdoin College and two from Waterville College. There were proper and good reasons why the faculty of the State College should have representation upon the board under the "harmony" law, but no good reason why four members representing the old classical colleges should have a place. This last has ever been regarded as a mistake, and the plan met with much opposition, and was one of the most unsatisfactory laws which had ever been presented to the farmers of Maine. Mr. Goodale had strongly insisted that the new college should be a college for farmers, and he had planned the manual labor requirement which made it obligatory for each student to work three hours a day for five days in the week—the labor to be as far as possible educational—but there could be no necessity that in a statute governing the board of agriculture four of its members should be taken from the old-school classical colleges. The opposition to this change in the law, however, gradually disappeared, the liberal college members were discontinued, and as the workings of the law became better understood as the years went on the wisdom of uniting the board of agriculture and the State College became more apparent and did effective service for both, until, in course of time conditions and public sentiment had so changed that it was deemed wise to dissolve the ex-officio relation of the secretary of the board to the college.

The first session of the board of agriculture under the new law, was held at Orono, with a public convention at Bangor, and from that the two meetings a year naturally came to be called the winter and autumn meetings.

During 1870-1872 they were held at Lewiston, Foxcroft, Farmington, Lincoln, Paris and Skowhegan. There were some advantages that followed this change in the work of the board. It brought to its meetings a class of speakers from other states who ranked high as agricultural teachers; it carried those meetings into towns that had never had the advantages of them before, and by the attendance at the meetings of the faculty and students of the State College, it advertised the college throughout the State, and secured more friends for it than could have been done in any other manner. The language of the new law was that one of the two meetings a year should be held at Orono, or so near, that the students of the college could attend, that they might have the benefit of the lectures and discussions. This section of the law became construed that wherever the students could be taken free, through the liberality of railroad officials in granting them transportation, was in such nearness to Orono that they could attend. Under this interpretation of the law, they went across the State—from Alfred in York county to Houlton in Aroostook, to attend the meetings of the board, and wherever they went made champions for the college. From this custom has been evolved the annual encampments of the now University students held annually in different parts of the State.

This change in the meetings of the board brought another change in the work of the secretary. Instead of so much original work in the preparation of papers or treatises for the annual volume, the bulk of the same was made up of the papers and lectures given at the meetings which required very little editing. Hence the annual reports were more composite in character and in some respects less valuable than in case of the carefully thought out, labored treatises, such as Mr. Goodale had given us in the earlier years of his secretaryship. These meetings also foreshadowed the branch meetings of a subsequent date and the farmers' institutes of to-day—and the farmers of the State could no more go back to the two meetings a year of the board, now that they are having forty-seven institutes in a year, than the travelling public could go back to the stage coach in their business trips from Augusta to Portland by way of South West Bend in Durham.

Among the distinguished speakers from out of Maine who addressed these conventions of the board during the later years of Mr. Goodale's secretaryship were Dr. George B. Loring of Massachusetts; Dr. Henry Boynton of Vermont; Hon. Simon

Brown, editor of the New England Farmer; Hon. T. S. Gold, secretary of the Connecticut board of agriculture; O. S. Bliss of Vermont; X. A. Willard, John Stanton Gould and Harris Lewis of New York; Hon. J. B. Walker of New Hampshire and Alexander Hyde of Massachusetts. But three of these, I believe, are now living. It was the plan then to arrange the strongest speakers for the winter meetings, at which more farmers were usually present than at the autumn meetings, and to depend upon home talent and members of the board for the fall sessions. The plan inaugurated under Mr. Goodale's management, of obtaining distinguished and prominent agricultural teachers from out of the State for the chief meetings of the year, has been continued through all the different administrations of the board to the present day.

At the annual meeting of the board held at Winthrop in January, 1873, another gentleman was elected secretary in place of Mr. Goodale, who had served continuously in that office for seventeen years, and was at that time fifty-eight years of age.

I was acquainted personally with Mr. Goodale during fifteen years of his term as secretary, and for ten years of the term knew him intimately. I became his assistant in 1865, did much of the editing of the contributed matter in his reports, read his proofs and carried on a frequent and close correspondence with him. Hence I came to understand him well and from being so much with him to see much of his private life and was able to judge of his character. For his friendship, assistance and encouragement in my early professional life I owe him a debt of gratitude which I have always gratefully acknowledged, and which I have never been able, nor can ever expect to repay.

Mr. Goodale was a constant and unremitting worker, and during the years of his secretaryship was also interested in many other and business matters. Indeed, it seems now, as I recall it, that, many as were his duties as secretary of the board, and thorough as was the honest, conscientious work which he put into their performance—they were but a small part of what he accomplished, year by year. He was a careful and active business man interested in many affairs. During his term as secretary he managed the most extensive nursery in the State; was severally vice president and president of one of the largest savings banks in Maine (which, during the last years of his management of its affairs had deposits of more than $1,500,000); was chemist, president and manager of the Cumberland Bone Company, and for ten years a trustee of the State College. Each of these varied interests demanded his close attention—no one of them was attended to second hand—he was personally responsible in each case, and the responsibility was faithfully discharged. In all the affairs of the State College; in much of the work of the scientific survey of the State; in the wide and diversified interests of our agriculture as represented by the board and the agricultural societies; in the minute work required as chemist of the Cumberland Bone Company, when that company was at the height of its business in the manufacture of superphosphate in Maine; in the oversight of his large nursery and thriving store; in the care pertaining to the affairs of his bank, especially regarding the safe placing of its funds—in all these matters, sufficient it would seem to occupy the time and effort of two men—Mr. Goodale was never found wanting.

In addition to these public duties Mr. Goodale was a great general reader and a close student; he made several journeys to other states to investigate their methods of agriculture and study special lines of farming adapted to our conditions, to fit himself for his work in connection with our own agriculture, and he was constantly making experiments in chemistry, in plant culture, in artificial fertilization; and beside this carried on an extensive correspondence with eminent agriculturists, not only in our own country, but abroad. And this was long before the days of stenography in private use, or the dictation of correspondence to a typewriter. Among his foreign correspondents were Sir J. Bennett Lawes and Dr. Augustus Voelcker—who came over from Germany to be chemist to the Royal Agricultural Society of England. I remember of his once calling my attention to an error in the published results of a chemical analysis made by Dr. Voelcker, and telling me there was an error in his analysis or an error in the printing. In a letter to Dr. Voelcker he pointed out the error, and received a reply from that great chemist in which he said there was a typographical error in the table which was not discovered until a part of the edition had been printed, and it was a copy of the journal of the Royal Society containing the error that had got over to America, and had fallen under the eye of the critical and accurate chemist way down here in Maine. He explained the error and his correction agreed with Mr. Goodale's interpretation of the matter.

Mr. Goodale was a man of great physical endurance as well as large mental reserve, or he could never have accomplished the amount of work which he did. He was a man of medium height, of stout frame and of extremely full habit. He smoked almost constantly when at work, as he told me "to keep down his flesh." Mr. Goodale was a very silent man. He talked but little; he rarely entered into what we might term general conversation, and he seldom smiled. When he laughed, he laughed heartily, but this was something very foreign to his habit. I have no doubt that a deafness which affected him somewhat for many years, previous to his retirement from public office, contributed somewhat to this personal reserve. Although he did not "wear his heart upon his sleeve," he had one as big as his great frame and as tender as that of woman, when one got at it, and it didn't take long to find it when human sympathy or friendly aid were needed. His splendid service in behalf of our agriculture was based upon his interest in and endeavors to promote the welfare of our agriculture and our farmers. He loved botany and chemistry, trees, plants and flowers long before he had any thought of devoting his life to agriculture, and he loved them for themselves, for what they taught him, and for the pleasures they brought into his life. This being the case it may be said in truth that his interest in agriculture never ceased; his love for these things never left him.

The general results of Mr. Goodale's life-work are treasured for the future in the sixteen volumes of our Maine reports which he edited, and so large a part of which is the work of his own brain and hand. They are good reading for any day in the year even now, to the farmer who would improve his methods and get down to a better understanding of the nature-forces and agencies with which he has to do. No subject which Mr. Goodale touched was ever half done—thorough work put into whatever matter he had in hand. His judgment was most excellent—hence his advice was sought on many matters of interest to Maine agriculture. He was, with the late Gail Borden, interested in the condensed milk process and in 1863 assisted in starting a condensed milk factory at Farmington Falls, which, however, only operated for a short time. He experimented in the matter of beef extract, and had mastered the Liebig process as early as the great German chemist himself. He also gave great study to artificial fertilization, the use of fish as a nitrogenous agent in commercial fertilizers, and the hybridization of fruits. These matters were side affairs, so to speak, or mere incidents to fill up the spare moments of his active life.

In his domestic relations Mr. Goodale was most happy. His wife, an accomplished and beautiful woman, died in 1885. How many times has he praised her to me, telling me she was "ten times the man that he was" and that all he had been in life he owed to her. Five children survive Mr. Goodale to inherit an honored name.

It is now more than forty years since Mr. Goodale was chosen secretary of the board of agriculture, and twenty-five since he gave up his office to another. During the nearly half century of the existence of the board, many changes have come to its officers and its methods. The tenure of office in recent years has been much shorter with officials than it was in the earlier period of its history. These changes are the inevitable result of all human concerns. But if with them there is an improvement in methods making for the common good, we who play our little parts for a few years and then go into obscurity, ought not to be unwilling that the obscurity shall overtake us. As to the common good there can be no divided opinion regarding that. From a single meeting of the board, each year, which hardly no one but official members attended and which was always held in the same place, to fifty meetings a year held all over the State is a change in the methods and work of the board of agriculture which no one would now be willing to abandon.

In his introduction to the beautiful and pathetic "Story of Ida," John Ruskin has well said: "The lives we need to have written for us are of the people whom the world has not thought of—far less heard of"—who have done the greater part of its useful work. Surely the life of Mr. Goodale must come into this class of persons. He wrought that the work of the farmers' hands might be more intelligently guided, and the toil of his fields, directed by higher intelligence, be productive of results which should bring larger crops, greater profits, a keener enjoyment of the wonderful and varied forms of nature and higher intellectual happiness. In his life, and others like his, how true is the lesson so charmingly expressed by our own Whittier:

"Give fools their gold and knaves their power,
Let fortune's bubbles rise or fall—
Who sows a field, or trains a flower,
Or plants a tree, is more than all."

THE SEVENTEENTH SESSION OF THE FARMERS' NATIONAL CONGRESS HELD AT ST. PAUL, MINN., SEPTEMBER, 1897.

By WM. H. MOODY, Delegate.

I think there is no subject that interests farmers with which they are so little acquainted as with the workings and purposes of the Farmers' National Congress. I confess that in 1889, it was first brought to my attention with sufficient force to fix itself in my memory, and then only from the fact that Hon. Orrin Learned of Burnham, with whom I am well acquainted, was appointed a delegate, and attended the congress at Montgomery, Ala., that year.

In 1891, Hon. Wm. Freeman of Cherryfield, C. H. Walker of Fryeburg, C. L. Wentworth of Newfield, Hon. W. H. Vinton and Mrs. Harriet L. Vinton of Gray, were present as delegates from Maine, at the session held at Sedalia, Mo., Mrs. Vinton being elected to fill a vacancy. In 1892, President M. C. Fernald of the State College, and E. E. Dunbar of Damariscotta were appointed by Governor Burleigh and attended the session of the congress held at Lincoln, Neb., in November of that year.

In 1893, Judge Rounds of Calais, Col. J. M. Glidden of New Castle, and E. E. Dunbar of Damariscotta, attended the session of the congress at Savannah, Ga., in December, as delegates. I was appointed but did not go. These are all the delegates we have sent that I know of. Delegates have been appointed every year since the first one, I think, but very few have attended. The reasons for this are obvious. No appropriations have been made by the State to defray the expenses, and the fare has never been less than one and one-third rate, for the round trip, while the time the ticket ran has been limited to nine days. When I first agreed to go, sometime last June, I expected and was informed that we were to have half rate, but when the time came to buy tickets the same old rule prevailed.

It is but fair to say, however, that upon application to Col. F. E. Boothby, general ticket agent of the Maine Central, he told me if I would go over the Canadian Pacific, by what is known as the Soo route, he could give me a round trip ticket for the same fare (one and one-third) and I could stay as long as I pleased. On the morning of the 28th of August, I paid to the general office of the Maine Central Railroad, forty-two dollars, took my ticket, and at 8.45 started for St. Paul.

Our route lay through the White Mountain Notch, and if one can afford to pay for luxuries the money is well expended on this trip. Great pains are taken by the officials of the road, to point out objects of special interest, such as the higher mountain peaks, noting their elevation and special characteristics; the Willey house, and anything else of note. It will not be proper nor possible for me to describe my journey at length, however, as many descriptions have been written by abler pens than mine, but I cannot pass over the journey to St. Paul without a few comments on the country and the service of the railroad. As there were no sleepers attached until we were at Montreal, I rode in the day coach. The train was crowded, as this was the last day except Sunday that visitors from the West could return on their tickets. The weather was warm, in fact, hot; and when we arrived at Montreal I was tired out. I had wired for a sleeper, so I had no trouble about it there, and by ten o'clock I was in my berth as comfortable and contented as possible, and was asleep in less than half an hour, and did not awake until six o'clock in the morning.

We were then not far from Sudbury Junction, where the Canadian Pacific proper makes a straight course for Vancouver, going north of the lakes, in what seems by the map to be an air line. About noon of that day, we came to the "Soo," making a short stop, where passengers for Duluth and West Superior left the train, and new people for St. Paul got on board, when we were off again for our final destination, which began to seem nearer. Occasionally, during the first part of the day, we came to a little collection of houses at a station, but after noon we saw almost nothing but stunted bushes; miles and miles we travelled and not a sight of human habitation or cultivation of the land, in fact, the whole day's ride is through a desert. The next morning after daylight, I looked for and expected to find a better country, but was disappointed, there being little change, though there was some improvement; occasionally there was a cabin, a patch of potatoes, an old horse tied to a rick of hay or grazing at will, but that was all. At 8.45 in the forenoon, forty-eight hours after leaving Portland, we pulled up at St. Paul, nearly 1,500 miles. This was Monday, and the congress was not due to meet until Tuesday, so without stopping I went on to Minneapolis; and after some delay got to the foot of Minnetonka lake at about three o'clock.

Minnetonka lake is the great watering place of the West. It is fourteen miles long from east to west, from one to three miles wide, and full of islands, whose shores, with the lake shore, make three hundred miles of coast. About a thousand houses of all kinds are built on the islands and lake shore, a large number of which are hotels, or boarding houses. I visited several, the largest of which is the Lafayette, containing 500 rooms. It is owned by the Great Northern Railroad, and cost too much money to be a very paying investment. (It was burned about three weeks after I saw it, and will never be rebuilt.)

The Lake Park hotel contains about 300 rooms and the St. Louis 200, besides many smaller hotels and boarding houses. I was able to buy tickets from Excelsior, twenty-eight miles, for thirty-seven cents, so spent nights at Excelsior and days at St. Paul, as a close student of the seventeenth session of the Farmers' National Congress. As to the history of the congress, I will copy verbatim from the secretary's report of the congress held at Indianapolis, Ind., in 1896.

"We know but little of its history prior to 1884. There was a session at Louisville, Ky., in 1883, where Col. Robert Beverly of Virginia, was elected president, and Mr. Knott of Louisville, Ky., was chosen secretary. The same officers presided at Nashville, Tenn., in 1884. There is no record of these or any previous meetings of this body. From the best data attainable, there was a meeting in Chicago in 1881; Indianapolis, Ind., 1882; Louisville, Ky., 1883; Nashville, Tenn., 1884, and from the best information the meeting at Indianapolis in the fall of 1885 was fixed as the fifth annual session of the Farmers' National Congress of the United States of America. Col. Robert Beverly served as president from 1883 to 1887, when Col. R. F. Kolb of Montgomery, Ala., was elected president and acted as such until the meeting at Sedalia, Mo., where A. W. Smith of Kansas was elected. Hon. B. F. Clayton was elected at Savannah, Ga., in 1893, and re-elected at Atlanta, Ga., in 1895, to supersede Hon. D. G. Purse of Georgia, who was vice president, and acting president in lieu of A. W. Smith of Kansas, who had failed to attend the two previous sessions.

"At the called session at New Orleans in February, 1885, Hon. B. F. Clayton served as secretary pro tem, was elected at Indianapolis in the fall of 1885, and resigned in Chicago in 1887. Col. Parsons of Wisconsin was elected, but resigned in the fall, and Mr. Clayton was reappointed. He was elected at Montgomery, Ala., in 1889, and again at Sedalia, Mo., 1891. J. M. Stahl of Illinois, was elected at Savannah, Ga., in 1893, and re-elected at Atlanta, Ga., in 1895. Hon. J. B. Conner of Indiana was made treasurer in 1883 and was superseded by Hon. Wm. Lawrence of Ohio, at the Montgomery meeting, and he by Hon. Wm. Freeman of Maine, at the Sedalia meeting in 1891. Henry Hayden of Iowa was elected his successor at the Savannah meeting in 1893, and re-elected at Atlanta, Ga., in 1895. The first printed proceedings were those of the fifth annual session held at Indianapolis in 1885. Since then there has been kept a complete record of all the proceedings.

"Commencing with only five members, the congress has grown to be an important body, and its non-partisan position gives it strength with legislative bodies. It has accomplished a grand work in presenting such measures as the agriculturists of the country need. The meetings since 1885 were as follows: St. Paul, 1886; called meeting at Washington, D. C., February, 1887; regular meeting, Chicago, 1887; Topeka, Kansas, 1888; Montgomery, Ala., 1889; Council Bluffs, Ia., 1890; Sedalia, Mo., 1891; Lincoln, Neb., 1892; Savannah, Ga., 1893; Parkersburg, W. Va., 1894; Atlanta, Ga., 1895; Indianapolis, Ind., 1896; St. Paul, Minn., 1897."

Of course, the first thing after organization was the address of welcome by Mayor Doran of St. Paul, which was earnest and hearty, but which I have not the space to quote here. The reply was by Secretary John M. Stahl, after which D. R. McGinnis, vice president of the Minnesota State Agricultural Society, spoke briefly for that society. Governor Clough spoke for the state as Mayor Doran had spoken for the city, reciting some of the glories of the commonwealth, and gave special attention to the improved condition of the farming industry throughout the country. President Clayton's response was felicitous and eulogistic of the state and its people. President Clayton read his annual address and the congress adjourned for dinner.

In the afternoon session, Col. W. M. Liggit, dean of the Minnesota Agricultural College, delivered the principal address. His theme was, "The Best Methods to Still Further Increase the Usefulness and Practical Value of Agricultural Education."

His paper was an exposition of the modern trend of agricultural education, and a recital of the work done at the Minnesota school. The point of special prominence that was brought out in the paper and in the subsequent discussion, was that the youth educated there were going back to the farm, to put to practical application the lessons they had learned at school.

It is in this line of practical work that the Minnesota school is recognized as excelling all others. "The real schools of agriculture, the graduates of which stick to the farm or follow callings allied to productive agriculture," said he in opening, "are the pioneers and must blaze the way. They are making precedents and not following them. Those having worked along practical lines adapted to the promotion of intelligent head work and skillful hand work on the farm, have won a fair measure of success and are confident that they are on the right track, but as yet only the first steps have been taken in the new education, and what possibilities the future may develop can only be conjectured. One thing is certain; agriculture is, and always must be, the leading interest in the country, and any scheme of education which offers the young man special training for the farmer's calling, and at the same time promises to make a bigger and broader man of him, is one to which all who have the best interests of the country at heart may well give careful consideration.

"The evolution of the now popular idea of practical courses of study in schools has been slow. Half a century ago all school methods tallied with the idea that learning was for the few. The modern idea is to diffuse knowledge and give rich and poor equal opportunity for individual development and advancement.

"This is in such close accord with American sentiment and the theory of American government that it only needed to be proposed to be generally adopted. Now the State has opened all doors from the district school to the university, on the theory that ignorance is the enemy of the State and a menace to popular government. It is unfortunate that a radical revision of school methods did not quickly follow the swift movement toward popular education. We have continued to use the old machinery which was made to grind out doctors, lawyers and preachers, and our grist has been what might have been expected—a disappointment. The city has grown at the expense of the country. The brightest young people have left the farms; the standard of country living has been lowered and the professions are so overcrowded that the surplus is a burden to society.

"But, happily, common sense has been too strong for old traditions, and it is now generally admitted, that if education is to be universal, or even general, it must be along practical lines, and that school is now wisely counted best, which best fits the student for his chosen calling, and at the same time develops a well-rounded character.

"With a school of agriculture planned and conducted on right lines, the problem how best to extend its influence is greatly simplified. Without the right kind of a school to begin with, no amount of effort will make its influence grow. To be successful it must command the respect and approval of those most interested in its work. The 'granger' has been the subject of many newspaper jokes, but I know of no class who are quicker than farmers to recognize a good thing, and certainly none are quicker to see through a sham."

EVENING SESSION.

The evening session was opened by Mrs. Eleanor Ventrice Edwards of Minneapolis. Subject: "Picturesque or Intensive Farming."

Her address was drawn from the observations in a long residence in China. She outlined graphically Chinese manners and methods as applied to tillage. One branch of American farming, that of stock raising, is absolutely unknown in China. The chief product is rice, and each farmer has a few ducks that are trained to go upon the rice fields and eat the snails, frogs and other small animals that infest the fields.

Hens are also trained to follow the harvester and pick up every grain of rice that escapes his operations, for in China not even a grain of rice is wasted. This refinement of economy is shown in the care with which everything that could possibly add to the fertility of the soil is saved and applied.

When the stubble is burned, clods of earth are piled up in little ovens to absorb even the smoke from the fires. The walls of adobe huts which have received the smoke of the household fires and the exhalations of the human occupants for long periods are pulverized and added to the soil. Every farmer has his pig, and the animal is raised absolutely without cost. His habitat is the front door step, his food the bran of the rice hulled and eaten in the house. His head is the chief offering for the household god, and his flesh, with that of the fowls, furnishes the family with meat.

Mrs. Edwards referred to the fact that the hen is forced to work double time. She not only lays her own eggs, but the Chinese have a fashion of filling egg-shells with the spawn of fish and allowing the hen to warm them into life. They are then placed in shallow ponds for further development.

SMALL FARMS.

Speaking of the size of the farms, she said that the owner of an acre was a nabob, and the average holding is much smaller. One-sixth of an acre will support a farmer, and she told of a one-acre farm, which had attracted her interest. It supported its owner and his wife, his aged father and mother, and two children, producing everything they needed. Even their clothing was woven by the wife. Upon the death of a farmer, his landed estate is divided among his sons, the eldest getting one-tenth in addition to an equal share of the remainder, this excessive share being allowed to enable him to bear the expenses of the proper worship of his ancestors.

Comparing the enforced productiveness of the soil of China with that of the United States, Mrs. Edwards said that the tillable soil of New York, producing in like proportion, with its returning quality reduced one-half by reason of the difference of climate, would support the entire population of the United States, and the arable land of the United States thus considered would support a population of two billions, or the entire population of the world. Industry and economy are the cardinal principles of the Chinese farmer, and this was the lesson Mrs. Edwards desired to particularly impress upon the practical farmers in the audience.

Then came Prof. Shaw, with a lecture on "Value of Forage Crops." The question of forage crops he characterized as the question of all questions to the farmer. Dairymen, growers of meat, and tillers of the soil are alike interested in forage. In his opinion, the question of a gold or silver standard dwindled into insignificance in comparison with it.

No country in the world is favored as is the United States in the abundance and variety of its forage crops. They are legion and it would take a book to tell about them. Taking them up hastily, however, Prof. Shaw managed to cram a good deal of information about a good many of them into the limits of a twenty-minute paper.

With a few words about corn, he passed to sorghum, remarking that it was strange that it took the American farmer thirty years to find out the best use for sorghum as forage. Then came the non-saccharine sorghums, the clovers, alfalfa and the various kinds of peas. Speaking of the so-called Canadian field pea, Prof. Shaw said that there were sections of the United States where two bushels of this pea could be raised to one for the best pea-producing Canadian soil.

Within a few days, in Montana, he had counted 192 pea pods upon one vine, a marvelous production. Then he took up the rape plant. Some years ago, when but 600 bushels of rape were raised in the United States, he had predicted that the time would come when 10,000,000 sheep and lambs would be fattened upon rape in the United States, and the prediction was repeated. He said that to-day there are probably 100,000 acres of rape growing and no less than a million sheep and lambs are feeding upon it.

SHEEP RAISING.

This led the professor to the subject of sheep, and he deplored that the industry of sheep raising is made so little of in this country, in comparison with what it should be. Canadian sheep to the number of two hundred and fifty thousand are being annually imported by way of Buffalo, in the face of the high duty, and Canadian mutton is advertised in New York.

This market might be in the possession of the farmers of the United States. Passing rapidly along with his subject, he referred to the millets, rutabagas, turnips, artichokes, peanuts, the common cereals, and winter rye, and spoke highly of a mixture of wheat, oats, barley and spring rye. Drawing a further illustration as to sheep raising from his own experience, Prof. Shaw said that four years ago when he came here, he was told that sheep could not be raised at a profit in Minnesota, and those who made the statement really believed it. He said he wished the delegates could see a ten-acre piece of ground at the experimental farm, which had afforded forage for ninety-three sheep since the dawn of last spring, and there was forage enough on the land to carry the sheep until winter, even if growth were to stop now.

He characterized sheep as the "agricultural Klondike," of the United States, and concluded with a few words as to the proper rotation of forage crops for the various sections of the country.

Prof. Shaw's description of his experiment at the farm seemed to arouse the greatest interest among the delegates and he was plied with questions that led him to a detailed statement as to the forage and the methods pursued, which occupied the time of the congress until the adjournment, with the exception of the report of the committee on location, announcing the selection of Fort Worth.

The first business of Wednesday which I deem of interest to the board, was the election of officers, which resulted as follows:

President—Hon. W. D. Hoard of Wisconsin.

Secretary—John M. Stahl of Quincy, Ill.

First Assistant—D. O. Lively of Fort Worth, Texas.

Second Assistant—George A. Stockwell of Rhode Island.

Third Assistant—Alex. Dunlap of Michigan.

Treasurer—N. G. Spaulding of New York.

It may be interesting to the board to know the states represented. The votes do not show the number of delegates, however, so I have not noted them, as one delegate was allowed to vote for half the delegation of a state and two for the whole, no matter how many there were.

While upon this subject, I will say, that the representation was fixed for meetings hereafter, at one for each congressional district, two at large and one for each state society and college, giving to Maine ten delegates.

The states represented were Alabama, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nevada, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, South Dakota, Texas, and Wisconsin, and the vote on call of states was 315.

The first paper read at this session was by Mr. Randall on fairs.

Mr. Randall outlined the causes that lead to success or failure of state fairs. A worthy purpose he made the first essential. Those that had no other object in view than to add another department to the political machinery of the state, or the creation of places for impecunious politicians would meet with speedy disappointment. There must be loftier aims. There should be a well defined purpose in everything, even in the amusements. Good location and good buildings, and, most important of all, good weather, were essentials. Industry, as well as competency and honesty, were necessities in the men that had the management of the fair. There were no places for drones there. Those connected with fairs who were disposed to regard their duties and responsibilities lightly, and whose principal efforts were expended in the distribution of passes among their acquaintances and finding jobs, or at least places on the pay roll, for their friends, should be given other employment at the earliest possible opportunity.

They might be good fellows, but they were worth nothing to a fair. As for the exhibit, it should be comprehensive and include all the resources of the state. And then there should be legitimate and interesting amusements. But these should not include any degrading or demoralizing influences.

A state fair was no place for so-called "Midway" features. All intoxicants should be prohibited and pool selling, betting and gambling devices strictly barred. "State fair managers," said he, "cannot shock the moral sensibilities of the people and succeed."

This declaration was received with much applause. A friendly environment and a spirit of generous hospitality must pervade the community where the fair is held. The prejudices between the city and country should disappear at this time.

Concerning the future of state fairs, he said:

Give little heed to the man who speaks or writes of the decadence of state fairs. There is as much interest in them as ever, and their field of usefulness is in no way circumscribed. Organize the fair properly; put it in charge of men who will work actively for the good of the institution itself, men who will give it a purpose and who will put some life and energy into it; give it a suitable location and a sufficient equipment; make both the exhibition and amusement features what they ought to be, and by giving studious attention to the needs of exhibitors and visitors, the fair will succeed.

WOMAN ON THE FARM.

Mrs. Emma Sickles of Chicago spoke for the woman's department of the farm. She urged a better knowledge of the duties of the home among the girls, especially the preparation of food, the importance of food values, and the necessity of protection from food adulteration.

SUGAR BEETS.

Assistant Secretary Lively read a paper prepared by A. S. Goetz, manager of the Pecos Valley Sugar Beet Company of New Mexico, on Beet Sugar in the United States. The paper was elaborately prepared and full of instructive ideas on the question. Mr. Goetz pointed out that ninety per cent of the sugar used in this country is imported and that $100,000,000 is annually spent abroad which might be kept at home if proper attention was given the sugar beet industry by the farmers of the country. Sugar beets furnished the one crop the price of which is fixed before it is planted and which is not affected by speculation or by the season, be it good or bad. There are no agents to be paid, but the farmer deals directly with the manufacturer, contracting for the sale of his crop before any work is done to secure it. The present tariff he considered ample for the protection of the industry. The manufacturer was vitally interested in the prosperity of the farmer and must pay him a price that would give a fair profit.

The paper detailed the best methods for establishing the industry in any community, the isothermal conditions necessary for the profitable culture of the beet and technical details as to the manufacture of sugar.

The resolutions reported favorably include the endorsement of the postal savings bank system, the appointment of a committee of three on classification and rates for the transportation of fruits and vegetables, to consult with joint traffic associations, and report to the next congress, congressional aid in the extermination of the gipsy moth, restrictive legislation as to undesirable immigrants, liberal appropriations for the continued improvement and reclamation of the Mississippi river, the construction, maintenance and operation of the Nicaragua canal by the United States, the extension of homestead privileges to actual settlers upon reservations hereafter to be opened and the passage of the "free home" bill now pending in Congress, the election of United States senators by direct vote of the people, the copyrighting of state pure food labels, elementary instruction in agriculture in the public schools, a continuation of the experiments in rural free delivery, the establishment of a division of domestic science in the agricultural department, and uniform pure food laws for the protection of health and business integrity. Most of these resolutions were adopted by the congress without debate.

By invitation of Mr. J. J. Hill, president of the Great Northern Railroad, about six hundred delegates and associates of the congress started at 8 A. M. Friday, on an excursion through a part of Minnesota and North Dakota, for a two days' ride.

Our course was north about twenty degrees west, St. Cloud being the first principal station, next Sauk Center, then Alexandria, where we stopped for awhile to get a breath of fresh air, and view a country village. Our stop was short and again we steamed away across country in the direction of Fargo, the first town across Red River in North Dakota. One feature of interest during the first part of this day was the great number of lakes, as they are called there, and what we call ponds. Minnesota outnumbers Maine in lakes, and we passed through the most noted part of the state in this respect, as I am informed. After we got away from St. Paul a hundred miles we were fairly in the wheat fields, or as it seemed to me wheat field, there being no place where one left off and another began, and as we neared the Dakota line the stacks were nearer together, indicating a better crop and better wheat land. We arrived at Fargo at six o'clock, where we were met by many of the citizens with teams, who took us driving for two hours and showed us the principal sights and special features of the country. Fargo is the county seat of Cass county, North Dakota, and is widely known for its enterprise; well built residences, trim blocks, paved streets and smoke stacks of factories are to be seen in every direction, and wheat fields abound within the city limits. The State Agricultural College and Experiment Station are located here. With 8,000 population, it supports three daily papers and all modern facilities in shape of telephone, water works, electric lights, gas, street cars, etc.

The next morning we continued our journey to Grand Forks, county seat of Grand Forks county, and the second city of importance in North Dakota, 322 miles from St. Paul. It is close to the Red River that divides North Dakota from Minnesota and large quantities of Minnesota logs are brought here to be sawed, while large flouring mills grind wheat for the markets of the world. The State University and Grand Forks College are located here. We now make a turn which takes us exactly west, and run to Larimore, about forty miles from Grand Forks. Larimore is a pretty town in the midst of the grain fields of the western part of Grand Forks county. It is the crossing of the Great Northern line from Wahpeton, Maysville and Casselton to Park river and Langdon. Near by is the famous Elk valley farm of 10,000 acres belonging to N. A. Larimore, where the World's Fair commissioners saw sixty-five self-binders at work in a single field. We now leave the Pacific Coast line of the Great Northern and turn south and arrive at Maysville where we take dinner.

There we see the working of an elevator and learn its management, see the foul seed taken from a sample of wheat, and the percentage made, by which the value is fixed. Here too is the state normal school, and not far from here the train was stopped and we went into the fields to see the threshing machines work; four men were pitching bundles on to the carrier as fast as they could, and the wheat ran from the cleanser into the wagon, in a stream as large as a small stove pipe. The average day's work is 1,500 bushels. We were in the very center of the wheat raising land of the West, and I made a careful calculation as to how much grain I could at favorable times see in the stack, and also asked the opinion of others, and have no doubt that I could see in a favorable location from the car platform 20,000 bushels in the stack. We had thus far seen no binder at work, as the cutting was all done, but now we began to see them, and a few pieces of wheat seemed too green to cut for some days. I was not able to learn why the season was later here than farther north.

Our sight seeing is soon over now as night begins to lower. We stop at Wahpeton at about eight o'clock, two hours behind time, and when we make another start it is to cross the Red River again to Breckenridge in the state of Minnesota.

I must not forget to say that Prohibition prevails in North Dakota, and they told me in Fargo as in other large towns that no liquor was sold. We had a night ride of nine hours, which was rather dreary as the last of every excursion must be, and arrived in St. Paul about five A. M. September 5, feeling extremely gratified with our splendid trip through territory the equal of which is seldom seen in any country.

The congress had not adjourned sine die, and met again Monday morning, where without doing any business that would interest the board, we adjourned finally.

I hope you will bear in mind that I have been making a report, and not writing an essay, and have been obliged to leave out many things, not having space for all. I have therefore left out that which I deemed of least interest, and possibly I may not have written something that I should rather have put in, but in the main, I think, I have given you the most important matter for your consideration, and those who will read this report hereafter.

Voted, To adopt the following resolution:

Resolved, That the thanks of the Board be tendered to the Hon. S. L. Boardman for his able address on "The Life Work in Behalf of Maine Agriculture of Stephen L. Goodale."

W. H. Moody—In the selection of a committee on finance I think that one important consideration should be the locality of the member. I do not know how many times this committee may be called together, but if they were situated a long distance apart the expense for the year would be a good deal. It has seemed to me that, other things being equal, it would be better to select those members that are as near together as possible, and that has been the principal consideration in my appointment of that committee, which is as follows: John J. Frye, T. E. Skolfield and L. O. Straw.

On motion of Prof. Woods:

Voted, That the location of the Dairy Conference be referred to the executive committee. The matter of an interstate dairy conference was also referred to this committee.

Voted, That the thanks of the Board be extended to the president, Mr. W. H. Moody, for the very able and interesting report of the Farmers' National Congress presented by him.

Voted, That it is the sense of this Board that the secretary be a member of the executive committee, and we do hereby constitute him a member of that committee.

Voted, That the thanks of the Board be extended to the railroads of the State and the Cony House for reduced rates, and to Col. E. C. Stevens, superintendent of public buildings for courtesies extended the Board.

Adjourned.

OFFICERS OF AGRICULTURAL SOCIETIES.

Name of Society.	President.	P. O. Address.	Secretary.	P. O. Address.	Treasurer.	P. O. Address.
Maine State Agricultural	Isaiah Pompilly	Lewiston	Geo. H. Clarke	North Anson	E. G. Eveleth	Auburn.
Eastern Maine Fair Association	F. O. Beal	Bangor	Ezra L. Stearns	Bangor	E. B. Nealey	Bangor.
Maine State Pomological	John W. True	New Gloucester	D. H. Knowlton	Farmington	Chas. S. Pope	Manchester.
Androscoggin County	Lincoln Morrison	Livermore Falls	J. L. Lowell	Auburn	C. H. Gibbs, M. D.	Livermore Falls.
Androscoggin, Durham	A. G. Fitz	Durham	F. H. Miller	West Durham	C. H. Bliss	Durham.
Aroostook County	George W. Auber	Houlton	Ira J. Porter	Houlton	Geo. F. Merritt	Houlton.
Aroostook, North	Cyrus Chase	Blaine	E.T. McGlaughlin	So. Presque Isle	A. E. Irving	Presque Isle.
Aroostook, South	T. B. Bradford	Golden Ridge	Isaac Cushman	Sherman Mills	Alpheus Craig	Island Falls.
Cumberland County	Alonzo Libby	Westbrook	Chas. H. Leighton	Westbrook	F. D. Scammon	Gorham.
Cumberland, North	Richard Cook	Edes Falls	N. C. Pinkham	Bolster's Mills	James Thomes	Harrison.
Cumberland Farmers' Club	C. A. Merrill	Cumberland Ctr.	L. W. Hadlock	West Falmouth	N. M. Shaw	W. Cumberland.
Cumberland, Gray Park Association	Wm. P. Haskell	Gray	J. W. Stevens	Gray	J. W. Stevens	Gray.
Cumberland, Bridgton Farmers' and Mechanics' Association	Ed. C. Walker	Bridgton	Fred C. Knight	Bridgton	W. M. Staples	Bridgton.
Cumberland, New Gloucester and Danville	S. R. Robinson	Danville Junc.	L. L. Whitman	Upper Gloucester	Geo. C. Jordan	Upper Gloucester
Cumberland, Lake View Park	Arthur Dyer	Sebago	J. P. Fitch	East Sebago	J. P. Fitch	East Sebago.
Franklin County	P. P. Tufts	Farmington	Reuben Hatch	Farmington	G. M. Currier	Farmington.
Franklin, North	Wilson C. Beal	Phillips	M. Sewall Kelley	Phillips	J. W. Butterfield	Phillips.
Hancock County	W. J. Creamer	Penobscot	Nahum Hinckley	Bluehill	M. P. Hinckley	Bluehill.
Hancock, North	H. T. Silsby	Aurora	A. W. Silsby	Amherst	A. W. Silsby	Amherst.
Hancock Fair Association	A. W. Ellis	Ellsworth	H. F. Whitcomb	Ellsworth	H. J. Joy	Ellsworth.
Hancock, Eden	C. W. Kittredge	West Eden	Frank A. Wood	Salisbury Cove	J. E. Hamor	West Eden.
Kennebec County	D. B. Savage	Augusta	W. G. Hunton	Readfield	C. H. Stevens	Readfield.
Kennebec, South	C. F. Achorn	Cooper's Mills	A. N. Douglass	Chelsea	Jasper S. Gray	South Windsor.
Kennebec, Pittston Agricultural and Trotting Park Association	C. C. Libby	East Pittston	G. R. Mansir	East Pittston	H. A. Clark	East Pittston.
Knox, North	Moses Bowes	Union	W. A. Bessey	Union	Geo. C. Hawes	Union.
Lincoln County	A. M. Card	Alna	A. I. Phelps	Damariscotta	A. A. Hall	Newcastle.
Oxford County	John A. Roberts	Norway	A. C. T. King	South Paris	A. C. T. King	South Paris.
Oxford, Riverside Park Association	J. A. Twaddle	Bethel	H. S. Hastings	Bethel	H. S. Hastings	Bethel.
Oxford, West	C. H. Walker	Fryeburg	W. H. Abbott	Fryeburg	W. R. Tarbox	Fryeburg.
Oxford, Androscoggin Valley	B. C. Waite	Canton Point	H. T. Tirrell	Canton	D. W. Goding	East Peru.
Oxford, North	Geo. O. Huse	Andover	John F. Talbot	Andover	Lewis C. Akers	Andover.
Penobscot County	Chas. R. Sutton	Stillwater	O. Bussell	Old Town	O. Bussell	Old Town.
Penobscot, Lee Union	Ira Barnes	Lee	Nathan Averill	Lee	C. H. Tuck	Lee.
Penobscot, West	Joel Richardson	Stetson	J. W. Butters	Exeter	R. C. Rich	Exeter.
Penobscot, North	S. T. Mallett	Springfield	B. D. Averill	Kingman	Edwin A. Reed	North Lee.

Penobscot, East Eddington Farmers' Club	J. H. Comins	East Eddington	E. B. Comins	East Eddington	J. H. Comins	East Eddington.
Penobscot, Orrington	Albert G. Dole	South Brewer	N. A. Nickerson	Orrington	N. A. Nickerson	Orrington.
Piscataquis, East	W. H. Snow	Milo	A. L. Ward	Milo	A. L. Ward	Milo.
Piscataquis, West	Frank Hart	Howard				
Sagadahoc County	W. B. Kendall	Bowdoinham	W. S. Rogers	Topsham	L. E. Smith	Brunswick.
Sagadahoc, Richmond Farmers' and Mechanics' Club	S. E. Skillins	Richmond Cor	C. E. Dinslow	Richmond Cor	D. W. Alexander	Richmond.
Somerset County	Orlando Walker	Anson	J. F. Withee	Madison	C. A. Wilbur	Madison.
Somerset, East	J. Finson	Hartland	S. H. Goodwin	St. Albans	S. L. Mayo	Hartland.
Somerset, Central	Warren Russell	Skowhegan	H. A. Archer	Skowhegan	A. R. Bixby	Skowhegan.
Somerset, New Portland	W. R. Richardson	No. New Portland	W. B. Clark	N. New Portland	Elmer Quint	N. New Portland.
Waldo County						
Waldo and Penobscot	M. C. Chapman	Newburgh	E. H. Nealley	Monroe	F. L. Palmer	Monroe.
Waldo, North	Edwin Rand	Unity	E. B. Hunt	Unity	F. A. Bartlett	Unity.
Waldo, West						
Washington County	A. S. Farnsworth	West Pembroke	Sidney A. Wilder	West Pembrok	Clifton Laughlin	Pembroke.
Washington, North	Chas. H. Yates	Princeton	Albert L. Jones	Princeton	S. G. Spooner	Princeton.
Washington, West	D. W. Campbell	Cherryfield	E. F. Allen	Columbia Falls	F. L. Allen	Columbia Falls.
Washington, Central	J. E. Vose	Machias	W. H. Phinney	Machias	M. Gardner	Machias.
York County	E. W. Staples	Biddeford	S. S. Andrews	Biddeford	Geo. H. Boothby	Saco.
York, Buxton and Hollis	J. W. Meserve	Bar Mills	J. B. Elden	Bar Mills	F. J. Leavitt	Hollis.
York, Ramshackle Park	G. E. Mitchell	West Newfield	J. L. Carlton	West Newfield	A. H. Davis	West Newfield.
York, Shapleigh and Acton	S. R. Thyng	Ross' Corner	F. K. Bodwell	Acton	H. A. Stanley	Shapleigh.
York, Ossipee Valley Union	R. G. Pease	Cornish	Levi L. Cook	Cornish	E. E. Guptill	Cornish.
York, Springvale Agricultural and Mechanical Association	J. H. Makin	Springvale	A. W. Low	Springvale	F. A. Clark	Springvale.
York, North Berwick Agricultural Association	Nathaniel Hobbs	North Berwick	Geo. W. Perkins	North Berwick	John B. Russell	North Berwick.

ANALYSIS OF EXHIBITION.

Name of Society.	Number of horses and colts.	Number of thoroughbred bulls and bull calves.	Number of thoroughbred cows, heifers and heifer calves.	Number of grade bulls and bull calves.	Number of grade cows, heifers and heifer calves.	Number of oxen and steers.	Number of animals for beef.	Number of cattle shown in herds.	Total number of neat stock.	Sheep.	Swine.	Poultry (coops).
Androscoggin County	94	23	65	-	80	136	18	36	358	96	-	185
Androscoggin, Durham	20	-	8	6	9	46	8	8	85	30	4	36
Aroostook County	-	-	-	-	-	-	-	-	-	-	-	-
Aroostook, North	72	13	16	10	44	18	-	-	101	82	11	54
Aroostook, South	-	-	-	-	-	-	-	-	-	-	-	-
Cumberland County	88	21	44	10	52	82	14	20	243	39	33	66
Cumberland, North	46	-	-	2	46	36	4	31	84	14	27	2
Cumberland Farmers' Club	10	-	-	1	6	18	2	4	27	-	-	7
Cumberland, Gray Park Association	26	11	34	2	41	52	-	25	165	18	2	37
Cumberland, Bridgton Farmers' and Mechanics' Asso.	36	3	3	5	4	28	2	-	45	7	25	12
Cumberland, New Gloucester and Danville	74	1	-	7	49	24	2	16	99	29	1	15
Cumberland, Lake View Park	12	-	-	5	31	34	-	-	70	-	-	4
Franklin County	65	15	69	25	116	142	13	96	476	325	10	57
Franklin, North	40	8	26	12	45	90	6	35	222	78	13	3
Hancock County	24	2	2	9	50	40	-	-	103	11	-	9
Hancock, North	21	1	4	2	8	8	-	-	23	4	1	11
Hancock Fair Association	20	1	14	4	29	6	-	7	61	20	2	65
Hancock, Eden	1	-	6	2	12	-	-	8	20	2	2	8
Kennebec County	70	13	28	-	72	122	12	48	295	43	36	17
Kennebec, South	34	10	9	5	17	134	8	15	198	13	12	5
Kennebec, Pittston Agricultural & Trotting Park As.	12	2	4	6	18	116	2	25	173	26	16	9
Knox, North	30	7	19	3	19	32	7	9	96	34	21	16
Lincoln County	38	8	17	3	29	82	11	27	177	14	15	17
Oxford County	50	29	35	-	119	66	12	36	297	64	53	21
Oxford, Riverside Park Association	60	17	41	14	57	46	-	26	175	32	29	4
Oxford, West	88	11	20	2	16	120	6	10	164	42	51	100
Oxford, Androscoggin Valley	32	9	45	4	22	62	6	14	162	21	-	15
Oxford, North	17	5	30	3	6	16	4	6	70	22	18	10
Penobscot County	-	-	-	-	-	-	-	-	-	-	-	-

Penobscot, Lee Union	-	-	-	-	-	-	-	-	-	-	-	-
Penobscot, West	43	15	27	7	30	24	-	20	123	30	2	22
Penobscot, North	20	1	3	10	25	30	7	2	78	7	20	9
Penobscot, East Eddington Farmers' Club	23	2	6	1	20	-	-	12	41	32	4	20
9 Penobscot, Orrington	11	-	-	1	12	-	-	4	13	9	12	10
Piscataquis, East	6	-	1	-	11	-	-	-	12	-	2	12
Piscataquis, West	-	-	-	-	-	-	-	-	-	-	-	-
Sagadahoc County	40	26	81	-	111	84	4	70	376	74	60	160
Sagadahoc, Richmond Farmers' & Mechanics' Club	13	4	19	-	39	26	6	64	107	-	-	10
Somerset County	15	8	15	4	65	68	2	18	180	180	4	2
Somerset, East	44	4	3	2	44	30	8	20	91	47	14	-
Somerset, Central	-	-	-	-	-	-	-	-	-	-	-	-
Somerset, New Portland	26	3	-	3	19	8	2	20	55	6	6	-
Waldo County	-	-	-	-	-	-	-	-	-	-	-	-
Waldo and Penobscot	58	17	30	4	54	56	21	85	267	76	4	46
Waldo, North	24	-	-	9	20	18	16	-	63	26	28	7
Waldo, West	-	-	-	-	-	-	-	-	-	-	-	-
Washington County	35	4	25	-	28	10	-	18	85	48	18	25
Washington, North	19	-	-	4	9	-	-	-	13	15	10	4
Washinton, West	57	11	14	-	26	24	-	-	75	46	38	62
Washington, Central	49	6	12	1	23	22	-	-	64	33	30	44
York County	25	34	127	1	17	114	36	116	292	3	37	282
York, Buxton and Hollis	10	1	2	-	22	20	-	-	45	-	-	4
York, Ramshackle Park	8	-	1	2	5	16	2	-	26	-	1	2
York, Shapleigh and Acton	17	-	-	8	37	136	12	-	193	16	9	39
York, Ossipee Valley Union	23	13	19	-	27	178	8	29	274	30	10	24
York, Springvale Agricultural & Mechanical Asso	14	5	20	-	10	100	8	-	143	32	18	18
York, North Berwick Agricultural Association	25	8	13	12	6	95	8	18	160	18	15	4

ANALYSIS OF AWARDS.

Name of Society.	Amount of premiums paid trotting bred stallions.	Amount of premiums paid trotting bred brood mares	Amount of premiums paid draft stock stallions.	Amount of premiums paid draft stock brood mares.	Amount of premiums paid family horses.	Amount of premiums paid gentlemen's drivers.	Amount of premiums paid matched carriage horses.	Amount of premiums paid colts.	Amount of premiums paid horses for draft.
Androscoggin County	$33 00	$19 00	$10 00	$10 00	$9 00	$10 00	$12 00	$48 00	$27 00
Androscoggin, Durham	-	3 00	-	-	3 00	3 00	-	12 00	6 00
Aroostook County	-	-	-	-	-	-	-	-	-
Aroostook, North	1 50	2 50	2 50	3 25	2 50	3 25	-	17 00	6 50
Aroostook, South	-	-	-	-	-	-	-	-	-
Cumberland County	45 00	15 00	-	15 00	20 00	20 00	15 00	-	32 00
Cumberland, North	-	-	-	-	7 00	-	2 00	2 00	68 00
Cumberland Farmers' Club	2 00	-	-	-	-	5 00	-	4 00	-
Cumberland, Gray Park Association	4 00	2 00	-	-	5 00	15 00	8 00	7 50	-
Cumberland, Bridgton Farmers' and Mechanics' Association	-	-	-	-	5 00	5 00	5 00	8 00	28 00
Cumberland, New Gloucester and Danville	5 00	5 00	-	-	3 00	8 00	5 00	6 50	8 00
Cumberland, Lake View Park	-	-	-	-	5 00	6 00	5 00	7 00	20 00
Franklin County	22 00	6 00	6 00	5 00	6 00	15 00	19 00	19 00	15 00
Franklin, North	-	-	2 50	4 50	-	3 50	2 00	8 50	-
Hancock County	12 00	-	.	11 00	-	5 00	1 00	12 00	8 00
Hancock, North	-	1 50	-	1 50	1 25	-	-	1 25	15 50
Hancock Fair Association	20 50	7 50	-	-	-	-	-	13 00	18 00
Hancock, Eden	-	-	-	-	1 50	-	-	-	-
Kennebec County	45 00	6 00	25 00	14 50	10 00	10 00	6 00	35 50	18 00
Kennebec, South	3 75	4 50	-	-	2 65	3 00	2 50	12 65	5 25
Kennebec, Pittston Agricultural and Trotting Park Association	-	-	2 00	3 00	-	2 00	-	8 50	-
Knox, North	3 00	2 00	2 00	3 00	3 00	2 50	2 50	7 00	8 50
Lincoln County	5 00	3 00	3 00	4 50	2 00	11 00	-	9 25	2 00
Oxford County	-	-	53 00	29 00	18 00	35 00	-	54 00	69 00
Oxford, Riverside Park Association	6 00	6 00	-	-	-	25 00	-	13 92	38 00
Oxford, West	-	-	-	-	7 00	-	16 00	5 00	15 00
Oxford, Androscoggin Valley	10 00	9 00	-	-	-	10 00	9 00	21 00	7 00
Oxford, North	-	-	4 00	4 50	-	10 00	-	7 50	16 00

Penobscot County	-	-	-	-	-	-	-	-	-
Penobscot, Lee Union	-	-	-	-	-	-	-	-	-
Penobscot, West	17 00	10 50	-	5 00	8 00	10 00	10 00	25 50	15 00
Penobscot, North	-	-	1 00	2 00	-	4 50	-	14 50	3 50
Penobscot, East Eddington Farmers' Club	-	1 50	-	1 50	2 50	2 50	-	5 00	7 00
Penobscot, Orrington	-	2 00	-	-	-	3 00	-	4 50	-
Piscataquis, East	-	-	-	-	-	-	2 00	3 00	-
Piscataquis, West	-	-	-	-	-	-	-	-	-
Sagadahoc County	14 00	15 00	-	-	8 00	15 00	-	25 00	16 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	75	-	75	-	-	-	-	1 05	7 24
Somerset County	3 00	2 00	-	-	-	3 00	3 00	6 00	18 00
Somerset, East	-	-	-	9 50	-	10 00	9 00	12 50	4 00
Somerset, Central	-	-	-	-	-	-	-	-	-
Somerset, New Portland	-	-	-	-	-	-	-	-	-
Waldo County	-	-	-	-	-	-	-	-	-
Waldo and Penobscot	18 00	7 00	12 00	6 00	10 00	7 00	10 00	33 00	50 00
Waldo, North	11 00	6 00	-	-	4 50	-	6 00	-	-
Waldo, West	-	-	-	-	-	-	-	-	-
Washington County	-	5 00	-	5 00	-	-	8 00	42 00	10 00
Washington, North	5 00	3 00	3 00	3 00	-	-	2 00	4 00	3 00
Washington, West	40 00	7 00	-	-	-	50 00	-	116 00	46 00
Washington, Central	-	6 00	6 00	6 00	-	12 00	-	26 00	8 00
York County	40 00	5 00	-	-	-	-	-	62 00	28 00
York, Buxton and Hollis	-	-	-	-	-	-	-	-	10 00
York, Ramshackle Park	8 00	-	-	-	4 00	34 00	-	2 00	-
York, Shapleigh and Acton	-	-	-	3 00	6 00	6 00	-	9 25	-
York, Ossipee Valley Union	23 00	5 00	-	-	8 00	10 00	-	25 00	-
York, Springvale Agricultural and Mechanical Association	-	-	-	3 00	3 00	3 00	-	10 00	-
York, North Berwick Agricultural Association	-	5 00	-	-	4 00	-	5 00	-	-

ANALYSIS OF AWARDS—Continued.

Name of Society.	Amount of premiums paid thoroughbred bulls and bull calves.	Amount of premiums paid thoroughbred cows, heifers and heifer calves.	Amount of premiums paid grade bulls and bull calves.	Amount of premiums paid grade cows, heifers and heifer calves.	Amount of premiums paid herds.	Amount of premiums paid working oxen and steers.	Amount of premiums paid matched oxen and steers.	Amount of premiums paid trained steers.	Amount of premiums paid beef cattle.	Amount of premiums paid town teams.	Amount of premiums paid oxen and steers for draft.
Androscoggin County	$58 00	$80 00	-	$86 00	$36 00	$10 00	$36 00	$ 9 00	$18 00	$78 00	$72 00
Androscoggin, Durham	-	12 00	$7 50	7 50	6 00	-	6 00	12 00	6 00	-	18 00
Aroostook County	-	-	-	-	-	-	-	-	-	-	-
Aroostook, North	22 00	46 00	10 50	36 50	-	16 50	-	4 00	-	-	-
Aroostook, South	-	-	-	-	-	-	-	-	-	-	-
Cumberland County	35 00	53 00	-	72 00	32 00	51 00	34 00	-	26 00	20 00	118 00
Cumberland, North	9 00	5 00	-	-	22 00	6 00	9 00	12 00	5 00	10 00	72 00
Cumberland Farmers' Club	-	-	-	4 00	4 00	-	-	5 00	3 00	12 00	19 00
Cumberland, Gray Park Association	9 50	25 00	2 00	25 50	14 00	2 00	5 50	-	-	14 00	26 00
Cumberland, Bridgton Farmers' and Mechanics' Asso.	5 00	3 00	5 00	10 00	-	18 00	3 00	-	3 00	20 00	27 00
Cumberland, New Gloucester and Danville	2 00	-	7 00	29 00	13 00	2 00	3 00	-	2 00	10 00	5 00
Cumberland, Lake View Park	-	-	7 00	16 50	-	14 25	2 00	-	2 00	7 00	16 00
Franklin County	33 50	56 00	33 00	62 00	35 50	9 00	52 00	9 00	10 25	63 00	36 00
Franklin, North	6 00	9 80	5 50	15 00	10 00	6 25	9 15	2 00	5 50	20 00	4 75
Hancock County	5 00	2 00	15 00	62 50	-	28 00	-	-	-	5 00	15 00
Hancock, North	1 00	3 00	2 00	3 60	-	4 25	1 50	-	-	-	3 00
Hancock Fair Association	3 00	11 00	5 25	34 25	10 00	12 05	-	-	-	-	-
Hancock, Eden	-	1 00	3 00	6 75	1 50	-	-	-	-	-	-
Kennebec County	51 00	75 00	-	55 50	24 00	24 00	18 00	6 00	19 50	33 00	-
Kennebec, South	11 20	11 45	4 75	15 65	10 00	15 55	16 15	2 25	5 50	57 00	7 00
Kennebec, Pittston Agricultural & Trotting Park Asso.	3 00	4 50	6 00	14 00	6 00	9 50	10 50	-	3 00	25 00	18 00
Knox, North	6 25	8 50	6 50	17 25	5 00	8 25	6 00	3 00	5 00	6 00	6 00
Lincoln County	3 00	6 00	-	13 50	7 00	-	23 00	25 00	6 00	22 00	20 00
Oxford County	119 00	119 00	-	121 00	36 00	120 00	43 00	-	23 00	67 00	51 00
Oxford, Riverside Park Association	46 75	87 50	7 00	64 75	8 00	38 25	9 37	3 05	-	24 00	36 00
Oxford, West	29 00	42 00	-	18 50	10 00	27 50	28 50	6 00	11 00	60 00	44 00
Oxford, Androscoggin Valley	32 00	24 00	7 00	34 50	10 00	25 00	24 00	5 00	5 00	18 00	36 00
Oxford, North	-	-	3 25	15 75	8 00	6 75	7 00	2 50	-	4 00	12 00

Penobscot County	–	–	–	–	–	–	–	–	–	–	–
Penobscot, Lee Union	–	–	–	–	–	–	–	–	–	–	–
Penobscot, West	30 50	59 50	18 50	53 90	8 00	19 00	7 00	1 00	–	–	10 00
Penobscot, North	1 50	2 00	8 00	40 00	–	13 50	2 00	–	2 00	–	–
Penobscot, East Eddington Farmers' Club	3 00	–	–	10 25	9 00	–	–	–	–	–	–
Penobscot, Orrington	–	–	1 00	7 75	4 00	–	–	–	–	10 00	–
Piscataquis, East	–	75	–	5 50	–	–	–	–	–	–	–
Piscataquis, West	–	–	–	–	–	–	–	–	–	–	–
Sagadahoc County	66 75	121 25	–	114 50	44 00	59 50	16 00	8 00	9 00	56 00	49 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	1 90	5 75	–	8 60	4 75	2 80	3 30	–	1 20	–	9 75
Somerset County	6 50	8 50	3 50	20 00	–	6 00	9 00	2 50	1 00	6 00	12 00
Somerset, East	8 00	6 00	5 00	68 00	8 00	–	35 50	3 00	14 50	20 00	20 00
Somerset, Central	–	–	–	–	–	–	–	–	–	–	–
Somerset, New Portland	–	–	–	–	–	–	–	–	–	–	–
Waldo County	–	–	–	–	–	–	–	–	–	–	–
Waldo and Penobscot	53 00	67 00	10 00	89 00	32 00	44 00	10 00	6 00	59 00	16 00	36 00
Waldo, North	–	–	19 50	23 75	–	–	11 00	4 50	11 50	–	–
Waldo, West	–	–	–	–	–	–	–	–	–	–	–
Washington County	11 50	21 50	–	25 50	22 00	15 00	–	–	–	–	–
Washington, North	–	–	5 00	16 00	–	–	–	–	–	–	–
Washington, West	52 00	53 00	–	49 00	–	70 00	–	–	–	–	–
Washington, Central	20 00	22 00	–	18 00	–	28 00	–	–	–	–	–
York County	271 00	674 00	3 00	41 00	175 00	208 00	21 00	23 00	20 00	35 00	82 00
York, Buxton and Hollis	–	–	–	–	–	–	–	–	–	–	10 00
York, Ramshackle Park	–	4 00	5 00	14 00	–	2 00	4 00	3 00	4 00	10 00	6 00
York, Shapleigh and Acton	–	–	6 50	18 50	–	6 00	18 00	14 75	6 00	55 00	17 00
York, Ossipee Valley Union	41 00	49 00	–	41 01	16 00	36 50	32 00	–	10 00	52 00	25 00
York, Springvale Agricultural and Mechanical Asso	7 00	26 00	–	9 00	–	19 00	3 00	2 00	2 00	22 00	13 00
York, North Berwick Agricultural Association	17 00	12 00	10 00	18 00	30 00	21 00	8 00	–	5 00	16 00	5 00

ANALYSIS OF AWARDS—CONCLUDED.

Name of Society.	Amount of premiums paid sheep.	Amount of premiums paid swine.	Amount of premiums paid poultry.	Amount of premiums paid grain and root crops.	Amount of premiums paid fruit and flowers.	Amount of premiums paid bread and dairy products.	Amount of premiums paid honey, sugar and syrups.	Amount of premiums paid agricultural implements.	Amount of premiums paid household manufactures and needle work.	Amount of premiums paid objects not named above.	Total amount of premiums and gratuities paid.
Maine State Pomological	-	-	-	-	649 50	-	-	-	-	-	649 50
Androscoggin County	64 00	-	126 00	73 00	65 00	40 00	12 00	5 00	98 00	179 00	1,323 00
Androscoggin, Durham	13 00	6 50	14 25	21 30	12 40	3 80	7 90	-	21 55	14 00	216 70
Aroostook County	-	-	-	-	-	-	-	-	-	-	-
Aroostook, North	19 25	11 00	46 00	46 25	35 00	15 00	5 00	6 25	21 50	54 34	434 09
Aroostook, South	-	-	-	-	-	-	-	-	-	-	-
Cumberland County	29 00	12 00	85 00	21 00	13 00	8 00	-	-	36 00	72 00	879 00
Cumberland, North	3 00	8 00	1 00	14 75	14 00	3 00	2 50	-	12 70	2 50	*290 45
Cumberland Farmers' Club	-	-	1 00	7 25	12 00	3 25	-	11 25	-	1 50	94 25
Cumberland, Gray Park Association	8 00	1 00	12 00	10 50	10 50	9 90	1 25	-	15 35	36 00	269 50
Cumberland, Bridgton Farmers' & Mechanics' Ass'n	5 00	6 00	-	7 50	10 50	7 50	-	-	25 25	30 50	237 25
Cumberland, New Gloucester and Danville	4 00	2 00	6 75	12 35	15 25	4 25	1 75	-	23 85	13 75	197 45
Cumberland, Lake View Park	-	-	1 25	7 30	7 45	3 45	-	-	7 75	-	134 95
Franklin County	135 00	6 50	29 75	4 50	45 85	17 25	6 70	2 00	31 30	8 75	799 85
Franklin, North	14 50	2 75	1 50	8 00	13 85	4 35	-	-	21 45	1 20	182 55
Hancock County	13 00	-	4 50	46 90	12 44	12 15	5 10	-	34 26	17 25	327 10
Hancock, North	2 50	1 00	4 50	31 55	20 55	7 25	85	-	27 50	12 60	147 65
Hancock Fair Association	19 75	3 50	33 75	28 25	23 00	18 50	4 50	-	82 65	-	348 45
Hancock, Eden	1 25	50	4 50	34 10	19 15	3 10	-	-	22 10	18 55	117 00
Kennebec County	25 50	18 00	36 00	62 50	78 00	38 25	3 00	-	86 75	77 85	901 85
Kennebec, South	2 50	2 50	3 85	11 20	12 65	13 25	50	-	39 25	14 95	291 45
Kennebec, Pittston Agr'lt'l & Trotting Park Ass'n	8 25	5 50	4 00	8 25	14 50	1 75	1 25	-	14 95	4 76	178 21
Knox, North	10 75	4 00	5 25	13 75	23 90	13 00	6 55	-	25 95	2 00	216 40
Lincoln County	7 50	3 00	11 50	38 50	17 25	11 50	4 25	-	36 00	2 00	296 75
Oxford County	35 00	22 00	6 00	34 75	54 50	58 50	14 05	36 00	45 45	240 75	1,504 00
Oxford, Riverside Park Association	12 00	11 00	4 50	10 57	20 00	5 30	-	-	-	16 65	493 61
Oxford, West	32 00	36 00	59 50	16 75	18 50	28 25	16 50	1 00	36 75	5 25	570 00
Oxford, Androscoggin Valley	20 50	-	8 50	2 25	21 35	10 25	2 50	8 00	21 30	27 00	408 15

Oxford, North	16 25	9 50	9 50	21 33	4 90	8 55	3 85	1 00	15 50	17 50	209 13
Penobscot County	-	-	-	-	-	-	-	-	-	-	-
Penobscot, Lee Union	-	-	-	-	-	-	-	-	-	-	-
Penobscot, West	8 00	6 00	14 40	20 20	13 55	28 00	2 00	7 50	90 60	11 00	509 65
Penobscot, North	3 00	4 00	4 25	2 50	5 70	3 50	50	-	5 25	-	123 20
Penobscot, East Eddington Farmers' Club	7 00	3 50	6 00	27 95	18 25	7 00	4 25	-	13 30	5 00	134 50
Penobscot, Orrington	3 50	3 00	4 50	16 50	16 60	3 00	1 50	-	26 30	7 00	114 15
Piscataquis, East	-	3 00	1 50	5 50	50	1 00	-	-	50	-	23 25
Piscataquis, West	-	-	-	-	-	-	-	-	-	-	-
Sagadahoc County	26 00	19 00	82 25	89 75	92 50	51 00	15 25	-	63 25	215 63	1,291 63
Sagadahoc, Richmond Farmers' and Mech's Club	1 15	-	2 20	9 80	3 80	2 90	.25	.50	10 25	2 35	81 04
Somerset County	32 00	1 50	3 00	7 05	2 35	2 25	1 45	-	11 30	-	170 90
Somerset, East	35 50	10 00	-	8 50	3 50	15 50	6 25	-	27 05	50 00	†389 30
Somerset, Central	-	-	-	-	-	-	-	-	-	-	-
Somerset, New Portland	-	-	-	-	-	-	-	-	-	-	-
Waldo County	-	-	-	-	-	-	-	-	-	-	-
Waldo and Penobscot	55 00	13 00	25 50	39 50	45 75	24 00	1 50	-	113 75	16 00	909 00
Waldo, North	11 00	2 50	3 25	25 00	7 00	10 50	4 50	-	34 25	29 75	225 50
Waldo, West	-	-	-	-	-	-	-	-	-	-	-
Washington County	26 50	13 00	19 50	52 45	15 50	23 10	1 50	-	46 25	7 00	370 30
Washington, North	5 50	4 00	1 75	10 25	6 00	5 25	-	-	22 60	-	99 35
Washington, West	42 00	14 00	56 00	80 00	66 25	24 25	4 50	-	80 50	51 75	902 25
Washington, Central	21 00	15 00	66 80	40 75	28 05	9 40	2 60	-	63 60	-	399 20
York County	6 00	42 00	334 00	38 00	26 00	33 00	-	-	33 00	50 00	2,250 00
York, Buxton and Hollis	-	-	-	-	-	-	-	-	-	-	20 00
York, Ramshackle Park	-	1 00	50	-	-	-	-	-	27 50	-	129 00
York, Shapleigh and Acton	5 50	11 50	17 25	56 50	22 00	10 25	-	-	7 00	108 00	404 00
York, Ossipee Valley Union	10 00	6 00	17 50	13 00	8 00	4 45	1 05	-	44 50	15 00	493 01
York, Springvale Agr'lt'l and Mechanical Ass'n	11 00	18 00	21 00	22 00	8 00	5 00	-	-	34 30	5 00	246 30
York, North Berwick Agricultural Association	9 50	10 00	3 00	34 00	15 00	1 75	2 25	-	34 05	-	265 55

*Discount 50 per cent, $145 22. †Discount 65 per cent, $253 05.

FINANCES.

Name of Society.	Amount received from the State.	Receipts for membership.	Receipts from loans.	Receipts from entry fees for trotting purses.	Receipts from all other sources.	Total receipts.	Amount expended in improvements.	Amount expended in trotting purses.	Expenses during the fair.	Amount expended for all other purposes.	Total amount paid out, including premiums and gratuities.	Value of property belonging to the society.	Amount of liabilities.
Maine State Pomological	$1,000 00	$63 00	$500 00	-	$25 00	$1,588 00	$36 75	$649 50	$175 00	$729 89	$1,591 14	$500 00	-
Androscoggin County	548 75	36 00	-	$455 00	1,053 88	2,093 63	77 93	1,080 00	276 66	193 51	3,951 10	400 00	$600 00
Androscoggin, Durham	81 04	-	-	91 75	416 77	589 56	50 00	285 00	106 30	5 00	663 00	2,000 00	1,400 00
Aroostook County	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroostook, North	240 66	62 70	-	305 00	867 43	1,475 79	-	746 75	199 23	74 00	1,454 07	4,000 00	3,000 00
Aroostook, South	-	-	-	-	-	-	-	-	-	-	-	-	-
Cumberland County	364 65	-	250 00	692 50	2,819 38	4,126 53	152 56	1,450 00	1,010 00	629 00	4,120 56	6,000 00	1,225 00
Cumberland, North	124 91	5 00	-	132 75	116 70	379 36	149 95	162 50	43 30	226 37	727 35	600 00	150 00
Cumberland Farmers' Club	74 05	11 00	-	153 75	488 77	727 57	5 00	365 00	309 78	48 50	822 53	3,000 00	350 00
Cumberland, Gray Park Association	122 91	-	-	365 00	1,612 44	2,100 35	-	650 00	1,613 29	-	2,532 79	9,000 00	1,750 00
Cumberland, Bridgton Farmers' and Mechanics' Association	49 65	2035 00	200 00	208 00	1,181 48	3,674 13	1,167 36	495 00	106 62	1,395 23	3,401 46	2,500 00	-
Cumberland, New Gloucester and Danville	57 40	-	-	64 00	604 25	725 65	20 00	169 00	119 00	97 00	602 45	2,500 00	-
Cumberland, Lake View Park	46 82	-	-	38 50	351 85	437 17	60 00	178 00	62 00	-	434 95	1,000 00	100 00
Franklin County	293 30	669 00	-	395 00	2,658 40	4,015 70	263 41	862 50	575 55	1,385 27	3,886 58	10,000 00	-
Franklin, North	92 06	264 00	-	106 25	514 99	977 30	50 00	268 75	25 00	451 00	977 30	3,244 84	2,191 05
Hancock County	94 68	-	-	195 75	1,276 97	1,567 40	-	474 25	246 10	327 10	1,374 55	5,000 00	1,050 00
Hancock, North	55 05	6 00	11 74	-	511 58	584 37	150 00	-	273 76	25 00	596 41	-	11 74
Hancock Fair Association	241 62	-	-	321 00	2,862 39	3,425 01	298 79	1,055 00	1,038 98	447 75	3,188 97	11,500 00	-
Hancock, Eden	-	25 00	-	-	294 70	319 70	30 00	-	141 52	12 25	300 77	-	10 00
Kennebec County	315 95	-	300 00	216 25	1,552 67	2,384 87	125 00	533 50	234 20	326 20	2,120 75	3,000 00	1,200 00
Kennebec, South	88 51	-	-	103 00	1,468 53	1,660 04	186 75	370 50	204 80	348 32	1,401 82	1,600 00	-
Kennebec, Pittston Agricultural and Trotting Park Association	39 67	25 00	200 00	50 00	620 26	934 93	175 00	433 70	326 23	-	1,113 14	1,200 00	900 00
Knox, North	78 97	251 00	-	81 00	380 63	791 60	-	260 00	292 22	103 08	871 70	-	80 10
Lincoln County	-	4 00	-	20 00	1,010 96	1,034 96	-	207 75	703 38	111 90	1,319 78	875 00	275 00

Oxford County	605 67	18 00	-	528 00	4,213 88	5,365 55	-	987 50	332 89	1,058 70	3,883 09	10,000 00	-
Oxford, Riverside Park Association	131 60	-	-	190 10	661 52	983 22	125 00	529 00	424 25	126 40	1,698 26	2,400 00	400 00
Oxford, West	223 22	50 00	-	470 00	2,031 78	2,775 00	300 00	900 00	262 00	1,508 06	3,540 06	7,800 00	1,500 00
Oxford, Androscoggin Valley	161 04	21 00	-	297 50	1,344 42	1,823 96	-	605 50	471 14	149 86	1,634 65	2,500 00	3,243 00
Oxford, North	73 54	15 00	-	107 13	806 22	1,001 89	60 00	356 95	-	293 75	919 83	2,300 00	-
Penobscot County	-	-	-	-	-	-	-	-	-	-	-	-	-
Penobscot, Lee Union	-	-	-	-	-	-	-	-	-	-	-	-	-
Penobscot, West	180 40	30 00	-	396 00	1,131 26	1,737 66	467 49	950 00	214 11	120 00	2,261 25	9,000 00	2,000 00
Penobscot, North	56 89	3 00	-	-	52 77	111 66	5 00	-	10 00	10 00	148 20	-	36 58
Penobscot, E. Eddington Farmers' Club	34 00	-	-	-	134 39	168 39	-	-	75 16	-	209 66	3,000 00	-
Penobscot, Orrington	50 52	-	-	56 00	632 31	738 83	35 00	213 00	58 75	191 46	612 36	1,000 00	450 00
Piscataquis, East	-	12 00	-	-	41 30	53 30	-	-	4 00	18 00	45 25	-	-
Piscataquis, West	-	-	-	-	-	-	-	-	-	-	-	-	-
Sagadahoc County	595 44	541 00	2508 11	705 00	3,261 87	7,611 42	226 50	1,207 00	1,825 23	3,061 06	7,611 42	5,000 00	1,591 25
Sagadahoc, Richmond Farmers' and Mechanics' Club	-	1 50	-	-	117 75	119 25	-	-	24 62	15 00	120 66	50 00	15 00
Somerset County	-	-	-	81 00	415 15	496 15	-	180 00	40 10	25 00	416 00	800 00	160 00
Somerset, East	167 62	45 00	-	184 50	886 47	1,283 59	50 00	753 50	306 00	170 23	1,415 98	3,500 00	2,458 51
Somerset, Central	-	-	-	-	-	-	-	-	-	-	-	2,000 00	665 00
Somerset, New Portland	-	50 00	-	37 50	286 35	373 85	189 82	100 00	9 86	47 71	347 39	500 00	11 25
Waldo County	-	-	-	-	-	-	-	-	-	-	-	-	-
Waldo and Penobscot	250 00	20 00	22 15	275 00	3,458 52	4,025 67	364 70	1,010 00	575 58	347 91	3,207 19	4,000 00	-
Waldo, North	98 49	13 00	-	159 00	396 81	667 30	-	402 00	150 00	-	777 50	-	-
Waldo, West	-	-	-	-	-	-	-	-	-	-	-	-	-
Washington County	141 54	9 00	-	202 50	789 91	1,142 95	19 26	520 00	142 67	91 52	1,143 75	1,700 00	1,025 00
Washington, North	-	-	-	180 00	531 18	711 18	-	450 00	75 40	86 43	711 18	3,000 00	1,800 00
Washington, West	353 18	6 00	-	165 00	2,296 40	2,820 58	-	540 00	912 00	187 00	2,541 25	1,822 00	650 31
Washington, Central	148 70	4 00	-	215 40	882 80	1,250 90	-	517 50	289 89	-	1,206 59	-	-
York County	-	-	3000 00	290 30	5,564 11	8,854 41	2,000 00	1,565 00	2,371 97	1,948 67	10,135 64	12,000 00	10,000 00
York, Buxton and Hollis	80 72	-	-	54 50	219 74	354 96	-	183 00	-	-	203 00	3,100 00	1,510 30
York, Ramshackle Park	86 86	-	50 70	158 00	426 30	721 86	75 00	390 00	170 00	86 86	850 86	4,500 00	316 14
York, Shapleigh and Acton	147 82	204 00	60 00	-	19 70	431 52	-	-	22 25	-	426 25	2,000 00	-
York, Ossipee Valley Union	200 00	-	-	605 00	1,770 99	2,575 99	-	1,225 00	509 70	427 00	2,654 71	6,500 00	2,016 28
York, Springvale Agricultural and Mechanical	81 27	-	-	150 00	929 14	1,160 41	190 57	482 50	150 00	-	1,069 37	5,000 00	67 62
York, North Berwick Agricultural As.	93 31	-	-	407 50	1,989 15	2,489 96	459 87	717 50	1,111 43	245 97	2,800 32	8,000 00	5,864 96

REPORT OF PROCEEDINGS

OF

STATE DAIRY MEETING,

Held at Bangor, December 2d and 3d, 1897.

Thursday, A. M. Meeting called to order by President J. W. Dudley.

ADDRESS OF WELCOME.

By CHARLES S. PEARL, President of the Bangor Board of Trade.

Mr. President, Ladies and Gentlemen: In the absence of our mayor from the city it becomes my pleasant privilege to very cordially welcome to our midst the Maine Board of Agriculture. And I would not do it in any formal manner, but rather that my words might carry with them a cordiality that has a meaning. I welcome you to the Queen City because you gather here from the hills and the valleys of every part of the good Pine Tree State so dear to every one of us citizens, and because you, with us, are deeply interested in whatever pertains to its highest and best welfare.

You are welcome, I assure you, because you are the representatives of that class of our fellow citizens who are identified with that pursuit that is the very life blood of our prosperity as a State. We welcome you because we appreciate what you are doing as an organization, and individually, for the development of our State in that line which shall bring to it the truest and most permanent prosperity. We also recognize our debt of obligation to the farming interest of our State for their firm allegiance to good government and a high standard of moral life.

For such reasons we extend to you a most cordial welcome to our city and our homes, and to all that we have to offer as a city that shall tend to make your visit to us an enjoyable one. Furthermore, I desire in behalf of the Bangor Board of Trade to extend a cordial welcome to you, and to invite you to visit their rooms in City Hall building, where you will find the papers from the different parts of the State on file, and where we will endeavor to make you feel at home.

Again let me assure you of our cordial welcome, and the sincere desire that your meeting may prove both a pleasant and a profitable one.

RESPONSE.

By WILLIAM H. MOODY, Vice President of the Board.

Mr. President, Ladies and Gentlemen: I am very glad to meet you here, and it is a pleasure to me to express the thanks of the Board for the very cordial welcome we have received from the city of Bangor through its representative. In making a few minutes' speech it is a little hard to tell just what line to pursue. I have been thinking a little in connection with this subject, and have thought of some of the phases of agriculture which I learned through history. Two hundred years ago Dean Swift, who had the brightest intellect, in some respects, of any man raised in the British Isles, said that he who can make two ears of corn, or two blades of grass, grow where one grew before, has done more for the world and deserves better of the people than the whole race of politicians put together. That has passed into a proverb, but still he meant something when he said it, and it shows to me that at that time there was a struggle to raise sufficient of agricultural products for the people to eat. Prof. Gowell, whom I have heard talk a great many times and from whom, in fact, I have learned very much or nearly all that I know about this business of agriculture, says that when the cow first commenced to give milk she only started in to give milk to feed her offspring. All the developments have been by man for his use. The same is true in regard to agriculture. Two hundred years ago nothing was known about transporting food from one place to another. It is true that Jacob sent his sons down to Egypt, and Abraham went from Palestine to Egypt to get some corn, but a commerce in agricultural products was unknown. It was then an effort to get enough to eat, and the necessity for such products caused an increased exertion until 100 years later Franklin said that the boy with a broom in a printing office was of more account than all the ox drivers in creation. The products of agriculture had become plenty, and the fellows that could make books were scarce. The development has been very great since that time, and nations have found that in order to even up the food products and provide all countries with something to eat, which is, of course, a requisite, they must stimulate agriculture in every possible way; and European countries began long before we did, to do this. In 1852 the Board of Agriculture was formed in the State of Maine, Dr. Holmes having largely to do with its formation. It provided that we should hold one meeting in each county every year, and you would be surprised to know the principal obstacle that they met when they started out. The difficulty was to get somebody to come to the meetings. An institute was held in every county, but nobody came. Fifteen years ago I was at an institute in Monroe, the best farming town in Waldo county, and there were only thirteen present in the forenoon. It was a well advertised institute, with speakers from Rhode Island and two or three men from our own State, besides the secretary. The speakers were abundantly able to tell the people something that they ought to know, but there were only thirteen in the forenoon and perhaps about forty in the afternoon. But the people have been learning, and the efforts of the Board of Agriculture have had a good effect. We have no trouble now in getting a large audience. We intend to hold three meetings in each county each year, and sometimes we hold more. We endeavor to advertise them well, and always have good audiences, which shows that the people want to learn something about these subjects, and that is a very favorable symptom, because when a man wants to learn something, in these days, there is some way for him to learn it. There is somebody who knows, there is literature in abundance, and, in fact, we have a college where we can instruct the boys in agricultural science.

Now this is the tenth dairy meeting which we have held. They are held in different parts of the State, in the interest of the dairymen, and, I judge by the exhibit, in the interest of the parties that sell the dairy implements as well, and we invite everybody to come in. We have the best speakers the country affords, practical speakers. We used to get some man who could talk pretty well, but really did not know much about the subject, and that was the complaint. "Oh, you have a college fellow there, he does not know anything about farming; wonder if he ever milked a cow?" But now we have practical men, and men who are also thoroughly educated; men who can tell you what they know, what they have found to be a fact, what they have proved, and this is worth something to you. We are glad to see you here to-day, and glad to see the interest you manifest. We hope to have a very large meeting, because I am satified that the subject is of the very greatest importance to the State of Maine. There is nothing but dairying and fruit raising that will pay in this State to-day, at present prices. Dairying is the stronghold of the people. If we produce something that people want to eat, and it is of good quality, there is a market for it. We are close to Europe, in fact, we are close to all the world, and if the product will not sell at home it will sell somewhere, and it brings back to us the money and it does not exhaust the soil.

Again I express the thanks of the Board for our kindly welcome, and hope that the city of Bangor will prosper.

OUR DAIRY WORK FOR 1897.

By Prof. G. M. Gowell.

Mr. President, Ladies and Gentlemen: Since these dairy meetings were established, or at least for a number of years, it has been customary for us to compare notes each year, and see how we are getting on. This is very proper, too, because unless we are making some advance it is hardly worth our while to pursue this line of work, and if we are falling behind it is very important that we know it. I endeavored to prepare something in the way of statistics, so as to show what we have been doing the past year. The only way to do this seemed to be to reach out to the creameries and those organizations that were doing work in this line. I had secured a list of the creameries that were organized in the State and had been doing business in past years, and I had learned that there were about sixty-three of them. To these I addressed letters containing a few questions relating to the work of this past year, and I received twenty-seven replies. These replies gave me the amount of money that they had paid out, the number of cows that had contributed milk or cream to the various creameries, the number of patrons, and some other items. The returns were not all complete, but were nearly so. The money returns I think were figured down very closely, while the number of cows it was quite necessary to estimate in many cases; although some returned these, I should judge, from a canvass through their cream gatherers. From these returns we can, perhaps, compare our work of the past year with that of the year preceding. To these twenty-seven creameries 5,083 farmers contributed milk or cream, and they furnished the milk or cream from 34,384 cows. The amount paid by the creameries to the farmers for their milk or cream was $978,312. One year ago twenty-two creameries that reported gave $812,000 as the amount paid out, while this year those same twenty-two creameries report $830,000 paid to their patrons, showing that the business has increased some $18,000 in these twenty-two creameries alone. Not all of these creameries have been prosperous. Nine of them have paid less than they did a year

BUTTER EXHIBITED AT THE NORTH AROOSTOOK FAIR, PRESQUE ISLE, 1897, BY MRS. C. E. CREASY, MAPLETON.

ago, some of the nine considerably less; but eleven have paid more, and of these one has increased some $20,000, so that the total increase is $18,000. This feature of the work is encouraging, showing that the business has increased.

Another item of importance is the sale of sweet cream. Last year $250,000 worth of cream was shipped from the State, and this year the sales are reported as $350,000, showing that there has been an increase in the sales of sweet cream of $100,000. This, of course, is an encouraging feature, as it gives us a market that we otherwise would not have.

Only two cheese factories have reported, and these show that there are 100 patrons and 500 cows, and $11,000 are paid to the farmers. Last year we had more returns; I think five factories reported.

Now those twenty-two creameries gave us every return very closely, and, taking their figures, we find that they have had 4,138 patrons, with 25,041 cows, and they paid to the farmers, $731,312. This shows that each of those cows that contributed cream brought its owner $29.22. That is, for each one of those 25,000 cows that furnished cream to the creameries the farmers received a little less than $30. The average to each patron of the creameries was $177.

While these figures show that our business has increased during the past year, although the prices in many instances have been lower than the preceding year, yet there is something else in connection with it that is not so encouraging, and that is the fact that the farmers did not receive more than $30 as the gross income of each one of their cows. Some of the cows have done much better, and others, of course, not nearly as well. Eleven of these creameries have not paid to their patrons over $20 per cow, some as low as $11 per cow for the season's work. We have eight creameries that have paid their patrons from $20 to $30, four that have paid from $30 to $40, and three that have paid from $40 to $45 for the cream from each cow. These are the extremes,—$45 in one case, and in two cases the returns were as low as $11 per cow, the average for the 25,000 cows being a little less than $30.

Ques. Is it not possible that in the case of the $11 cow, or even others, you did not get the full report of what they had done for the year? Wasn't a part of the milk kept back from the creamery, and butter made outside? I would like to know if it is possible that we have any cows as mean as that.

Ans. It seems to be almost one of the impossibilities that a cow should not return more than $11. I can only say that this is the data that has been given me. I cannot comprehend how a creamery could do business and pay to its patrons only what would be an average of $11 per cow. Probably the milk was not furnished during the entire year.

And right here I may say that I hope to do a little differently next year, if I do this work. I think I shall ask the creamery men of the State early to furnish each one of their patrons a sheet, and ask him to give a list of the cows that furnish milk for January, February, March, April, May, etc., throughout the entire year, so that at the close of the year we may have the farmer's testimony as to the number of cows that furnished milk to the creamery for each month, and the number of cows he owned and did business with. In this way only, of course, can we get down to fine work. And yet the fact stares us in the face that even the largest returns are not very extravagant. The dairy business of the State, if it does not return over $30 per cow on the average, is not what it ought to be. There are some causes for this, and what are they? Is it because we are not getting enough for the product we are making, or is it because our cows are not giving us milk and cream enough, or where is the trouble? There is a trouble somewhere, and I presume it exists all the way along. In the first place, why are we not getting more for our product when we put it into the markets? I think I may safely say, because it is not good enough. This is not a very pleasant statement to make, but I believe it to be a fact. We are doing a great amount of business spread out over a large territory. Every creamery man is trying to increase his business, and get as much out of it as he can. That is right, but at the same time I believe that we are covering too much territory,—hauling the cream too far, and collecting that cream at too long intervals. The cream is not brought into the creamery soon enough so that the best quality of butter can be made from it. It is necessary for the creameries to have a certain amount of cream to do business with. If small quantities of cream are collected every day it entails considerable expense, and consequently creamery managers are collecting the cream as infrequently as they can and have it come to them in such a condition that they can possibly handle it. Every creamery butter-maker very well knows that in order to make butter of a high quality, it is necessary to get just as close down to the cow as possible. When a space of four or five days is left between the milking of the cow and the making of the cream into butter, you do not get the best quality of butter.

I have talked about this so much, and so many times, that I almost get ashamed of myself, and yet what is the good of these dairy conferences unless we do consider this question and try to better our condition? I believe in more frequent collections. Whenever I have presented this matter creamery men have said, "We cannot do it, we cannot bear the expense; it is not possible for us to do it and live. We must cut down the cost of collection just as much as possible." They also say that the product would not sell for enough more to cover the increased cost of the extra collections. I do not think that is correct.

I have also advocated the bringing of each individual's cream to the creamery in a can bearing the producer's name, so that the creamery manager, when the cream comes to him, can at once detect any cream that is not in perfect condition, and reject it. If it all comes in together you know that it is impossible to take out the defective cream. This is already being done by some creameries. Mr. Smith is doing it, and Mr. Nichols. Mr. Smith is doing a business of some $55,000 a year, and every man's cream comes to his creamery in a package of its own. His butter-maker is able to pick out the cream that is off in condition, and reject it. He is able to carry on his great cream trade in Massachusetts in this way. There is nothing to hinder every creamery man in the State from doing it, by simply equipping himself with a properly constructed wagon, and using individual cans. He will then have his cream under such complete control that the butter-maker will be able to make a higher quality of butter.

I do not know whether the difficulty lies in the fact that we are not getting enough per pound for our butter, or that our cows are not good enough. Sometimes I think we are overestimating the ability of the cows in our State to produce milk or butter. We are handling our pure blood and grade Holsteins, Jerseys, and Guernseys, and getting large quantities of milk or cream, and perhaps we are expecting too much of the average cows. I had this matter brought home to me very forcibly a short time ago. We got short of milk at the College, and I went out and bought four cows. I thought they were good milk producers, they had the dairy form, large udders and large milk veins. They were rugged cows, and had every indication of being strong milkers. I brought them home and put them into our herd, and we fed them more generously than we were feeding our well bred Jerseys and Holsteins, and yet we are not getting the milk from them that I expected. We have increased the grain ration, but I do not know whether their digestive organs are defective, or their assimilative organs such that they have wasted the food,—at any rate they have not put it on to their backs or into the milk pail. I wonder whether we have not too many of that kind of cows that we are trying to do our dairy business with. Dairying enables the farmer to change his hay and grain into money, at home. If it were possible for a man to go out and buy hundreds of tons of hay and grain, and keep a large stock, and pay his help and still have a good business left, with satisfactory returns, the work would soon be overdone. But it is carried on by the farmers individually. They are selling their products to their cows at home, and this is about what there is to dairying. It is a form of cattle feeding that we are employing to get the most out of the crops that we have raised.

There is something else in connection with this matter. There are thirteen creameries in the State that I believe are doing business, that for some reason have not sent in any returns. Probably some of them are doing very little business, but I think they are doing something, and I have an idea of about what the business of many of them is. I have used the same basis in making an estimate that I have employed before, and I believe they have a patronage of five or six thousand cows. These are all small creameries, the large ones have reported. This would give us 39,000 cows contributing their milk or cream to the associated dairies. You know that a year ago we had in the State 142,000 cows. Last spring the assessors returned 137,000. Taking out the 39,000 that are contributing their product to the associated dairies or creameries, we have left 98,000 cows, the milk or cream from which we may safely infer is being worked up by the farmers at home. These cows are contributing their substance to private dairying, and right here is where we are doing our fine work. We have, all over the State, herds of well bred cows in the hands of expert farmers who are caring for those cows in the best manner, and working up the milk and cream into the finest quality of butter, and selling that butter to private customers, either in our cities and villages, or in those outside of the State. We have a good many men who are doing this work, and who are doing better work than the creameries are. Brother creamery men, I do not want you to feel hurt by these statements. The conditions are such that you cannot help yourselves. Here is a good farmer with a good herd of cows, which he is giving good feed and care. He has put himself into training so that he is familiar with the best methods of caring for the animals and manufacturing the product. Having everything under control, he is making a high quality of butter. If he pooled his milk with his neighbors, even though when it left his hands it was in the best condition, it would be depressed by beeing pooled with poorer articles. The creamery man can never reach so high a plane as the private dairyman can.

Ques. Is it possible for cows giving milk testing two and one-half or three per cent to make as high a grade of butter as those that give milk testing five per cent or more?

Ans. I cannot answer you, because there is such a difference in individual cows. Some cows that give a milk that has a low per cent of fat are excellent butter-makers, and others are not. I do not know of a rule that will apply.

In regard to the remedies for the low grade of our product, that must come in here,—I have said that we are covering a great amount of territory where the cow population is sparse, and the creamery men, in order to maintain their business and hold it at its best, are willing to take the cream from every farmer who will offer to sell it. That is wrong. I know that wherever the business is conducted every farmer is urged to furnish cream, and there are comparatively few instances where the creamery men reject the cream from farms because the surroundings of those farms and the condition in which the cows are kept are not satisfactory, although they will reject it when it comes in a sour condition. Now while we have the highest class of farmers, and the highest class of people, in the State of Maine, that there are in any State, yet we have among us a lot of slovens. I do not know to what class they belong, but we find them, and I know of but very few instances in which those men have been excluded from contributing cream to the creameries, when they had any considerable amount. I believe that is wrong, and we ought not to continue it.

Now, as to the quality of work that is being done by our private dairymen, for which we get no credit. We know that we have many towns where the leading business is manufacturing butter at private dairies and furnishing it to consumers direct. I was called last fall to judge the butter at a little country fair. I think there were but fifteen samples presented. It was in one of those sections where the cream route was not patronized, and those parties were selling to private customers altogether. With the exception of excessive or indifferent salting, from the use of a coarse salt, those fifteen packages of butter, or at least thirteen of them, were of a very high standard. I was surprised that in a small neighborhood so much of the butter should be of such a high quality. I believe our method of improvement is to be in weeding out the indifferent patrons and holding ourselves to a better quality of work.

Ques. Did I understand you to say that the average quality of dairy butter is higher than the average quality of creamery butter in the State of Maine? Do the 30,000 cows contributing cream and milk to the creameries average lower than the approximate 100,000 cows from which dairy butter is made?

Ans. No, I did not intend to say that. We do not know what the quality of the butter is that a good many of those 98,000 cows furnish. Of course very much of the butter made by the people at large is of an inferior quality. It is consumed at home or in the country villages, but little of it finding its way into the large markets. But I say that it is possible for those who are doing a good business to make a better quality of butter than the creameries do, and they are doing it. I have no means of getting at the quality of the butter made by very many of our farmers. Where it is made under indifferent conditions, without care or thought, of course the product is very low indeed, and then in many of the private families there is a lack of skill in manufacturing, which the creamery always has. This poor milk, when it comes to the creamery, is capable of being made into better butter than if it were made up by unskilled hands at home. In this way the poor workers would be advanced, but the good workers would be held back.

Do not understand me as arguing against associated dairying. No man believes in it more firmly than I. But I believe we are not doing the work we are capable of, and I believe it is well for us to recognize it, and put ourselves to the improvement that we must make.

THE DAIRY OUTLOOK FOR 1898.

By Secretary B. W. McKeen.

Mr. President, Ladies and Gentlemen: I hardly know what I may be able to say at this late hour of the morning that shall be of interest to you as dairymen. I have followed Prof. Gowell's remarks somewhat closely, in relation to the dairy work for 1897, and I believe we can all agree upon the main points as he has presented them. In looking at our work for 1898, I am pleased to say that I note signs of encouragement for the Maine dairyman. I believe that the farmer in this State of Maine, who goes intelligently and thoughtfully into the business of dairying, extending his work as far as he possibly can along the lines with which he is acquainted and upon which he is equipped for business, may expect good results. We are aware, of course, of the prevailing low prices, but as we look carefully into the prices for all other kinds of goods, not only the goods from the farms but the goods from our manufactories and from our other business establishments, we shall find that the same low prices prevail. So that I think we must accept the conditions as we find them, and prepare ourselves to work in accordance with those conditions. I am not so sure but that it is one of the encouraging signs of the times that prices have reached a lower level, that they are now in a condition so that we may reasonably expect them to continue as high as they are at present. I think that is really a benefit to our business as dairymen.

There are certain conditions governing the dairy business which I believe present themselves to us as dairymen to-day with greater force than ever before. There is no doubt at all in my mind as to the truth of the saying that it shall be the "survival of the fittest" among Maine dairymen as well as among men engaged in other professions or business. He who, from his farm or from his creamery, can put into the market goods of the best quality at the least cost, is going to succeed. There is no room to-day, friends, for slipshod methods in dairying, in any part of the distance all the way along the line, from the feed and care of the cow up to the time when the goods are placed in the market. The exigencies of the case require intelligent, thoughtful work.

I have noted a little tendency on the part of some of our agricultural writers, as well as some of the speakers to whom we have listened recently, to advocate a slightly different class of animals for dairying than we have formerly had. I think that this is an error. I believe that there never has been a time within my knowledge of public agriculture, when a specifically bred dairy cow was more essential to success in our dairies than at the present time, because of the fact that it becomes necessary for us to have an animal that is capable of producing the article we wish to put upon the market as cheaply as possible. It cannot be done with any other animal. We want an animal of a distinctively dairy type, that carries with her the butter-making functions. I think that those of us who engage in dairying in 1898 will do it with a distinctively bred dairy animal, taking what we get from beef, etc., as a by-product and not as a direct revenue. I believe we should study more carefully than ever before this dairy type, and provide ourselves with those animals as never before.

Then the next thing to be considered in the outlook for 1898 is how we shall feed those animals. I believe, friends, that the

Maine dairyman must produce his butter cheaper in 1898 than he has done in 1897. I mean by this that his food must cost him less, and it should cost him less, in my opinion, by producing more of it upon his own farm. I believe that if the Board of Agriculture in our meeting here to-day could impress upon the minds of those dairymen that are assembled here the possible capacity of their farms for the production of cattle foods, and if that were the only idea that remained impressed upon their minds as they went home, it would be time well expended. None of us fully realize the capacity of our farms for the production of stock fodders. There are no farms in Maine to-day, I believe, carried on in such a way that their owners are reaping all of the benefits along these lines that they ought to reap. We are too apt to think that we cannot go beyond a certain limit upon our farms. I have noted a tendency recently, in the minds of many people, to think that because they are located in the State of Maine the climate and soil are naturally and necessarily against them, but I maintain from experience, from observation, and from reading, that our climate is not against us, that our soil is not against us, but that they are in our favor. I believe that we have in many sections of our State, where our farms are most productive, a soil that would compare very favorably indeed with much of the soil in the noted dairy sections in this country outside of our own State. There is no good fodder plant to-day that is produced anywhere in our country that cannot be produced in the State of Maine. In fact, some of our best fodder plants are produced in their perfection in this State and in adjoining states, and as they are nowhere else. As we go west, and as we go south, we find the grasses deteriorating. The quantity per acre is less than it is here, and the quality of the grass is not equal to that grown in our climate and upon our soils. The testimony of cattle feeders all over the country is that there is no food, as a coarse food, which exceeds red clover for dairy purposes, and in no place with which I am acquainted, or of which I have learned by reading or observation, will that plant thrive as it does in our immediate vicinity. So I think we have only to take hold of this mattter thoughtfully and industriously, and work it out along the line of self-production, in order to place the production of our goods at the lowest possible point so that they may be put upon the market at a profit all the time.

There is another thought in connection with this production of foods that I would like to mention to you, and that is the ease with which stock fodder can be raised in the corn plant. We are all familiar, of course, with the plant. We know the character of the soil on which it thrives, and the most of us know the best way of raising it, but a great many farmers are as yet unacquainted with the silo, and the food that is taken from the silo, and I have no doubt but that there are prejudices in the minds of many of you in relation to it. I have caused a sample of ensilage from the silo of Mr. George Flint of North Anson to be sent here, and it is now on exhibition. I would call your attention to it, and ask you if you see anything in it that is objectionable as a stock fodder. You will note its color, its form, that it is entirely free from mold, that there is nothing that indicates decay in any description or form; and when I say to you that the land on which this sample of ensilage was grown produced fifteen tons of this same kind of fodder per acre, you will see the enormous amount of stock fodder that that man is growing upon a limited area. I believe we should have our attention called more and more to the capacity of our farms along this line.

Prof. Gowell has touched at some length upon the necessity of maintaining the quality of our goods, and has pointed out, I believe truthfully, many of the places where we fail in quality. In the first place, we must strive for a denser cow population in sections where creameries are doing business. I believe that it is impossible for us to maintain that quality of goods in our creamery work that it is necessary for us to have in order to compete successfully for our best markets unless the cow population is dense enough so that the cream or milk can be collected and handled while in its best possible condition. I was in a creamery in the southern part of the State a short time ago, and opened a ten gallon can of cream which had come in. As I pulled out the stopper of the can the sour smell from that cream arose at once to my nostrils, showing that the cream was past the proper condition for churning long before it was received at the creamery. It is impossible for the best quality of goods to be made from such cream. When it comes to the creamery in that way, and is mingled, as it is necessarily, with all of the other cream, the quality of the whole is lowered to the standard of that one can. Until we can overcome these difficulties, we must be content with lower prices for our goods in the markets, and these difficulties are to be overcome largely by attending to the business more than we are now attending to it, and by extending our work,—putting in more cows so that our cow population shall be dense enough to enable the creamery man to collect his cream and get it to the factory in the best possible condition.

I would like to call your attention to another thing which I think is of supreme importance to us as dairymen. It is a matter which was called to my attention about a week ago more particularly than ever before, by one of the market men in Boston, while I was taking a short trip through Faneuil Hall market. It is the condition of our salt, the places where our butter salt is stored, and the manner in which it is handled from the time it goes into the hands of the retailer until it reaches the butter. The fact was called to my attention that there is nothing which we handle that will absorb bad odors, that will deteriorate from being placed in contact with bad smelling articles, any worse than salt. We have an illustration of it here to-day in two samples of butter from the same farm, salted with different classes of salt, the salt evidently having been kept under different conditions. The one scored high, and the other scored low. They were both made, as far as the mechanical work was concerned, in exactly the same way, and under the same supervision. I am informed by our butter expert, and by other butter men whom I have interviewed, that very much of the trouble which they get from flavors probably comes from the salt being kept in places where it takes into itself the odors of things that are allowed to remain near it. It certainly is very unfortunate indeed for any farmer who has complied with all of the necessary conditions for success, in regard to his cows, their feed, their care, their milking, the care and handling of the cream, and the manufacturing of the butter, to have the butter so severely injured by the salt being allowed to become impure. I am not speaking in regard to any particular brand, as one brand will probably absorb bad odors as much as another. I think that this is something that perhaps has not been called to our attention as much as it should be, and I believe that it ought to be called to our attention more than ever before for our work for 1898.

I will say in closing that I am very much encouraged for our Maine dairymen. I am aware that we have not reached that point of perfection, as indicated by the scores that we have been able to get at our dairy meetings, which we ought to expect and which we hope to reach. I believe that we have received as fair treatment as we possibly could receive, at the hands of our experts, and I think that there are conditions which we must overcome before we shall receive the score which we are seeking for. Of course I am aware that there is something which goes along with reputation, and when a state, as New Hampshire did at the World's Fair, succeeds in getting the first prize for her goods, that carries with it a reputation which helps in the market and may possibly help in the scoring as well. Still, we must put up with these conditions.

From the fact that the market has turned somewhat away from dairying and toward the production of other articles upon our farms, I take courage for dairying, because I am aware that the depression in prices, as far as it has been caused by the overproduction of goods, has come about very much from the fact that a large number of people have engaged in dairying because they have been obliged to do it, and not from choice. They have become dairymen perforce, because it was the only branch that appeared at that particular time to offer any inducements for profit, but as the market tips, as it has for the past six or eight months, towards stock production, in other lines, sheep raising and poultry growing, we shall find those farmers going back to their first love and leaving the dairy fields open for the natural dairymen. I believe that this is an important matter for us to consider, and we should not let the fact that the markets are tipping a little in the other direction interfere at all with our selection of the animals, their care or their feed. I hope that as we look into this matter of dairying in Maine, and consider the results that we are able to obtain in our meeting here to-day, we shall go out and go into the work with a great deal more courage than we did a year ago to-day; and when we assemble at the close of 1898 we shall feel that we have been able to do better work for our farmers and for ourselves than we have in any previous year.

Ques. Do you think that there is a prospect that prices for dairy products in 1898 will be lower?

Ans. I think that prices will be fully maintained. I have no reason to doubt it. In fact I have received encouragement from quite a number that in their judgment the prices would be more than maintained.

MAJOR HENRY E. ALVORD.

Pardon me for forcing myself upon this morning meeting when I have a definite assignment for the afternoon, but I am not intending to say anything about creameries this afternoon, and, as I feel somewhat responsible for the organization of some of the first co-operative creameries in the State of Maine, I would like to say a few words in regard to creamery management now, the subject having been introduced by both of the speakers of the morning. It is evident to me, in studying the whole field of dairying, and especially of butter-making, that the reduced selling price forces upon us, as it does upon producers and manufacturers in all other lines of business, the necessity of studying closely the cost of production and of manufacture. As to the cost of producing milk, I have no doubt, from what has been already said, that it is possible for the cow owners of the State of Maine to produce milk a good deal cheaper than they do now, but I do not propose to discuss that question this morning. That may be safely left to the State Board of Agriculture, with its capable Secretary, Prof. Gowell, the Experiment Station, and the Agricultural College.

I want to speak more particularly about creamery management,—the cost of manufacture. The process between the cow, or the milk produced by the cow, and the delivery of the product to the consumer, is another part of the business where we must study the problem of reducing cost. How shall this be done? Probably all will agree with me that the heaviest item in making butter by the co-operative plan is in the transportation of the cream, and generally the heaviest item in farm dairying is in the delivery of the goods to the consumer. Fifteen or sixteen years ago I came into this State, at the invitation of your Board, and advocated co-operative butter-making, advocated the establishment of creameries as a matter of economy, believing then, as I do now, that this is the cheapest way for any dozen, twenty-five or one hundred farmers collectively to make and market their butter, and believing that it can be done thus cheaper than the farmers severally can do it on their respective farms. Now, just as I advocated fifteen years ago the co-operation of dairy farmers in the creamery as a matter of economy, I am prepared to advocate to-day the co-operation of creameries themselves as a matter of economy. If, as I believe has been proved in this and other states, it is cheaper and better for twenty-five farmers to make their butter under one roof, with one churn, and to be sold in one lot, I also believe that it is better for ten creameries to make their butter under one roof, in one establishment, and sold in one lot. I am, to-day, for the co-operation and combination of creameries, instead of farmers, in the interest of economy of manufacture. And I am satisfied, from examples which I might quote if I had time to cite them, that there is positive economy, as in all other lines of manufacture, by increasing the quantity of product in any given place. The more butter you can make in one place, under one supervision, in the hands of one man, and with one set of machinery, the cheaper you can make and sell it. It is the same with butter as with cotton cloth or wooden ware, or any other line of manufacture. We may have as many fears as we please about combinations, suggestions of trusts, etc., I tell you that in this age of necessary concentration and combination it is a great deal better for us to take advantage and go and do likewise than it is to spend our time growling at other people for doing their business in the best way for them. Let us advance, therefore, in the system of creamery management and conduct. Let us abolish about nine creameries out of every ten we now have; convert them into separating stations, if you will, into substations where the milk of the immediate vicinity shall be brought for separation, or, if necessary, actually do away with them. Let us do business on a larger scale, and then what will be some of the problems presented? Prof. Gowell has spoken of the difficulty of bringing the cream to the creamery, the danger of its being injured in quality before it arrives there, but there are ways of overcoming this. My ideal creamery of the present and of the future (and it is not necessarily ideal because such creameries are now in existence), is a manufacturing establishment just like a cotton mill or a woolen mill, which deals only with the matter of manufacture and sale, and which buys its raw product, which in our case would be cream, wherever and whenever it can, if it gets an article that suits it as raw material to manufacture, at the right prices. Preferably in connection with dairying and butter-making I would have this creamery owned by the owners of the cows, as is generally the rule in the case of co-operative creameries. Then whatever profit there may be at the place of manufacture will also revert to the owners of the cows. Such a creamery being established, dealing only with the question of manufacture and sale, the larger the business it does the cheaper it can do it, and hence the more margin left for return to the raw product. Then let the producer of cream get it to the creamery when he pleases and as he pleases. It is entirely possible for him to send the cream 100 or 200 miles. You can bring cream from St. Albans, Vermont, and manufacture it into good butter here in Bangor if you take the right measures to do it, at all times of the year. But I need not talk about cream transportation here, you know more about it than I do. It is easier to transport cream long distances in good condition than it is to transport milk, and we all know that milk goes to Boston and New York, anywhere within a radius of 200 miles, in a perfectly sweet condition at all seasons of the year.

Let the producers of cream get their cream to the central manufactory in any way and at any time they please, always understanding that it is to be paid for according to its quality at the time of arrival. Then it is the interest of the producer of that cream to get his raw material to market in good condition, just as it is your part to get your grain or your wool to its buyers in a satisfactory condition, although those are not very good illustrations. What would the manufacturer do with the cream bought in this way? Would it all go into the same tank? Would the tainted cream or the deteriorated cream be allowed to injure the whole mass? By no means. The creamery, as a buyer of raw product, would grade the article purchased, and would purchase different grades of cream, according to its quality on arrival. The cream on arrival would be inspected, and would be paid for first according to its content of butter fat, determined by the test, and beyond that paid for by the idea of quality at the time of arrival. This necessitates a competent expert cream inspector at the place of delivery, just as every manufacturing concern has its experts to examine and determine the quality of the raw material which they receive and pay for before they manufacture it. There are factories already in operation in several parts of the country which do this, co-operative gathered cream factories, and it is a very wise thing to do. I would suggest this to the managers of co-operative creameries: do not recognize all cream as alike in butter-making qualities, but grade your cream, if you have but two classes. Let there be class A and class B, and let class A be paid for at a higher rate than class B. Let those farmers that produce A cream get payment for A cream, and those that produce B cream payment for B cream. I know of creameries that are now making three grades of the cream which they receive, and paying for it at three prices, generally making a difference of about one cent per pound of butter fat between the grades. If they are paying twenty cents for the highest grade of cream, they will pay nineteen cents for the next grade, and eighteen cents for the lowest grade. The result of the adoption of that plan is the same as has been the case with the adoption of our co-operative creamery system. When a man found that his milk tested three and one-half per cent and his neighbor's four per cent, he would endeavor to get his milk up to four per cent as soon as possible. And where this plan of grading cream has been adopted, for the first week about half of the cream would be of the first quality and half of the second quality, but before the first month expired pretty much all of the cream would get up into class A.

The difference in price would lead the producer to take better care of his cream, and I am satisfied that for nearly all the year farmers can produce cream and keep it and deliver it at the factory, anywhere within fifty miles, sending it only twice a week, and have it go into class A. It only needs the same care that is exercised by some of your creameries that ship cream out of the State, to make it possible to do this. This plan gives to the creamery the greatest efficiency possible. It gives to the farmer who produces the best cream and knows best how to take care of it, the advantage of so doing. It may pay one man better to send his cream only two or three times a week, even if he receives a cent per pound less than some other contributor who sends it every day. It would be a business question which everybody can settle for himself. But we must get this matter of manufacture concentrated, so that it shall be done in larger quantities at reduced rates; and we must in some way get the matter of transportation reduced to a better system than we have at present.

Incidentally, in connection with separation, I fully believe that the mechanical separator system must come. Whether it shall be a separator on every farm, or on every three or four neighboring farms, or one separator for a considerable territory, is a question which must also be settled by the people for themselves, according to local and business conditions.

These are some of the questions which it seems to me our creamery patrons and our creamery managers must be studying in order that '98 shall be as much or more satisfactory than '97 or '96.

THURSDAY AFTERNOON.

STATE AID FOR THE DAIRY INDUSTRY.

By MAJOR HENRY E. ALVORD, Chief of the Dairy Division, United States Department of Agriculture.

Mr. President, Ladies and Gentlemen: It is my belief that it will be a long time, if the time ever comes, before the dairymen of Maine will do much towards seeking a foreign market for their butter, cheese or cream. With the excellent local markets which you have in your own State and near-by states, which markets are growing probably as fast as your production, the need of finding more distant, and especially foreign markets for your products is and will be largely removed. But it must be remembered that other people are producing, in other states, and if the surplus grows in those states, their products will invade your ground and an effort will be made to undersell you. Consequently you are interested, with all the rest, in getting a good market for the surplus products of this country, if any exist. The question of the surplus of butter, if we have one, affects every man who owns a cow in this country. So, what I have to say does after all relate to you, as well as to other parts of the country, although perhaps indirectly.

All regular trade depends upon success in maintaining a satisfactory and uniform quality in the product concerned. This is especially true as regards the products of the dairy. If we want to retain a good customer, we know very well that we must attain a standard in milk, butter or cheese, which satisfies him, and then hold to that standard, furnishing products varying very little in quality. And it is often necessary to keep up a uniform quantity of supply, also.

These requirements, which are familiar enough in the small dealings from the farm, where producers and consumers are in direct communication, are equally applicable to larger business operations. They were largely the cause of the successful substitution of co-operative dairying, or the creamery and factory system, for much of the private dairying of fifteen or twenty years ago. Examples might easily be given in connection with concerns doing a large city milk business, syndicates or combinations of cheese factories, and the development of extensive creamery plants.

The same principle holds true, and must be kept constantly in view, in any attempt to build up an export trade and find foreign markets for butter and cheese made in the United States. Opinions differ as to the extent of the American surplus of butter, if any exists. There has appeared to be a surplus of butter for the last two years, and at times a surplus of our higher products of butter for the first time. As we look the matter over we find that as a whole the creamery system is extending and the product of butter from creameries increasing faster than consumption is increasing in this country. So that, whether it be a fact or not that we have a surplus now every year, of more or less extent, there seems to be no question but that the time is near at hand when a surplus of butter will be produced in this country; and even if not a surplus of the best butter, any surplus affects the whole market. A surplus at the top, particularly, affects all grades; and the finding of markets in other lands for considerable quantities of butter and cheese from the United States is something which we need already to be looking after carefully, because of the prospective surplus, especially of butter.

The Department of Agriculture at Washington has been making some trial exports during the last year, endeavoring to find suitable foreign markets for American butter of high grade. In looking for a market we find at once that Great Britain is at present the great butter-buying country of the world, spending nearly eighty million dollars annually for butter made by people in other lands. By examining the British markets we find that large supplies of butter, with which our American article must compete if it goes there, come from Denmark and Sweden, from far distant Australia, from Canada, and even from the Argentine Republic. A noticeable feature in the butter reaching England from any one of these countries, (excepting perhaps Argentina, which is too new to dwell upon at any length,) is the general uniformity of quality in the article. Investigation shows that this is largely the result of direct efforts made through governmental agencies to promote the dairy industry. It appears, therefore, to be well worth our attention to consider some of the methods pursued in these producing countries to increase the quantity of butter made and to improve its quality.

Danish butter has a firm position at the top of the markets for salted butter in Great Britain. Two-fifths of all the imports by Great Britain, in value, are from Denmark. That is, the English pay to that little country, Denmark, about thirty million dollars a year for butter alone. Denmark will be the strongest competitor of creamery butter from the United States, while this country is striving to get a foothold in the same markets. Yet this position of Danish butter is comparatively new, and it is interesting, therefore, to note some of the agencies employed to obtain it.

Thirty years ago the average annual net export of butter from Denmark was 88,000 cwts.—or 4,400 tons. The net quantity now exported yearly is ten times as great; in 1896, it was 887,000 cwts.—or 44,350 tons. I say net exports because Denmark imports butter largely, curious as it may seem, partly for consumption and partly to export again. The Danes seem to be a thrifty people who are quite willing to sell their butter to England at twenty-five cents a pound and buy butter from other countries to use themselves at twenty cents a pound. And then, again, it is true that the Danes bring into their country large quantities of Swedish butter every year, practically as good as their own, and re-export it as Danish butter, thus increasing their trade. The total exports of butter from Denmark to Great Britain in recent years have been as follows, and that shows that the trade is still growing. The records are usually kept in hundredweights.

In 1894 the total exports of Denmark were 1,145,000 cwts., and of this, 1,114,000 cwts. went to Great Britain. In 1895 the total exports were 1,157,000 cwts., and of this 1,132,000 went to Great Britain. In 1896 the total exports were 1,223,-000 cwts., and of this 1,189,000 cwts. went to Great Britain. So you see that the increase has been at the rate of from fifty to one hundred hundredweights per year, and that ninety-five per cent, and sometimes ninety-six per cent, of the whole quantity exported from Denmark goes to great Britain. Let us consider the way in which the Danes have built up this foreign trade. The rapid progress in Danish dairying dates from 1860. In that year the Royal Agricultural Society of Denmark, not the Government but a voluntary, self-constituted society, patronized and recognized by the government, first employed a scientific man to apply himself exclusively to the improvement of dairying in that country,—Prof. Segelcke. This society had before this done much for dairying in Denmark in a smaller way. Even as early as 1837 this society began the education of farmers' daughters in better methods of dairying; but not until 1860 were the revelations of modern science applied to, to assist in the work. Segelcke's special work at first was to teach the Danish dairymen to depend upon a knowledge of facts in place of guess-work, and to rely upon accuracy in detail. He introduced scales and thermometers, and also started butter shows and competitions as educational agencies. Young men were taught the principles underlying dairying; they were made experts, and then were employed by local societies. In 1874 Segelcke was appointed professor of Dairying in the Royal Agricultural College of Denmark; the first appointment of any person to a single line of agricultural work under the title of dairying, I believe, in the history of colleges of this kind. At the same time, 1874, Prof. Fjord was selected to assist in the work, and he gave the most of his attention to the mechanical part of dairying. In 1876 the government granted a money subsidy to Fjord's experiments in connection with ice houses and the use of ice in dairying. In 1878 cream separators were first brought into Denmark. The government experimented with them and from that time the dairy work became extended over a wide field, with liberal appropriations. In 1879, about twenty years after the first scientific work began, the first notable fruits appeared. At the London National Exposition of that year, the first prize for salt butter, open to the world, was won by Denmark. From that time to this Danish butter has stood at the head of the butter market of Great Britain; just as twenty-one years ago this fall it was announced, to the surprise of all our Eastern and Atlantic states, that Iowa, new to us then as a dairy district, had won the first honors in the butter contest at the Centennial Exposition at Philadelphia, and from that time to this Iowa creamery butter has stood at the head of the large dairy markets of this country.

Later, experiments were made in testing milk, with separators, and further in pasteurizing milk; and also experiments and investigations were undertaken in transportation. In 1889 government butter contests began in Denmark. The government put up a special building, costing sixty-five hundred dollars, and started periodical butter shows, or rather contests or competitions, which were held during several months of the year. These have been continued to the present time, the cost of maintaining them being six or seven thousand dollars a year. At the risk of using a little more time than may be expected, I think I will run over some of the principles in these contests, because they furnish, in my opinion, a good example to be followed in this country. In fact, they are beginning to be imitated in some states in the West now. In Minnesota, particularly at St. Paul, contests have been held during the past year, and others are to be held in the West during the coming year.

These butter shows in Denmark are held at the expense of the government during several months of the year, and a suitable building furnished, where an even temperature can be maintained winter and summer. The butter exhibited remains there fourteen days, the judges giving their decision first on the samples as received, and second, fourteen days later. The butter is nearly all put in casks something like elongated nail kegs, and these casks are submitted in no particular order but are so arranged that it is impossible for the judges to be guided by any outward sign. The dairymen, creameries or factories obligate themselves in advance to send to the place of exhibit when called upon samples of butter taken from their ordinary make. When they receive a communication, by letter or telegram, they at once, within a few hours, send in a ready made cask of butter, and repeat this as often as the superintendent of the contests calls upon them for one. They enter for the season, subject to call. This butter sent in for exhibition must not be reworked, it must go just as it was made, that day or the day before, for the market. The dairyman in this way is unable, as is usual in shows, to make a special piece of butter for exhibition. It is the dairy's or creamery's ordinary produce which thus has to be submitted. It is a governmental contest, an examination not of specially prepared show butter but of ordinary butter made for the markets. The director of these state shows in Denmark has the right of utilizing the state telegraphic service. He is in possession of the requisite information to know by what means of transport the butter leaves each factory. He wires for a cask of butter to be forwarded, and allows just time enough for the manufacturer to select a cask and get it placed on board the steamer. No time is allowed to tamper with the butter in any way. The object is to secure from each party competing a cask from his daily output which may be regarded as an average sample. Every precaution is taken to ensure this, and there are heavy penalties for any attempt to evade these provisions.

Wherever errors are discovered, arising from an inferior raw product, from careless handling of the milk or cream, from carelessness or ignorance on the part of the manufacturer of the butter, or from any other cause, the creamery man, factory manager, or person responsible for this, is informed what the trouble is, and, if necessary, a member of the government staff visits the creamery or factory to show the cause and to give proper instruction, to avoid a repetition of this error. At the inception of these shows, in 1888, 350 dairies and factories competed. At the present time six or seven hundred compete every year. These particulars indicate with what care the butter industry is fostered in Denmark.

In 1882 the first co-operative dairy or creamery was established in Denmark, and within ten years 1,000 of such co-operative establishments were built. In 1892 grants began for dairy instruction of a high grade. Then the government appointed four chief dairy experts, divided the country into four districts and assigned one of these experts to each district. This government expert travels through his district and criticises, advises, instructs and supervises the dairying. The government also employs advisory dairy mechanical engineers, so that any factory manager or dairyman having trouble with the machinery in connection with his work can have the services of an engineer by paying his expense of travel. The government employs a number of veterinary surgeons in the same way, subject to call on the part of the cattle owners, to attend to stock difficulties simply by having their expenses paid by the person who calls for them.

The government has done much in various ways to improve the dairy stock of the country, as, for example, by importations of new blood and by placing well-bred bulls in various sections where they are needed.

Further than this, the Danish government has built refrigerator cars and maintained them for the benefit of exporters, and has arranged for steamers with cold storage to leave the principal ports. Eight or ten new harbors have been developed, so that there should be convenient places for steamers, without concentrating the work wholly at Copenhagen, as was done for a great many years. And you know very well from the geographical position of Denmark that they have long and severe winters, and their harbors and water-ways are closed with ice for months at a time. This would interrupt their export trade, and the government has built great stone vessels, ice boats, to break out these harbors and clear the water-ways, so that steamers will ply regularly throughout the year, keeping up a regular export trade. Not that the government does this wholly, but it assists in all these lines of work, in order to ensure quick, certain, and regular lines of export for butter and other Danish farm products; for the Danes export largely of other products, particularly of bacon. And the consequent growth of the dairy exports is according to the figures which I have already given.

Then Denmark has excellent dairy laws, well enforced, as to oleo and dairy imitations, and as to the adulteration of butter in general, including the use of preservatives. It is hardly necessary to go into the details of this branch of the subject, as it is not quite pertinent to our general matter. I wish to call attention to this provision against the use of preservatives in butter-making. So far as I know, Denmark is the only country in the world that absolutely prohibits the use of preservatives. Some of the states of this Union do it, but none of the other countries. In examining, as the agents of the Department of Agriculture at Washington have done several times, all the different kinds of butter that could be found in the London market, they found that Danish butter, butter from the United States, and generally the butter from Canada, were the only butters to be found on sale from foreign countries that were not adulterated with preservatives, or assisted in their keeping qualities by chemical means, such as we would not tolerate at all in this country, although but very few places have any special laws upon the subject. I was quite struck with this fact in my examination of samples from the various countries, sent from London three or four times this last summer. Danish butter is never found with preservatives, nor is any of our butter so far, though I am afraid some of our people will begin that thing pretty soon if they are not watched. And Canada does not encourage the use of preservatives, although in some cases Canadian butter has been found with preservative ingredients.

Then the Danish government, as a further means of assistance, supports dairy or creamery agents in Great Britain to look after the interest of their exporters to that country. Consequently you see that the English, as buyers, have ample governmental guaranty of the purity, and virtually of the high quality, of the Danish butter. And, as you can very well understand, these facts alone place the butter from Denmark on a substantial footing in the markets of Great Britain.

I have already mentioned the fact that Swedish butter is about equal to that of the Danes. It is so regarded in England and it is so regarded by the Danes themselves, because they largely buy the Swedish butter and sell it again as their own. So that much butter really made in Sweden is sold in London as Danish butter. As to the direct export of butter from Sweden to England, there has been considerable growth of late years, as these figures will briefly show. In 1892 Sweden sent 336,000 hundredweights of butter abroad, and 229,000 hundredweights of this went to Great Britain, rather more than two-thirds. The remaining third largely went to Denmark and from there to Great Britain. In 1894 Sweden exported 438,000 hundredweights of butter, and of this 266,000 went to Great Britain; in 1896, the total exports were 487,000 hundredweights, and of this 324,000 went to Great Britain; showing an increase of fifty or sixty thousand hundredweights per year.

The Swedish government also maintains a butter agent at Manchester to look after the interest of the home producer and seller. Swedish cheese is largely consumed at home.

Butter shows and competitions are held in Sweden much as in Denmark. These are supported by the government, to stimulate to a better quality and to ensure greater uniformity. There are thirty-three government dairy schools in Sweden, and one of them is especially prosperous. There are also men who are called "Consulents," or dairy experts, one of whom is stationed by the government of Sweden in each county, as a public and free adviser of the dairymen and creamery men in that county. So that the country lends its advice and assistance to the dairymen of Sweden, almost, as you might say, at their very doors; just as in France the government supports an officer called a professor of agriculture, in every county, who is a sort of general agricultural counselor to the farmers in that county.

Next we turn to Australia. The dairy industry of Australia is of quite recent growth. The exports from that country include some cheese, but are mainly butter, and all the butter exported is creamery butter. The export trade from Australia does not continue through the year, both because winter dairying is not done and because of the irregularities in transportation incident to the long voyage, thousands of miles, as you know, from Australia to England. The steamers sail from Australia with regularity, apparently, but because of the incidents to long ocean travel they often arrive in England in pairs, or but a few days apart, thus upsetting the regularity of supplies. You understand how that will affect the market. If what is intended to be a whole month's supply is precipitated on to any market all at once, it depresses the commodity. The price is below what it would have been if the same product had been offered evenly throughout the time when it was wanted for consumption. This irregularity operates to hinder the growth of the Australian butter trade with Great Britain, to some extent. Nearly all the butter from Australia which now comes to Great Britain reaches that country between the first of November and the first of May, our winter, of course, being summer in Australia. Last summer when I was buying some butter in London, through an agent, for the department (I think it was about the middle of June), we failed to find Australian butter. They said it was too late for fresh butter from Australia. And when we were buying again on the 22nd of October last, we were told when we inquired of the Australian agents that we were just about ten days too soon. There would be some in the market about the first of November. This shows that during that whole period from the middle of May to the last of October, there was practically no Australian butter in the London market, or nothing but butter held in cold storage. That is the very season of the year when, at the present time, our surplus is the greatest, and consequently Australian butter is not likely to be in our way for some time, in sending butter to the English markets.

New South Wales, Victoria, South Australia and Queensland, as well as New Zealand, all have their peculiarities as well as their similarities, in dairying. In all these provinces butter for export is inspected and graded by government officials. Ordinarily three grades are made. That which passes the required standard, and is regarded as good butter, receives the government brand, a voucher to the fact that the government of Australia regards this article as a good article of butter. The next grade is one which, although it is not disputed that the butter is fair and pure, is not considered good enough to bear the government brand. That is allowed to pass out of the country as butter but without endorsement, to be sold on its merits. The government does not back it. The third grade is that which is not regarded by the inspectors in Australia as fit for table use. They do not want it to go abroad, so they put upon it the stamp of "pastry," indicating that it is an inferior article. Thus the three grades are branded, unbranded, and inferior, or pastry.

When the butter from any factory is found to be of low grade, of inferior quality, the factory is listed, and as soon as possible one of the dairy experts visits it, examines it carefully and ascertains the cause of the difficulty, and then gives instructions in order that these difficulties may be removed. This, as you will readily see, is a very cheap and very effective method, well worthy of imitation, because it puts all the labor and expense just where it will do the most good. It does not send the doctors from house to house inquiring after the health of the community, but their whole time is devoted to those who are sick. The result has been a very rapid improvement in the average quality of Australian dairy products. In 1894-5 out of all the butter offered for export from Australia seventy-nine per cent was branded, twenty per cent regarded as medium, not branded, and one per cent of the whole lot was branded pastry. In 1895-6 eighty-eight per cent was branded, less than tweive per cent not branded, and one-tenth of one per cent branded pastry. In 1896-7 eighty-nine per cent was branded as endorsed by the government, less than eleven per cent was regarded as medium, and barely a trace, just a few packages, were considered inferior and branded as pastry.

Pasteurizing experiments in the making of butter in Australia received a great deal of attention at the hands of butter experts, and the pasteurizing of cream is approved and recommended for the keeping quality and greater uniformity, during at least nine months of the year. For reasons of which I am not fully informed and which are somewhat surprising, the experimenters are doubtful as to the advisability of pasteurizing during the very hottest weather. That seems to be their experience. Preservatives are very freely used in the butter of Australia, mainly borax in its different forms. Our agents could not find any fresh Australian butter on the 22nd of October, and as we wanted to get a package we hunted for it in cold storage, and found a package of butter from New South Wales, made in January, 1897, received in London in April, 1897, and kept in cold storage ever since, six months or so. That was taken out and purchased by us, and shipped to this country, and was shown in the Chicago Board of Trade about three weeks ago, and to the Elgin Board two weeks ago last Monday. It was in remarkably good condition, perfectly sound, well made, well kept butter. But upon examination it was found, at ten months old, to be strongly borated, and that is what the Australians do right along. They must do it. The first thing their butter has to undergo is a two months' voyage at sea, to reach a satisfactory market. With these conditions prevailing I think it is plain enough that butter made in this country, which can be delivered in London market within ten or fifteen days from the churn, need not fear any particular competition with Australian butter. There will be no serious rivalry between butter from Australia and the United States, unless it results from these very careful measures taken by the government to advance the quality of Australian butter and secure its arrival in the British markets in its best state.

Now we turn to Canada, for we cannot allow that country to pass, it being of importance to us, and affording us many excellent examples of the way in which government may assist the dairy industry. Thus far the growth of cheese-making in Canada is more notable than that of butter-making. The cheese of Canada is also of a higher standard than its butter. As to the growth of cheese-making and the trade of Canada, and its effects upon trade in the United States, perhaps I can best give it in a few words by quoting from a publication of the department, which some of you may have seen. "The past fifteen years have brought great changes in the conditions and relations of cheese markets on the part of the United States and Canada, all detrimental to the cheese interests of the United States. The Canada market for consumption has been entirely lost to us, and exports to Great Britain have decreased to a little more than one-third of what our high water mark once was. English buyers residing in New York, as they did by the dozens some years ago, have almost disappeared. Accompanying this loss of trade has been a deterioration in quality. Meanwhile Canada appears to have gained all that the United States has lost. Her cheese exports, which amounted to nothing prior to 1865, have grown continually, until they greatly exceed those of this country, and Canadian cheese now sells at the higher price. One effect of this condition is to cause many tons of cheese every year to be shipped across our border and sold as Canadian cheese, bringing a higher price than if sent from our own make." I have a diagram which shows the steady decrease of the exports of American cheese during the last twenty years, and the corresponding increase in the exports of Canadian cheese, the increase in Canada exceeding the decrease from the United States. The growth of Canada's cheese trade is enormous. Since 1860 it has increased a thousand fold. Then Canada exported less than a one-hundredth part of the quantity sent to Great Britain by the United States, and now the export of cheese from Canada is nearly double in quantity and nearly ten per cent greater in value than that sent by the United States. This change began, evidently, as the result of the termination of the reciprocity treaty with Canada, about 1864 or 5. We had been selling cheese to Canada up to that time. They had not only made no cheese to export, but had not made enough for their own use, and we had been selling to Canada from half a million to two million pounds of cheese annually. But the moment the walls were built to stop that trade, Canada began making cheese for herself. The first year sixty factories were built. In 1871 there were 353 factories, making twenty-three million pounds of cheese; in 1881 there were 709 factories, making sixty-one million pounds of cheese; and in 1891 there were 1,565 factories, making 160 million pounds of cheese. And the quality of the product kept pace with the increase in quantity. Now the number of cheese factories and creameries in the different provinces of the Dominion exceed those in some of our leading dairy states. Quebec, which is not the foremost dairy province of Canada, had at the last report 335 creameries, 1,266 cheese factories, and 184 butter and cheese factories, a total of 1,785 dairy establishments, or more than the great dairy state of New York, and more than all New England! Butter and cheese are not made, however, at the same establishment at the same time, in Canada, because the rule is that cheese is made there in summer and butter in winter; and all the cheese made in Canada is full cream cheese. The Canadian law does not prohibit the manufacture of skim cheese, but it regulates it so thoroughly that there seems to be no disposition to make it. Public sentiment sustains the policy of making full cream cheese, and Canada has that reputation. There need be no fear of finding cheese skimmed to any extent which is made in Canada, much less filled cheese.

The Canadian dairy commissioner was first appointed in 1890, and we live near enough to the line to know something of the extraordinarily efficient work which has been done by Prof. Robertson and his able corps of assistants from that time to the present. He is now termed commissioner of agriculture for the Dominion, but his especial work has been from the first in the development of the dairy industry of Canada. He has been surprisingly successful. Provincial and local dairy associations have been assisted, and experiments have been made all along the line of dairying, and these have been bulletined and carried to the dairymen through institutes and other meetings. Dairies, factories, and creameries are visited, criticised, and instruction given in better methods. The work is practically supervised, all in the interest of uniformity in method, and resulting uniformity in quality of product. A general interest in the dairy industry has been aroused. Even the aid of the clergy has been invoked to assist in the work. Syndicates have been formed with large capital to manufacture on a large scale and to develop the industry, especially on the lines of determining the best methods of producing milk and the best methods of making its products. This work tends to the securing of uniformity and improvement in quality.

The cheese manufacture and export trade having been firmly established, Canada again turns to butter. And the important question arises,—Shall the United States allow itself to be beaten in the foreign market with Canada butter, as it unquestionably has been with Canada cheese? There is danger of this result unless we profit by our neighbor's example and show equal activity and progressiveness in our dairy work.

The Canadian officials, Dominion, Provincial and local, are giving wide spread instruction in the details of butter-making. Nothing is too minute to escape their attention. They investigate, teach and instruct as to the care of milk, the creaming and ripening, the churning and working, the color, salt, and methods of packing, forms and styles of tubs and boxes, paper wrappers and linings, storage, transportation and markets. There are experiments and bulletins, personal visits and lectures, institutes, and regularly organized well-conducted dairy schools. All this is done by the government for the dairymen; or rather, for the country, because the progress of the dairy industry is regarded as of material importance to the welfare of the country. As in Denmark, much attention is paid to the use of ice, refrigeration, cold storage, etc. The government of Canada has built and supplies at nominal cost local refrigerators for receiving stations for the goods of neighboring creameries and dairies, and temporary cold storage. A direct bonus has been offered to any creamery that would build its own cold storage house. Lines of refrigerator cars have been provided to carry the butter and cheese from the local government stations and from creameries direct to Montreal. Cold storage is provided by the government at Montreal; and then steamers have been assisted in providing a refrigerator department. The government during the last season has helped seventeen ocean steamers to fit up with cold storage. Weekly service has been maintained of refrigerator lines from Montreal to Liverpool. The machinery is duplex on these vessels, and the compartments are fully insulated so that loss and accident to butter in transit seems to be next to impossible. The government pays a large part of the first cost in fitting up steamers in order that it may control, to a certain extent, the space and the charges. The government makes contracts with steamship companies so that the charge for freight in cold storage from Montreal to England is not over ten shillings per ton more than first-class freight rate for goods outside the refrigerators. This makes it less than one-tenth of a cent per pound for these special accommodations. The result is that the whole charge for freight with the very best accommodations during the season of 1897 has been less than half a cent a pound. In New York and Boston it has been difficult to secure such facilities for butter export under any conditions, and when found they have cost nearly twice as much. Of course we understand that this government does not subsidize vessels in this way. I am pointing out how it is that the Canadians are gaining on us. Some United States butter during the last season was sent by way of Montreal because it was a cheaper and cooler route, but it found place solely by favor; the Canadians take care of Canadian butter first. This energetic and efficient work by the Canadian authorities all tends to improve the quality of Canadian butter. The effort is being made to have the butter produced at home as good as possible, and then to have it placed in foreign markets in as nearly perfect condition as possible.

And this work has borne fruit. In 1894 the exports of Canadian butter were two and one-half million pounds, worth rather less than four hundred thousand dollars. In 1896 the exports had increased to ten million pounds, with a value of almost two million dollars. In 1896 the exports of Canadian butter exceeded in value the exports of the United States, but in the year now closing it is evident that the United States exports will be rather in advance in quantity and equal in quality. These two countries as yet contribute only about one per cent each, of the butter Great Britain buys. The Canadian government has during 1897 arranged for weekly shipments from Montreal, fortnightly from St. John and Halifax, and monthly from Prince Edward's Island. It may be of interest here in Maine to know what the government in Prince Edward's Island has done for dairying. In 1892 there was no creamery or factory in this Province, and the government itself established the first cheese factory there. In 1896 we find thirty-three cheese factories and nineteen creameries in Prince Edward's Island. This year the product of butter and cheese in that Province is estimated at between $325,000 and $350,000. There were no silos on the island in 1892, but the Canadian government distributed good ensilage corn seed and encouraged the building of silos and this year there are forty in use.

The latest move by Canada has been to send its dairy commissioner, Prof. Robertson, to Great Britain, to himself canvass the condition of affairs and to leave behind him two special commercial agents to look after Canada's interests. These agents see to arrivals of Canadian products, and handle and forward them to desirable markets. They watch these markets and report their special wants, fancies and requirements, and they inform the producers, on the one hand, what to send and how to send it, and on the other hand they inform British boards of trade, produce exchanges, and merchants generally what they can get from Canada, how to get it, and where they can get what they want best. They furnish sample packages regularly, and make a regular canvass for trade. I submit to you that the United States must in some way do likewise, or we lose again in the butter race as we have in the cheese race.

It is very plain to me that we cannot be very hopeful about successfully competing in foreign dairy markets, with the countries whose work has been described, unless we take similar measures to raise the average quality of our butter and cheese and secure greater uniformity in these products.

But we cannot expect the government of the United States to do as Denmark, Sweden, Australia and Canada have done, and are doing, in the matter of direct instruction and supervision in dairying. Our government differs radically from those of the countries named,—and while we seem to be going pretty far in some things, in the way of paternalism, it is not likely we shall ever go as far as they do in the actual control of dairying, or any branch of industry.

As Secretary Wilson so well expresses it,—the government of the United States only tries to help the individual and the state, through the department of agriculture, and otherwise,—"where its arm is longer than theirs and its facilities greater." * * * "It is opening up new markets, introducing new plants and gathering facts for home producers, to the end that they may be better informed regarding their own work, and the operations of those the world over with whom they have to compete."

One helpful thing the federal government may well do. There seems to be no reason why the same general authority and machinery which now inspects animals and meats which are to be exported from this country, and places upon them the guarantee of the United States that they are pure and genuine, should not be extended to cover butter and cheese. This would go far towards maintaining the standing of our dairy products in foreign markets. If a trade in pure butter or cheese is built up under existing conditions, it may at any time be ruined through the shipment by unscrupulous persons of low grade or adulterated products, or those which have been preserved with agents generally considered harmful. A government inspection and certification of products which would grade above a certain fixed standard, would be highly beneficial.

It is, however, entirely within the province of the several states of the Union, to do much work to promote the dairy industry on lines like those described as in operation in other countries. A few states where dairying is of especial importance, have already taken action by legislation and otherwise, which to some extent covers the ground indicated. Wisconsin has done something in the way of employing cheese instructors. In Iowa and Minnesota the state dairy commissioners and their deputies inspect creameries and give more or less assistance to the business of butter-making. New York reguuarly employs three cheese instructors, who pass from factory to factory, criticising the work done and teaching the newest and most improved methods. All these state efforts have had good effect and demonstrate what might be accomplished by more work of the same kind.

In any state it is simply a question whether the dairy interest is of sufficient general importance to justify public expenditure for its advancement.

My purpose has been to call attention to the advantages which dairying has derived in other countries from aid given by the state, and to suggest thereby the possibility and perhaps the expediency of similar public assistance, to a greater or less degree, by some of the states of this Union,—and, in at least one particular, by the government of the United States.

Thursday Evening.

DAIRY EXPERIENCE MEETING,

Opened by Mr. W. G. Hunton of Readfield, Member of the Board for Kennebec County.

Mr. Hunton—As a practical farmer, I have one or two propositions that I wish to bring before this meeting, a meeting which represents, I trust, the dairy interests of our State. I trust that my remarks may call forth some criticism and discussion upon these topics which I wish to introduce. I wish first to speak of the quality of the product which we are producing, and the means of disposing of it at the present time, as I believe that those are the two most vital points in the dairy industry of the State of Maine to-day. I think we have had a practical illustration in the scoring of the dairy products which have been brought here for that purpose. I have had charge of arranging the exhibits in the cases, and I could but notice that almost the only fault that the scorer found with those products was in their flavor. Now I think there is no one present, no farmer at least, but that will say that he believes we have as good opportunities for producing a first-class article in the State of Maine as in any other state in the Union, or any other nation in the world. The only thing that can possibly be said to be against us is the long period of time in the year in which our cows must be housed. With that exception I think no one will dispute the statement that we have as good opportunities for producing a good quality of butter as any state or any country.

The next point is the disposition of this product, which is becoming an all important subject for us to-day. It is within the memory of almost the youngest dairyman of the State when the butter which was produced by the State of Maine was, to say the most, but an incidental product of the State. The dairy industry has come up within the last fifteen or twenty years, and it did not arrive at much magnitude until perhaps the last half of that period. We can easily see how in the early stages of that industry the product should not be as good as when more time and attention were devoted to it. We, then, in the State of Maine, were largely interested in stock raising, sheep husbandry and general farming. We had stock for general purposes. We were not intending to produce butter and were not educated to care for dairy stock. We were obliged to change to the stock which would produce milk, and the result was that we had a class of animals to care for, the care of which we knew nothing about. We had to gain the experience of properly caring for those animals, besides the experience of caring for the product. In the early stages of the industry the men had but very little to do with the butter-making. It was the wives, mothers and daughters of the farmers who had to learn that part of the business. Later as the amount of the product increased it became too large a business for them and we began to do it ourselves. We were called upon to learn a new trade. Soon the work increased so fast that we could not do it ourselves, and then associated dairying began. Therefore in the short period of twenty-five years we have been obliged to learn three or four trades in producing this product for the market, and the result is that

Maine butter is spoken of as having a Maine flavor, a flavor which in the past has cost us considerable money, because it is considered inferior. To-day, with this immense amount of butter that has been brought here for inspection, larger, I think, than at any previous dairy meeting, we find that the only fault that is found, in the majority of cases, is with the flavor of the butter. I believe that this is one of the points which should be brought up for discussion, so that if possible we might arrive at some method by which we can improve in that direction.

One word more in regard to the disposition of this product. We were all interested in the talk which we heard to-day in regard to the amounts of butter used in other countries, which these countries were not able to, or did not, produce themselves. It is only lately that we have become aware that any one in this country is interested in finding an opening for this product. It is within a short period of time that any public organization has been interested in endeavoring to find an opening for our surplus product. We can but see that some good is coming to us from the taxes that we pay for the support of the government which we love so well.

Although the press for the last ten years has been urging the farmers to increase in this line, and the Board of Agriculture has annually expended $3,000 in holding institutes all over the State in which the main topic has been dairying, it is rather humiliating to us to read the report of the census of the cows of this State for the last year and find that the number has decreased 5,000. With all our efforts, and with all the efforts of the press, the farmers have decreased the number of their cows. We might look at it from one side and say that it is best, for I believe that there are very many engaged in dairying who do not keep as many cows as they did five years ago, not because they are not as largely interested in the industry, but because they have learned by experience that in any herd some cows can be found that are unprofitable, and by weeding out these they can make a better product. There is that element entering into the matter, but it is not to the extent of the depreciation. We who are practical farmers and are endeavoring to live from the products of our farms, know that the moment a product of the farm will not furnish us with a reasonably respectable living and a few of the luxuries of life we lose interest in that branch of farming. And we who are practical dairymen know that the moment we lose interest in our business, in the care of our dairies, the profits begin to depreciate very fast. For where there are ten men who have the ability to make good farmers, I honestly believe that there are not five who have the ability to make good dairymen. There is something in the care of our dairy cows that demands more forethought and more attention than the majority of farmers are willing to give to it, and without that care and attention there is no profit in dairying, I do not care how good the cows may be, or how good the facilities for manufacturing the product. For the last two or three years we have seen such a constant decline in the price of our products that many of our farmers have lost interest in the business and have turned their attention, perhaps of necessity, in other directions, and the result has been less attention given to dairying and less profit from it. Therefore I say that I believe it to be the duty of the members of the Board of Agriculture, for the next year at least, to endeavor in some way to find an opportunity for bringing the consumer and producer of this great product nearer together, and thus save as far as possible the percentages paid to the middlemen, and give the producer the largest possible per cent of profit that the market will allow him to receive. I believe that there is a large field for dairying in the State of Maine to-day. We have every facility for producing the product and carrying it to the consumer in the best possible condition.

MR. E. E. LIGHT—Mr. President, Ladies and Gentlemen: I will detain you but a very few minutes, as we all desire to hear from the gentleman who is to speak to us this evening on the main subject. Some of the experiences of the past year have not been altogether pleasant, and I am sorry that this is so. It has been stated here to-day that the average income from the cows that are patronizing creameries has not been more than thirty dollars for the past year. I do not know as we can expect the cows to average very high when butter sells as low as I have known it to sell during the past summer. I know by the statistics of my own creamery work that the farmers have received some of the time this summer but a little more than ten cents per pound, net, for the butter that is made from their cream. And that statement has been corroborated by the facts which I have learned from other creamery men to-day. When good creamery butter is only netting the farmer at his farm ten cents a pound it seems to me like discouraging work. We may urge the farmers as much as we please to get better cows and be more economical in their feed and improve the quality of their product, yet the fact stands out, we cannot wink it out of sight, that we need better returns for our product. I believe the time is quite distant when the State of Maine will produce butter in such quantities that it will have to seek a foreign outlet. However, the foreign outlet is going to control the price of butter considerably, and the make of butter in other states will affect the market for the product from our own State. It seems to me that the dairy products of the State of Maine must, in order to get the best returns, find a market locally as much as possible. Then I suppose it is best to develop our cream trade as much as possible, and also it seems to me, although I have had no experience in the business, that when cheese is brought in large quantities from other states into the State of Maine and wholesaled at ten or eleven cents a pound, and good creamery butter is netting the farmer only ten cents a pound, we could develop in the direction of cheese-making somewhat, to the advantage of the farmer. It does seem to me that attention should be given to that subject in this meeting, and that the Board of Agriculture should agitate the matter of directing the product of the cows into that article which is consumed right among us,—that is, cheese. This subject will be considered to-morrow and I hope it will receive more attention before this meeting closes than it has received in other years.

Ques. Has the quantity of salt much to do with the flavor of butter? Some of my customers want the butter salted differently from others, and I make three or four grades, but I have not sold a pound of butter of my own make for less than twenty cents.

Major Alvord—The butter which you find in London and Paris, and all the cities of the continent of Europe, which has the most delicate flavor, and sells throughout the year from five to eight cents higher than any other butter, has not a particle of salt in it. No salt or brine touches it while it is being made. But I suppose to the taste of most people salt is a part of the flavor. There is no question in regard to the fact that too much salt destroys fine flavor. And also there is no question about the fact that no salt at all leaves a flavor the liking for which has to be acquired by habit and practice. It is not natural to us in this country, at any rate. But the tendency all over this country, throughout our markets, is toward less and less salt, and the very people who are talking the most to us about a higher flavor are favoring less salt; not none at all, but much less than has been used heretofore. I think the question can be answered in a single sentence in these words: The finest flavor in butter, so far as salt alone is concerned, accompanies a moderate amount of salt. Of course we should not forget what Secretary McKeen called attention to this morning,—that salt is a medium by which outside flavors are carried into the butter. I wish he would repeat in substance what he said in regard to the care that should be given to the selection, keeping and use of salt in butter-making.

SECRETARY McKEEN—I think it would be much more proper for Major Alvord to continue his remarks along this line of the necessity of keeping salt away from articles having a strong odor. I have had my attention called by market men to the necessity for keeping our butter salt in quarters where it cannot possibly become contaminated with any of the odors which are frequently floating around in our grocery stores, and occasionally where the salt is kept in our creameries and on our farms. We all should remember that there is nothing that we handle that will take upon itself foreign odors or impurities so quickly as salt, and then, in dissolving, it imparts those flavors to the butter. In the testing of our butter this morning we had two samples of butter salted with salt under different conditions, made by the same party. One of those samples scored very high and was considered by the judges to be a very nice piece of butter. The other sample scored very low, the trouble evidently coming from impurities which had got into the butter through the salt. The salt had been kept somewhere, in the stores or in the house, where it had taken upon itself certain impurities. I believe that we should take this matter into consideration in our work for 1898.

Mr. Light—I would like to inquire if there is any test that we can apply to the salt which we buy, in regard to its being impregnated with bad odors. It seems to me that here is a hint that the dealers in salt should take notice of. The creamery men and dairymen have to buy their salt of the dealers in salt, and it has been transferred long distances and passed through many hands, and they know nothing of its history. It seems to me that the manufacturers of salt should exercise some care in regard to the manner in which the salt is handled until it reaches the consumer.

Major Alvord—It is for the dairymen to determine the shape in which the salt comes to them. The demand on your part as buyers should be that the salt shall be furnished to you in thoroughly tight, almost air tight, packages. Never buy salt at a grocery store, or from any dealer of a lump lot. Buy your salt for dairy purposes or for creamery purposes in the original packages so that you can hold the manufacturer primarily responsible for its quality, and let those packages be as nearly air tight as possible. Discard sacks and insist that your salt comes in wooden packages, and preferably paper lined. If you insist upon this the manufacturers will supply it as you require it.

Mr. McKeen—The salt used by our creameries generally comes in barrels and these are often paper lined. I think this is the best way known to commerce.

Mr. Light—The salt barrels that I use have lining on each head but not on the body of the barrel. I would like to inquire if dry salt will absorb odors as quickly as damp salt.

Mr. McKeen—I think it will not. I would like to hear from Mr. Douglass on this subject. I think he will be able to answer these questions better than any one else.

Mr. Douglass—I am not a public speaker. My friend beside me will answer the questions for me.

Mr. Z. A. Gilbert—This discussion in connection with the matter of salt and of flavor comes right down to the point. I have been somewhat acquainted with the methods of Mr.

Douglass, and in conversation with him have gained some of his ideas in regard to the matter. He remarked to me just now, in relation to paper lined barrels for salt, that the paper lining does not work at all, for the reason that it is loose, and in rolling the barrel and working the salt the paper is ground up and mixed with the salt and causes difficulty. That would not necessarily hold true in regard to the heading, however.

I would endorse, so far as our trade is concerned, the remarks of the gentleman from Washington in regard to the tendency toward a lower degree of saltness, and also the fact that there is at the present time a measure of saltness called for. Furthermore, speaking for an expert, heavy salting overshadows flavor. With butter salted at the rate of one ounce per pound, which is what our market calls for in large measure, the saltness will overpower and overshadow the flavor. But a lower degree of saltness assists in bringing out flavor, toning it up. A butter expert in any exhibition will readily detect a butter without salt or a sweet cream butter. In either case the flavor is fine, it is delicate, but it is moderate. It needs a little measure of saltness to tone it up and bring it out distinctly. But if it is too heavily salted the flavor is overpowered, and it is almost impossible for an expert to distinguish between saltness and flavor. Butter is insipid if without salt, insipid if made from sweet cream, salt or no salt, but when you get it just right you bring it up to the highest standard.

As to the cause of the defect in this exhibition of butter, we find in looking over the score that the chief scale down is in the flavor. If we were to take the testimony of some of the exhibitors, the reason for this is found in the judge, but that cannot be wholly true, because the present judge is an honorable, honest-minded man and means to do just right. His interest may be somewhat emphasized in the direction of western butter, because he handles tons and carloads of that where he handles a pound of the State of Maine butter. Nevertheless, if there is an honorable judge in Boston, I think you have him here at the present time. This reason for the defect in flavor is one of the blind problems in dairying and one that calls for work on the part of the dairymen of our State more than any other feature connected with the business.

Reference has been made by a gentleman here to the matter of cleanliness. He states that the absence of cleanliness affects the flavor of butter. I want to throw out the suggestion that perhaps that would depend somewhat on the definition of cleanliness and to what you apply it. I am simply stating my opinion, which is that the defective flavor or barn flavor in butter that we refer to as coming from milk or cream by exposure in the barn is caused far more frequently by lack of ventilation, which holds those pungent barn odors which you find in a barn where the cows are confined day after day, week after week, and month after month, than by the slackness of the owner in not keeping the animals clean. Those pungent odors they breathe in with every breath, and we have learned that placing before those animals any substance like turnip tops, cabbage, onions, or sour ensilage, and letting them breathe those odors from morning till night will affect the flavor of the milk to the degree of the defect in the material before them. So living in those unventilated quarters will have precisely that effect, and here is a matter that should first be looked after, and which is the great defect of the practice of the dairymen of Maine.

BACTERIA AND THEIR RELATIONS TO DAIRYING.

By SIMEON C. KEITH, JR., Boston, Mass.

Among the most numerous and wide-spread of all living things is a group of small plants that have undoubtedly existed for ages and yet have escaped discovery until comparatively recent times. I refer to the organisms called bacteria which are more commonly known as germs. They were discovered some two hundred years ago, by a Dutch mechanician who constructed a magnifying glass that was so far superior to anything ever before made, that with it he was the first to see in putrefying liquids, such as beef-juice, etc., little animals as he called them, because many of them had the power of motion. Little more was known about them, however, until the beginning of the present century, when the forms were roughly classified and a hint at the truth arrived at, namely: that the germs found in putrefying liquids were the cause of the spoiling. It was generally supposed, however, that putrefactive substances, like meat, etc., spoil spontaneously, in other words that the germs had their origin directly from the matter in which they were found. This idea of spontaneous generation was generally held up to the time Pasteur, who finally disproved it by showing that matter that was subject to spoiling, never did so unless bacteria from without were introduced into it, or as he expressed it, life always proceeds from pre-existing life. As I have previously said, the bacteria are plants and are closely related to the molds and yeasts which we are all more or less familiar with. They are, furthermore, the simplest in structure of all the plants in the world, having as they do neither root, stem nor leaf. They consist simply of a very minute case filled with living matter, which is called protoplasm. Yet these little living cells are capable of nourishment, growth and reproduction, the essential functions of all life.

The number of shapes bacteria may have is very limited, in fact, there are only three fundamental forms of bacteria and these may be described as ball shape, rod or sausage shape, and spiral or corkscrew shape.

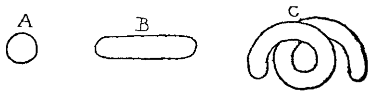


FIG. I—Types of Bacteria.
A—Micrococcus.
B—Bacillus.
C—Spirillum.

The bacteria are exceedingly small and in general may be said to be about one twenty-five thousandth of an inch in diameter. If a common sausage and a bacterium could be magnified alike, so that the bacteria would be as large as sausages, the sausage itself would be about three miles long and 2,500 feet in diameter. Up to the present time, some fifteen hundred species of bacteria have been described, which number probably represents, however, only a part of the varieties that really exist. Out of the known kinds there are few that are really detrimental to our health, only about fifty in all, while the remainder are either useful or harmless. You have probably been wondering, by this time, how it is possible for us to distinguish so many varieties, when there are only three forms to go by? While I cannot enter into this particular subject in detail, I will say that we find differences in bacteria, mainly from studying the effect on various substances in which they grow; in milk, for instance, some germs produce souring, some a rennet action and others a gaseous fermentation. Other differences are found in a similar way by growing the germs on other substances, so that in a complete description of a bacterium, we have beside the shape and size, some ten other differences, which are mainly of function.

The bacteria increase in numbers by a simple splitting of the cell into two or more, and under favorable conditions a single generation is completed in about twenty minutes so that in the course of five hours, starting from a single germ and allowing that one cell separated into two each twenty minutes, we should have over 250,000 bacteria produced as the result.

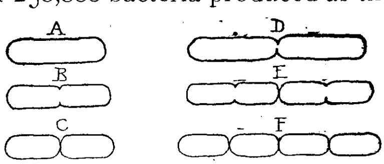


FIG. II—Showing method of reproduction in bacteria by transverse division of the cell. A, B, C, etc., successive stages of the reproduction of a bacillus during two generations.

The soil seems to be the normal habitat for most bacteria, and in the top layers of it billions to each handful are not unusual numbers. As we pass into the lower layers of the soil, we find the number of bacteria growing less and less, and at a depth of about six feet there are practically none. I call especial attention to bacteria in the soil, for here is the real source of many of the bacteria found in water (as the water washes the germs from the soil) also of the normal bacterial of the air (the drying of the soil and its being blown by the winds into the air.)

Having seen what the bacteria are, let us see how they effect the dairyman. Now milk from a normal, healthy cow, if drawn under proper conditions, is free from a very undesirable property which most milk has, that is, it will not spoil and is therefore free from bacteria. If, however, care is not taken in the experiment, the milk soon spoils, and the reason is, that the milk in the first place is a good food for bacteria to live upon, and secondly, that some bacteria got into the milk. Milk as it is delivered in the city is swarming with these bacteria, and is consequently partially decayed. It is not unusual in city milk to find from five to ten million to each cc. (A cubic centimeter being about half a thimbleful.) These bacteria are traceable to various sources, one of the principal being the dust of the stable. Compared with outside air, the air of the stable is particularly rich in bacteria, and when the milker begins his task, often hay, which is well known to be full of dust, has just been pulled down from the loft and possibly fed to the cattle; then again I have often seen hay hanging through loose planking, over the cows, and at times the cows backs are well nigh hidden from view with hayseed, etc. All of this dust has its effect on the milk, causing it to spoil and furthermore to be very dirty. This source of trouble is easily remedied by making a rule to never move hay in a stable for some hours before milking is begun, and further by sheathing up the ceiling of the tie-up. Of course I only offer this suggestion when it is impossible to keep the cows in a separate building, from that in which the hay is kept,—this being the ideal plan.

Another cause of the infection of milk, and further, perhaps one of the most objectionable ones, in many respects, is from cow-dung. The decomposed and digested food of animals is one of the richest sources of certain bacteria, and these great numbers persist in the dung to such an extent, that an exceedingly small amount of it is sufficient to inoculate and spoil a

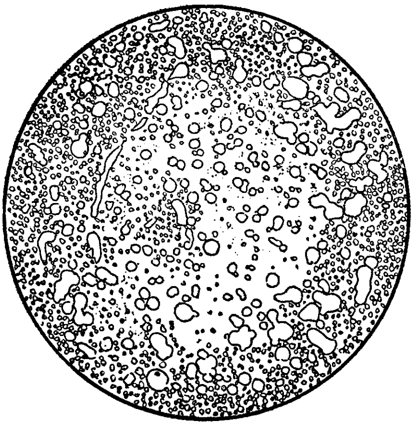


FIG. 3—(Raw milk, 7,741 colonies).

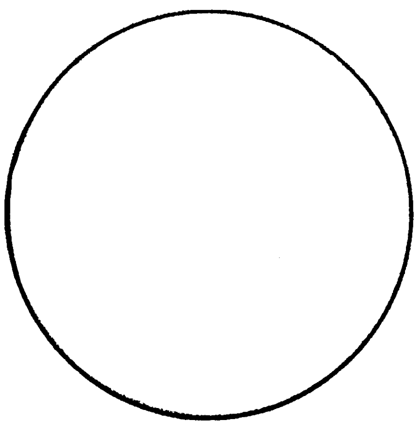


FIG. 4—Normal milk, no colonies.

Photographs of gelatin plate cultures showing the relative numbers of bacteria in equal quantities of ordinary milk and normal milk (condition of milk in cows udder).

whole pailful of milk. We have all been in stables where cows were improperly cared for, and seen them in many instances almost covered with dried excrement. A farmer can do no better thing to lower the quality of his dairy products, than to

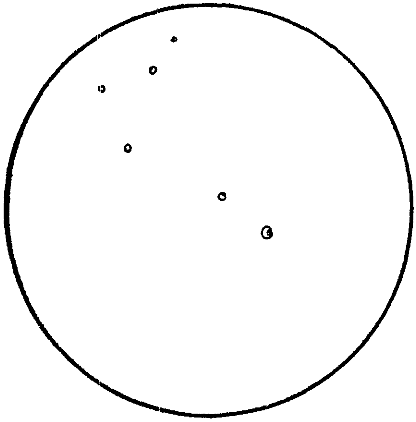


FIG. 5—Petri plate exposed two minutes out of doors. Contains six colonies.

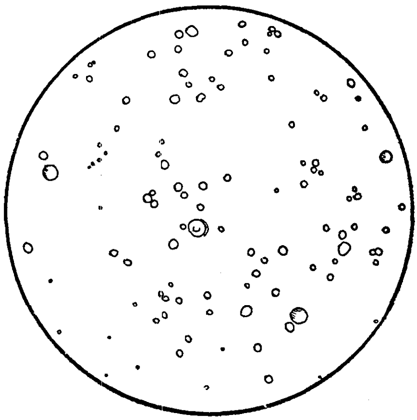


FIG. 6—Petri plate exposed two minutes in barn. Contains 111 colonies.

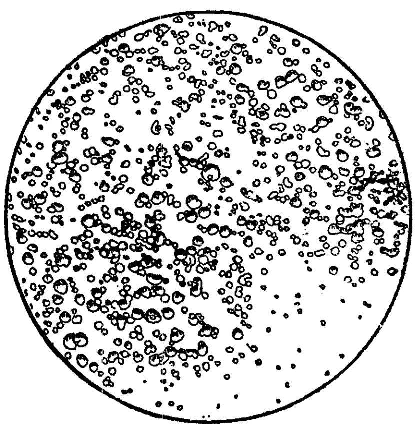


FIG. 7—Petri plate exposed two minutes under cow being milked. Contains 1,800 colonies.

Photographs of gelatin plate cultures—showing the relative numbers of bacteria in air outdoors, in a barn and under a cow while being milked (each white spot represents the result of growth of a single bacterium settling on the gelatin during the two minutes exposure.)

be lax in this particular, and I cannot emphasize this point too strongly, for I am convinced that it requires more attention than it is receiving to-day, as when dry, the excrement is easily dislodged from its temporary resting place, to find its way to the milk-pail. Again it sometimes gets there from the cow switching her tail, and sometimes the tail itself gets into the milk. Keep the cow clean. Card her and care for her, and have a couple of clean cloths ready, so that before milking you can carefully wipe off the udder, thus removing any loose hairs and dirt that may be there. Do this and see if you are not more than repaid for your trouble, in that your milk and dairy products will be better for it, and further that you will be setting the example for others.

Personal cleanliness is the next subject I wish to call your attention to and it is in some respects the most important of all. We can consume milk infected with bacteria from many sources without harm, but when the germs of disease are there, it is time for us to take warning. Now there has been a great deal of talk about Bovine Tuberculosis and rightfully so, too, I believe. But a factor that is little recognized is possibly doing more harm than the tuberculosis in spreading disease, especially in our large cities, that depend as you know on the country for their milk supply. Disease may be introduced by the men that handle the milk from its start in the country to its delivery in the city to the consumer, and every person handling such milk may add his or her share to the disease-dealing qualities of it. Several of the worst epidemics of typhoid fever in Massachusetts have been traced by Prof. William T. Sedgwick of the State Board of Health, to a contaminated milk supply. This can be to a great extent prevented by suitable care and if a rule could be adopted, that before milking or handling milk, the hands of the person be carefully washed and the nails cleaned, I am sure that it would be a long step forward in securing what we want at the present day, pure, clean and safe food. Aside from the sanitary point of view, the point of cleanliness itself is worth thinking about, for I am sure that you will admit that you would hardly want your wife to make bread with hands in the condition that you and I have seen milkers' hands, which often get washed with the milk as you know; and after all, milk is a food as well as bread.

Milk utensils deserve a word, in that they, too, when improperly cleaned, or made in such a way that it is impossible to clean them, add their share of bacteria infection to milk. All utensils, therefore, should be cleaned very carefully and, if possible, should be sterilized with live steam before using them. Dr. Russell of the Wisconsin Experiment Station recommends that all seams in crevices in pails and cans, be filled up flush with solder, and I can heartily recommend the proceeding, for the point of a dirty can alone, is enough when the case is aggravated, to cause very bad results in the dairy. You will see then that milk is a very susceptible liquid to infection from bacteria from various sources, and if we had to drink water containing as much filth and bacteria as milk contains, we should certainly criticise the health authorities strongly. Bearing these facts in mind, you will note that the cleaner you are in the dairy, the more you reach the ideal, normal condition of milk, and as a result the quality of your dairy products will be raised correspondingly, both from a sanitary and money standpoint, and it is my hope that you may act along the lines that I have indicated, for my observation shows that until this is done, no great advance can be made in the dairy industries in this or any other state.

Ques. Does milk drawn from a cow infected with tuberculosis contain tuberculosis bacteria?

Ans. It may or may not. Cows infected with tuberculosis of the udder are certainly dangerous animals to have, but I do not think there is any method by which we can tell whether a cow has tuberculosis of the udder or not to a certainty without killing her, and subjecting the udder to experts.

Ques. Would it not be very difficult to find the bacteria?

Ans. It is impossible to find them by microscopical examination. The way we have proven their presence is this: a small portion of the milk taken from a tuberculous cow has been injected into healthy Guinea pigs, and after a time those Guinea pigs developed the disease of tuberculosis in so marked a degree that there can be no doubt that the milk must have had the germs of tuberculosis in it.

Ques. May you not try a great many experiments of that sort and have the tuberculosis show itself in but very few?

Ans. Yes, indeed. I do not think that twenty-five per cent of the cows that respond to the tuberculin test have tuberculosis of the udder.

Ques. Do cows have tuberculosis without having the lungs affected?

Ans. They do certainly. It is not necessary that the source of the disease shall be in the lungs. There are a great many cases of tuberculosis of human beings in which the disease is not in the lungs at all. It may be in the alimentary canal the stomach, or the intestines.

Ques. Is the beef of an animal diseased with tuberculosis healthful?

Ans. I do not think it is unheathful if it is thoroughly cooked. Cooked bacteria are harmless.

Ques. Can you tell us how tuberculin is manufactured?

Ans. Tuberculin is made from a pure culture of the bacilli of tuberculosis which are obtained from people or animals that have died from the disease. Generally a piece of the lung, or a piece of diseased tissue, is taken, and by a tedious method we get a pure culture of the typical bacteria from it. Then this is inoculated into a flask of bouillon, and in that it develops, producing a toxine or poison, which is the active principle of the bacillus. The bacillus itself is not so damaging in many ways as the poison produced by it. The poison is separated from the germs and, when mixed with glycerine, forms tuberculin. The real, active principle of tuberculin is the poison produced by the germ when growing under artificial conditions in a culture medium. A Pasteur filter is used to separate the germs from the toxine.

Ques. What effect does tuberculin have on the animal?

Ans. Upon a healthy animal it does not have any effect as far as we know, if it is properly prepared. If, however, we have a cracked filter, and some of the germs get through, we are very apt to give the animal tuberculosis. But tuberculin from reliable laboratories contains no germs of tuberculosis, and is only the pure poison. When that is injected into a cow having tuberculosis, a number of hours afterwards there will be a rise of temperature, and that rise of temperature is the indication of the disease.

Ques. Is the rise of temperature in proportion to the severity of the disease?

Ans. I think not.

Ques. How many degrees does the temperature rise?

Ans. Only a very little.

Ques. Do the germs of tuberculosis increase rapidly?

Ans. They increase very slowly. Ordinary bacteria multiply once every twenty minutes, whereas you would not get more than one division in twenty-four hours in tuberculosis. There would be practically no more germs of tuberculosis in milk at the end of the time in which it would be used than when first drawn from the udder.

In the preparation of antitoxine for diphtheria, the same process is followed as in the preparation of tuberculin up to that point, but instead of stopping there an antitoxine is made by inoculating horses with some of the diphtheria toxine every day, or every two days, and gradually increasing the dose until the horse can finally stand enough to kill a dozen horses if given them at first. Very small doses are given at first, but after a few months the horses will get so that they can stand immense doses, and their system gets into a condition in which the blood has the power of neutralizing some of the poison. The great danger in a case of diphtheria is from the poison that is produced by the germs in the throat, and the antitoxine is injected into the system to neutralize that poison. No one who has ever seen the workings of antitoxine can doubt its efficacy for an instant. If two Guinea pigs be taken, and enough toxine is injected into them to kill both, and then one of them is given a dose of antitoxine, in twenty-four hours the one that has received the toxine only is dead, and the other, that has received the toxine plus the antitoxine, is as well as ever it was.

Ques. Does injecting tuberculin into a cow have any effect on the milk usually?

Ans. I think not, because the milk glands are really separate from the other organs of the body. They are only supplied with blood which nourishes the cells of the milk glands. These cells swell up and burst, and the liquid flowing out of the cells is the milk. I do not think the milk would be affected unless the dosing was kept up too long.

Ques. Is it possible to tell what stage the tuberculosis has reached in the animal by the use of tuberculin?

Ans. It is not, because very mild cases seem to respond as readily to the tuberculin test as very severe ones. In fact, there are some cases in which diseased animals do not seem to respond, and I think there are occasionally some instances where healthy animals do respond.

FRIDAY, A. M.

THE CHEESE INDUSTRY FOR MAINE DAIRYMEN.

By PROF. G. M. GOWELL.

Mr. President, Friends: This matter of cheese-making is rather a new subject for us to consider at our dairy conferences, and I can assure you that it is not an easy task for me to attempt to talk to you about it, perhaps largely because you are not in so close sympathy with it as you are with some other lines of our work. It is not a difficult matter to talk about a subject when everybody else is thinking along the same line, when the audience is going with the speaker, but to present a matter with which the audience is not directly in sympathy, and to which it is indifferent, to a certain extent, in such a way that it will interest the people, is a very different matter.

You know that when we first started in our dairying in the State of Maine, cheese factories were established all over the State. It was the cheese industry that was really the first departure from stock growing and cattle feeding that the farmers of Maine attempted, and considerable enthusiasm was aroused by our Board of Agriculture at that time, and by the speakers that came from New York. New York was then the cheese producing section of the country, and lecturers were brought here from there, and the subject discussed. The result was that all over our State cheese factories were erected. The farmers organized and began manufacturing cheese. I do not know just what the results were in all of these factories, but after a few years the work in the main was abandoned, and the farmers went back to their stock growing, or other lines of cattle feeding, and we had those unused cheese factories—not in almost every town, but in a great many of the towns of our State. These were cheaply constructed, and for the most part were left unoccupied. Some are yet standing. As I told you yesterday morning, I have the returns from only two cheese factories in our State. I presume there are others that have been in operation during the past year, but probably not more than six or eight have done any business. The cheese industry has been entirely overlooked, and we can readily understand the reasons for it. When our people gave their attention to cheese-making, they took hold of it with considerable enthusiasm, but the work continued for only two or three months, during the warm part of the year. At the close of the cheese-making season, in October, the milk was thrown back on to the farmers, and they had to take up dairying in their homes. They had no market for their butter, and they were not in sympathy with the business because they had been making cheese during the season. I presume that the fact that the work in the cheese factories was only continued for a short period of time was the leading reason why the cheese industry was abandoned. Another reason was that at just about that time Jersey cattle were introduced, and the production of finer qualities of butter was being taken up by our better cattle feeders, and our attention was diverted to butter-making. At that time fancy butter was selling at a higher price in proportion to its cost than was cheese, so that it was through the avenue of butter that the farmers sought to market the hay and grain products of their farms, rather than through that of cheese. You know that we have manifested a good deal of enthusiasm in the production of fancy butter, and have cultivated the tastes of our people so that they appreciate a nice article. We have been working along that line. People who had been using but small quantities of butter because of its inferior quality, just as soon as the nicer qualities were put upon the market commenced to use it in larger quantities, and thus by furnishing something that was a delicacy we have caused an increased consumption of butter, until now there is an undue demand for that product, and we are extravagant consumers of this better butter. And I believe that this is the way for us as farmers to find a market for our butter in the future,—not by furnishing a cheap quality, but by furnishing all good butter, and thus increasing the consumption, and consequently the demand for our product. We have become, as no other people on the face of the earth are, extravagant consumers of this product, in the sense that its value as a food is not equal to the price paid for it, although as an aid to the digestive process it may be worth all that it costs. If we had placed before our people cheese of the best quality, cheese as good as we are capable of making with the intelligence that we possess at the present time, they would in the same ratio, I believe, have become extravagant consumers of cheese. And yet I should not say *extravagant* consumers, because cheese, as an article of nutrition, compared with beef and other foods, is worth more than it is ever sold for. Butter is not worth what it is sold for as an article of food but simply as an aid to digestion. In our butter-making we throw away the material by which the system is nourished, we throw away largely the muscle-making nutrients that are in the milk, i. e., the casein of the milk, we throw away those elements that are capable of sustaining life and producing energy, and save only the fat. In our cheese-making, in a properly constructed cheese, we save all the nutrients of the milk. We simply preserve the milk in a form for future use, in which it contains nearly all its elements of nutrition.

Now it is of no use for us to talk about the production of cheese for our farmers, unless it is an object for them to pursue this line of work. In the statistics which I gave you yesterday, from the creamery managers of the State, we saw that the average produce from each of the 37,000 cows was $29.22. We know that during the months of May, June, July and August the price for butter ran very low. Very many of the creameries returned during those months from 14 to 16 cents per pound as the amount paid the farmers for the cream that would make a pound of butter. This is the cause of the low average returns. A large number of our people who are pursuing private and associated dairying are doing their work in the summer, and consequently a great surplus of summer butter, made during those months, is forced upon the market, and the price is crowded down so low, that although at that time the food for the cows is the cheapest of any season, the results are very unsatisfactory, especially where our creameries are relying upon butter as their product and not upon the sales of sweet cream. The cheese industry does furnish an opportunity for us to work up the milk during those warm months, and get more for it, I believe, than if we manufacture it into butter. And if we manufacture a large amount of our milk during those months into cheese, it will to some extent relieve the market of the great surplus of butter that is forced upon it. This butter is forced into cold storage and held until prices are higher, and then our market men force it off and hold back the fresh butter. This is what held our markets down this year during October.

It takes about 20 pounds of milk to make a pound of butter. Of course the quantity depends upon its content of butter fat; with 6 per cent milk it would require one quantity, with 5 per cent milk another, and with 4 per cent milk another; but I will assume, and it is not far out of the way for average herds, that it takes 20 pounds of milk to make a pound of butter. This butter returned about 16 cents a pound during the past summer months. That same 20 pounds of milk, made into cheese properly, will make two pounds of cheese, because with average milk, containing four per cent fat, 10 pounds is sufficient to make a pound of well made cheese. I do not mean green cheese that is forced off when it is carrying a large amount of moisture, but ripened cheese, fit for the market. You are well aware that there is no cheese of any sort that is selling in Maine markets at present for less than 10 cents a pound. Instead of the 16 cents that could be derived by selling the butter, 20 cents could be secured by selling the cheese. You understand, my friends, that I am not attempting to boom the cheese industry; that is not my purpose. I want to present it for just what it is worth, without any purpose to entice you to engage in that industry as competing with the butter industry, but to show that it does furnish an avenue for us to market a large quantity of the milk that we are producing in the summer months, when the grass is so free in our pastures.

Now, is there a demand for the cheese? At the present time we are not using much cheese, we have not a great cheese market. And why are we not using much cheese? Not that we are to blame, but because the cheese is not good enough, the quality is not what it should be. The people appreciate a cheese that is soft, that has a mild flavor, and is rich. Those are three conditions that are required. We all like cheese that is soft, mild flavored and rich. Does our market at the present time afford us such cheese? The cheeses that we buy at our stores or from our factories are harder than we like, dryer than we like, not as rich as we desire, and the flavor is either too positive or else it is insipid, or the cheeses are heavily salted. The cheese that we are using is not something that we desire very much of; it is not a desirable article of food. Perhaps this may seem unjust to you, but it is a fact. What is the reason for it? Largely that the cheeses that are found in our markets are manufactured in other states. Some of them are skimmed (and I presume this may be true to a certain extent in our own State), others are inferior because they are made for a different market from ours. The poor quality of the cheese is also due largely to the fact that the farmer furnishes the factory a quality of milk that is not suited to the production of the best cheese, and that at the cheese factories sufficient care is not put into the process of manufacture.

It may seem to you a little out of place for me to talk to you about making cheese, because, while I do not claim to know everything, yet sometimes I am asked to talk about sheep raising, or about pig growing, cattle feeding, or chicken feeding. I have been asked to talk about the cheese industry to-day, and we expect a man who is talking to know all about the subject on which he is talking. I do not claim that I know all about cheese-making, but I do claim that I know a little something about it. I am not a novice in the business. Although I have not been a practical cheese-making man all my life, I have had considerable experience in this line. For quite a portion of each season for the past few years I have devoted a considerable time to cheese-making. I have the data for every cheese that we have made, its history from first to last. I have noted the condition of the milk employed, its quality, the per cent of fat it contained, its degree of ripeness, the amount of rennet used, the time employed, the temperature employed, the condition under which the curd was worked, the fineness of the cubes, its condition on going to press, etc. Every item in connection with every cheese that we have made for six years has been carefully noted. Those cheeses have been cured under varying conditions, and I have tested them when they were ripe. This data has been worth something to me, as I have thus obtained an idea of the conditions under which we can make good cheese. Sometimes we have tried to make good cheese and have made good cheese, sometimes we have tried to make poor cheese and have made poor cheese, and sometimes we have tried to make good cheese and have still made poor ones. I have watched all the conditions carefully in all these cases.

One great reason why our cheese factories are not giving us cheese that is good enough for us is that they have not properly constructed buildings for curing rooms. I believe this to be the leading cause of much of the poor quality of cheese. These buildings were erected with a limited amount of money, and they were simply shells, many of them, the lower floor used for the manufacture of cheese and the upper floor as the curing room. During the heated portion of the year that room was altogether too warm for the curing. When the temperature was above 60 degrees it was too high, and much of the time it ran to 80. Those cheese became rancid, they leaked, and they dried so quickly that they became hardened. And when the cold nights came on the temperature was reduced too low and the cheese became mottled, an uneven quality was produced. So the best of results, even though the cheese had been made perfectly until the curing, could not be secured. The best cheeses are cured in rooms where the temperature can be held very evenly at not far from 60 degrees. It ought not to run below that, and should not go above 65. It should be held there every hour in the day for at least two months, during the curing period.

Then, again, care must be exercised that the atmosphere does not become too dry. In the best cheese factories an instrument indicating the amount of moisture in the atmosphere is used, and a certain degree of moisture maintained. Under these even conditions a rich, ripe cheese is produced.

There must also be a sufficiency of pure air in the curing room, because it has been proved that this is essential. Take a green cheese and place it under a glass bell jar, something that interferes with the free contact of the air with the surface of that cheese, and the curing is retarded. I once saw a cheese that had been under a bell jar for three months, and in tasting that cheese we found that it was still in a condition almost identical with the curd when it went to press, showing that it is the oxygen of the air coming in contact with the cheese that cures it. We cannot shut up the windows and maintain an even temperature in the curing room and still have good results. We must have a sufficiency of pure air. So you see that we must provide ourselves with conditions that are essential, in order to make good cheese.

What is the farmer's relationship to the making of good cheese? By the way, my friends, let me say to you that butter-making is a mechanical process learned in a very short time; a few months' work, by a man that is mechanical and careful, fits him for the business; but the work of cheese-making is a fine art. The work is so critical, and so much care and so much judgment is required, that it becomes a science as compared with the work required in the manufacture of butter. In butter-making, the milk is secured from the cow this morning, to-morrow morning it is skimmed, and in a day or two the butter is manufactured; so that in four days you have that manufactured butter on your shelf and know whether it is good or bad. If you make a cheese to-day, you must hold it from two to three months before it is ripe, and by that time you have almost lost track of the conditions under which you made this particular cheese. The season is half gone, and you do not know whether you ought to have changed the conditions under which you commenced your season's work or not. Covering so long a time the work is obscured, and a man has not the opportunity to correct his work from day to day, as he has in butter-making. This much is true,—the milk that comes from the cow has much to do with the quality of the cheese resulting. In Canada and Wisconsin I found that the milk that was employed in cheese-making was under very close supervision. The cheese-maker came very closely in contact with the farmer, and had certain rules that the farmer must conform to. During the warm weather the milk should be stirred very thoroughly so as to relieve it of the animal odor. It is disastrous to strain milk into our Cooley cans and submerge it as we do, and thus condense the animal flavor, and use that milk for making the best quality of cheese. The milk must be freed from the animal odors if it is to be used for the manufacture of the best cheese. It is the simplest thing in the world to do this. The little aerator which I brought here was to show this very point. By forcing the pure air into the milk the odors of the animal are entirely washed out. This is secured also by turning the milk from one pail to another in a very thin sheet, or a dipper is sometimes used. So the milk can be freed from impure flavors by the action of the air, just as the blood in the lungs is freed from impurities by the air which we breathe; and this must be done in order to secure milk from which we can make an article of cheese for which consumers will seek. The milk must be carried to the cheese factory very quickly, and must be furnished in such a condition that the cheese-maker can make from it a high quality of cheese.

Then where does the work of the cheese-maker commence? In butter-making it does not make much difference if it rains to-day and is sunshiny to-morrow, or if it is warm to-day and cold to-morrow, but with the cheese-making it does make a difference. The cheese contains a large amount of casein. You remember that it is the little trace of casein which we leave in the butter that causes it to get off in flavor, because the fat employed in butter-making is a tasteless substance. The oily substances are very delicate in their flavor, it is the casein that gives the marked flavors. When that small quantity of casein changes the quality of the butter so quickly, what may we expect from cheese, which is composed one-third of casein? Cheese is a much higher flavored product than butter. From day to day, whether it is foul or sunshiny, these various germs that we find more prevalent on some days than others, more active in a dark day, finding their way into this casein and into the cheese, and doing their work in the process of curing or of decomposing, have their marked influences.

Then if the cheese-maker were sure that to-day, to-morrow and the next day he would have milk of just the same quality, he could readily make cheese uniform throughout the whole season, but he is not. The milk comes to him to-day in perfect condition, it is sweet, it is free from impurities. He knows when he comes in contact with that milk that he can make cheese from it that will be perfect, if he does the work correctly. To-morrow the milk comes to him under other conditions. It is not the same to-day, to-morrow and the next day. The first step he should take is to test the milk so as to know the condition of the stock he is using. We are aided in that respect by the little plan which J. G. Harris discovered and employed many years ago, called the rennet test. By this test he was able to determine the condition of the milk from day to day simply by taking a certain measure of milk, perhaps a cupful or a pint, heating it to a certain temperature, and mixing with it a certain amount of rennet. He would thus determine the length of time that was required for a certain quantity of rennet to coagulate the milk. If by using a certain amount of rennet in a pint of milk to-day he found that it would coagulate in 20 seconds, and upon making the cheese he found that he had cheese that worked correctly and that he thought would be satisfactory, when the milk came to him to-morrow and he found that by using the same measure of milk and the same quantity of rennet it would coagulate in 20 seconds, he knew that he had the same stock that he had yesterday, and would make the cheese under precisely the same conditions. And if that cheese is cured under the same conditions as the other he knows that he is making a uniform product. But suppose it required 15 seconds to coagulate? He knew that he had a class of milk that was too far advanced for the making of the cheese which he made the day before. What is he to do? Well, he may try to correct this milk that is out of condition, but he ought not to take it at all. He has to employ other methods, a higher temperature and a little more rennet, but relying chiefly upon temperature, in order to make from that milk a cheese that shall be similar to the one he made the day before. If, in using his rennet test, he found that it took 25 seconds for the milk to coagulate, he would hold it a little longer, until the milk had advanced a little further in the process of maturing, had become a little more acid, and make a second test. The second test may show 22 seconds, but that is not fine enough, and so he holds it a little longer and makes a third test. When his test shows 20 seconds he knows that he has the same stock that he has been having, and can work under the same conditions.

Now, how shall he make a cheese that shall be soft? There are certain conditions that enter into the manufacture of cheese, and these are, degree of temperature, amount of rennet, length of time, and amount of salt. If we vary any one of these conditions we vary all the others, and we vary the results. A soft cheese is not made from high cooking. It is made from rather mild cooking. Too high a temperature gives us too hard a cheese, and we want to guard against that. The first step in cheese-making is to coagulate the casein, in just the same way that the milk-eating animal coagulates it. That milk is coagulated in the stomach of the calf by coming in contact with the juices of the stomach. It is coagulated quickly, and this coagulation makes a lump of curd, a substance that is almost completely indigestible, not in the stomach of the calf but on the shelf. The high temperature that is maintained in the stomach of the calf, and the large amount of the juices of the stomach, cause this curd to dissolve and become digested in the course of a few hours.

We might employ, and many cheese-makers do employ, large quantities of rennet, and make cheese that will cure in a few days or a few weeks. But this will cause that cheese to decay very quickly, and we do not want it to decay quickly. We want a cheese that we can keep for months, a cheese that the dealer can carry for a long period of time without having it change, so that a customer buying cheese now, and again a month from now, will get cheese which is in the main the same. We want a cheese that shall be slow in curing. Quick curing cheeses are lacking in mild flavors. They have strong flavors, while the slow curing cheese has the mild flavor for which we are seeking.

Our cheese-making must of necessity be very different from the cheese-making in many other sections. Canada and the people of the West are making cheese largely for export. They employ a considerable acidity, and they are a long time in making their cheese. They seek to make a cheese that shall keep for six months, perhaps, that shall be rather dry, and that shall be hard, so that it can stand a long sea voyage and be held for a long time in the foreign markets, and yet be a good cheese. Arnold, and all of our best cheese-makers, abandoned this method for home consumption. I found that the people of Wisconsin were making for home consumption the Brick cheese, the Swiss cheese, and the Limburger cheese. Cheese is consumed in large quantities in the West, and they were making it under conditions that gave them a soft, rich, mild flavored cheese. The Limburger is a cheese of strong flavor, but the Brick cheese is much like our mild, full cream cheese. The Swiss people made their Swiss cheese, a cheese that was full of holes as large as the end of your finger, a condition that for export would be disastrous. They had generated so much gas, and broken it down so completely that it became easily digested, and was sought for largely among the foreign population. The Brick cheese, made a foot and a half long, eight inches wide, and some six inches in depth, so that pieces can be cut from the end, is mild, and to me seemed rather insipid.

If we should attempt in our Maine dairying to make cheese as the Canadian and the Western people are making them, our people would never become great consumers of cheese, as we hope to have them become. We must make a cheese that is adapted to the use of the people here in our home markets first, because I would not seek for a foreign market.

The best of our cheese even, after it is made must go into damp curing rooms. Where we put the cheese into dry curing rooms we dry them out and get a condition of hardness that we do not want, and with that condition of dryness we lose the flavor for which we are seeking. The dampness is secured by moistening the floor very frequently in dry weather. It is not a difficult matter, but there should be cheese enough so that the entire attention of some one shall be given to the work. The floor should be kept moist enough so that there shall be sufficient humidity. We do not want a cheese that has a hard crust on the outside and is soft in the center, because when we get that condition we get something that is undesirable. The center is raw, while the outside is over mature, and this, of course, is unsatisfactory.

Regarding the matter of the size of the cheese, we want cheeses that are not too large. It is just as easy for us to make a cheese of the size of Young America, 10 pounds, or the second size, twelve or fifteen pounds, as to make a larger cheese. The cheese should be of sufficient size so that the consumer can buy a whole one. And we should make that cheese in such a way that even though it is small there shall not be too much rind. I believe that when we are supplied with a cheese that is mild in flavor we shall cultivate the desire for cheese and become extravagant users of it, for the reason that it will not be an artificial desire. We already have the desire for it, and when we can place before our people the means for gratifying this desire, they will surely gratify it. Go back into our country neighborhoods here in Maine, where the farmers and the farmers' wives are manufacturing cheese for home consumption, and what do you find in the homes of these old-fashioned people? You find the cheese cut up and put on to the table in junks, almost in proportion to the meats and vegetables on their tables. They use it as an article of food and not as a luxury, and we shall surely use it in this way when we are provided with a desirable article. A great many people cannot eat cheese, and what is the reason? Simply because the amount of acidity in the cheese is so great that it interferes with the digestive process, and gives them pain. We have a cheese at home that we obtained at the Carroll cheese factory. I am glad to say where it came from because it is the product of one of our country cheese factories. I saw the cheese up there and got a taste of it, and liked it so well that I had them select one and send to me, and we are eating almost as much cheese as bread. Nobody thinks it hurts him. People who ordinarily cannot eat cheese say that they think this cheese is an aid to digestion. When a cheese of that quality finds its way to the tables of our people, whether they are rich or poor, laboring classes or whatever classes, they are going to use it, and use it extravagantly. Yet it is not going to be an extravagance, because as an article of nutrition it is worth all it costs.

Right here is an opportunity for us to find a market for the products of our cows and our farms, and a reason why we need not be discouraged at the dairy outlook which the statistics of yesterday would seem to indicate. Here is an opportunity for us to make this mild article of cheese and supply the home and the export market with something that is desired. And instead of making a cheap butter and forcing it upon a market that is already surfeited, we can sell something that shall bring us better returns. It is a legitimate line of business. I do not want you to understand that I would advise that we change our business from butter dairying, in which we have thriven so well, wholly into this line of cheese-making. I do not believe it is necessary. But I do believe that it would be wise for these smaller creameries to provide themselves with good curing rooms, and invest perhaps from three to five hundred dollars in the appliances required in cheese-making, and so use up the surplus milk during the summer months in cheese, holding their cheese for a few months until it becomes cured, and getting for it even the prices that we are securing to-day. And I do not believe there is any difficulty in getting a higher price than ten cents a pound. But we cannot do this if we continue to do what many of our cheese-makers are doing at the present time. Anybody can coagulate milk and get it into the cheese hoop and try to cure it. In the early part of the season the tendency is to make a cheese that shall cure and be put upon the market when it is ten days old. What kind of a cheese do we have? We have got our milk into a solid form, and hurried the process of digestion so much that it can be consumed; but on the 11th day it is farther advanced, and in a few days it will became a putrid mass unfit for use. What is the condition of the new cheese when it is put into the hoop? It is a mass composed of about one-third casein, one-third fat and one-third water. Is the curd when it goes into the hoop digestible? You might as well try to digest an old rubber boot as to try to digest and get nutrition from a new made cheese. The process of digestion has to go on until sufficient time has elapsed for the cheese to be made easily digestible when it is taken into the human stomach. The work is hurried in many of our cheese factories. The cheese is not cooked sufficiently. Why do we cut the curd into cubes? So that when heat is applied that heat shall cause those cubes to contract and press out the surplus water. In trying to make a cheese that will give them as many pounds as possible from a certain quantity of milk, many cheese-makers do not cook that curd long enough so that it expels the water, but the water remains there. This is one of the causes of sour cheese. You know that we are liable to get a cheese that is hard, a cheese that is strong in flavor, or else a sour cheese. Two or three years ago we purchased from one of the largest cheese factories in Maine three cheeses that were desirable. This year we purchased some cheese from that same factory, expecting to get the same cheese, and we got sour cheese. I made inquiry and found that they had another cheese-maker. I do not know anything about the conditions that caused them to change cheese-makers, why a man that was an expert was changed for a man who was giving us sour cheese, and I claim that nobody wants sour cheese. There is no market for the output of any factory that makes such cheese.

The cheese-maker must put himself in training and become an expert workman. Such a workman can command good wages. Makers who do not have skill and conscience must not be tolerated. With good curing rooms and appliances the skillful workman can transfer our good, but low priced summer milk, into cheese that will yield us more money than has been received from the milk when made into summer butter.

CHEAPENING THE COST OF PRODUCTION.

By Frank S. Adams.

We all know that the margin between profit and loss in our dairying is growing less and less every year. The price of the product is going down, and we must work along some lines to cheapen the cost of production. The first thing that I will mention is that we should keep better cows. Every dairyman in the State of Maine must know that this is so, and it is strange to me that some dairymen will hang on to some of these all-purpose cows and try to compete with the man who is getting into a breed of dairy cows. It would be just as sensible for a man to try to cut his hay with an old-fashioned scythe and compete with the man who is running a mowing machine. We must have the best dairy cows.

Then we want to raise more feed on our farms. I have been brought up with the idea of home production instilled into my mind. I believe we can economize to a great extent in our feeding by raising more of our feeds. It is said by some that Maine is not a grain State; we can buy grain cheaper than we can raise it. And the western trade in grain has assumed enormous proportions. Go to any of our grain mills and you often have to wait three-quarters of an hour for your turn. In my judgment we can in a great measure stop this purchasing of western grain. I know that we have some conditions to compete with in raising grain which they have not in the West, but our conditions are not so far apart as they were before the introduction of improved machinery.

In looking over the report of last year I find that the average yield of corn per acre in this country is about 20 bushels, and I am going to speak for a few minutes on corn raising.

We have now all the improved machinery which is used in the West, and the only difference in the cost of raising corn in the State of Maine and in the West is in the cost of fertilization. While they raise corn in the West and get good crops without fertilizers, we are obliged to use some; but that increased cost is more than made up by the increased yield that we get. We think if we do not get more than 40 or 50 bushels that we do not get much of a yield. I think the farmers are making a mistake in buying corn. I want to make the statement that the dairy farmer never ought to buy one bushel of corn or corn meal to feed to his dairy cows. Corn meal belongs to that class of food that is called the carbohydrates, and we can raise it in abundance. And we have this advantage over the western farmers,—we are careful of our stover and they are not, they waste it. Did you ever reflect that there are 90,000,000 acres of corn in the United States, enough, if the fodder were carefully preserved, to feed all the cows, oxen and steers one-third of the year? and we have to feed, as a rule, only about two-thirds of the year. The western farmers are wasteful of this stover, but thanks to these institutes and dairy conventions we have learned to appreciate the value of the corn stover. We have learned that it is as valuable as the ear itself. As long as we have so much waste land in the State of Maine,—and I mean by waste land the land that is not producing paying crops,—I think that we should utilize it in the production of feed for our cows. In the older counties of the State, especially, we have land that is not under cultivation; it is mowed over, but it will not raise enough to keep a grasshopper alive. This soil contains valuable plant food, which should be made available by tillage. And there are swampy places on our farms that need to be drained in order to be utilized. I have raised good corn on land that, before it was drained, you could not drive a team over in the driest time in summer. All it needed was to be drained. Much of this waste land contains valuable plant food and only needs to be drained and tilled. And here I want to consider the question of tillage. The farmers in Europe have caught on to that more than we have in this country. This plant food in the soil that is not available can be made available by more tillage.

The next point that I would speak of is unemployed labor. What I mean by unemployed labor is that the farmer himself should work more. We cannot afford to keep a team and let it stand in the barn when we can be bringing out the plant food by tillage.

I was interested in the remarks yesterday in regard to Danish competition in our product of butter. When we get a surplus in our country we must look to foreign countries for an outlet, and national legislation cannot help us. I had a Dane working for me a year ago this winter. He came right from Denmark, and his father was a dairyman. I found that they lived very cheaply, the principal diet being pea soup, and farm wages are much cheaper than in this country, only about half as high. It looked to me like a serious matter if we were to compete with these Danes who hire their farm labor for $75 a year and live on pea soup. But I found out that they could not raise corn, and I am not afraid of competition with any country in the world that cannot raise corn, in the line of dairy products, because I believe that corn is the sheet anchor of our dairy industry. Peas are raised in Denmark in great abundance, as they are a native of cold countries. I believe that there is a great opportunity for the farmers in the State of Maine to raise more peas, to feed to their stock. Peas and oats are just suited to grow here in the State of Maine, and peas are very rich in the kind of cattle food in which corn is lacking, and by this combination,—corn, and oats and peas,—we get almost a balanced ration to feed to our dairy cows. And this makes a good rotation: corn, then oats and peas, and seeding down to grass, and it means more land under the plow. It does not mean smaller hay mows, but larger hay mows; oftener seeding to grass, more corn and more oats and peas.

One point more, and that is in regard to soiling crops. I believe that one great secret of success in dairying is to give our dairy cows a variety of foods. And by this combination of ensilage, soiling crops, and oats and peas, we get an excellent variety of foods. We do not wish to live on one kind of food, neither does our stock. The same machinery that we use for ensilage can be used for soiling crops, they go right along together. You that have not tried soiling crops, if you have a half acre of some old worn-out field or pasture that you can plow and plant to corn to feed to your dairy cows when the grass is short, and will do this, I assure you that you will be converted to raising soiling crops.

SECRETARY B. W. McKEEN.—I would like to say just a few words, in addition to what Mr. Adams has said, in relation to the corn crop and in relation to competition. Of course we are all aware that it makes no difference where we get this corn that we are feeding our animals, whether from the silo or the grain bin. A farmer in Maine or New England, in raising corn and putting it, entire, into the silo, and feeding that corn to his dairy cows, is feeding the same materials in practically the same condition, and as far as the palatability is concerned in better condition than he would be if he had taken that corn and dried it, husked it, taken it to the mill and ground it, and then fed it to the cows in the form of meal. So you see we can grow our grain very cheaply indeed, because it is a matter of proof that an average field of corn on our Maine farms can be cut and put into the silo ready for feeding in the winter as cheaply as it can be cut and shocked in the field ready for drying, leaving out all of the extra work between the shocking of the corn and the putting of that corn into the bin in the form of meal. I believe that this question of the availability of the corn plant for the Maine dairyman is something that we should consider more fully than ever.

I was very glad indeed to be able to give you at this time Major Alvord's lecture in relation to State aid for the dairy industry, and to have him note, as he did so very fully, the conditions under which we are meeting competition abroad. But I do believe that the Maine dairyman, as far as a practical chance for selling his goods is concerned, has plenty of room for those goods at his very door. I care not how much butter from the West, from New York and other states, goes into our foreign markets, the more the better. But I believe that we, here in Maine, have markets at our very doors that ought to be an encouragement to us. As a matter of fact one of the creameries of this State has bought tons and tons of butter from Northern New York, shipping it to the creamery and putting its stamp upon it, and selling it to its regular customers, the present season. Of course it was at a time when this creamery was selling more or less sweet cream, but it shows the extent of the demand for those goods in the immediate vicinity where they were made; and I believe when we figure up the amount of the export and import of dairy goods in our State we shall find that we import more than we export during the year. And until this condition of things shall change, until there shall be a far larger amount of butter and cheese made within our State, I believe that we have no reason at all to fear competition from any other state or from any other country.

J. W. DUDLEY.—I was wondering this morning, in looking over the program and seeing that Prof. Gowell was to talk on the cheese question, what he would have to say in regard to it. In our county several years ago we had quite a number, perhaps eight or ten, cheese factories in quite successful operation. But I think that at the present time there are none in operation, with the exception of one at Caribou, where for two or three months this summer they made a little cheese, I believe. In the times when cheese factories were running, there was quite a large amount of cheese consumed in our county, and even amongst the farming population. Almost any of us farmers would use a cheese, of the size they used to make, about twenty pounds, in a few weeks. But since these factories have closed I do not believe there is one-third as much cheese consumed in the county as there was at the time the factories were in operation. I know that in my own family we cannot eat the cheese that we buy. I brought home a small amount this summer, I think it was New York cheese, and it was about like eating leather, it was so tough.

I think it would be a good thing if some encouragement could be thrown out to the farmers that would induce them to go into this business. I do not mean the dairymen particularly, but we have in our county, and I presume you have in other parts of the State, men that could furnish milk for cheese factories that would not take special pains to furnish milk for butter factories. So I think that would be opening up a market, as we might say, for that product, which would help out in the line of butter-making.

I am glad to hear all these questions discussed in this meeting, and I am well satisfied that it will be for the interest of our State to have them brought before this convention.

L. O. STRAW.—It is now twelve o'clock, and I will take but very little of your time. I believe in specialties. I believe it is one great failing of ours in the State of Maine that we try to dabble in all things. We farmers are trying to raise too many things. We raise a little wheat, a little corn, a few potatoes and a few beans, and we raise just enough to carry us through the year. I do thoroughly believe that we should be specialists in some particular thing. If we have good opportunities to dispose of our cream we should apply ourselves to dairying. If we are in a location where we can raise good fruit, we should be specialists in fruit raising. If we are in a location where we can produce milk for a cheese factory so that we can furnish the people with cheese, and get a good price, we should adopt that line of work. At any rate we should be specialists.

I would like to inquire in relation to a silo. I am intending to build a new barn in the spring, and I have been inclined to a silo. Brother McKeen has filled me thoroughly with the silo idea. Yesterday I heard a gentleman say that only a few years ago there were eight silos in his town, if I understood it correctly, and to-day there is not one. Now I would like to inquire why the silo is a benefit in one part of the State and is not in another part. I do not know the gentleman who made this statement, and do not know where he came from, but I would like to know why the silo is a benefit in one place and is not practicable in another. If there is any gentleman who can help me out in this particular I shall be very glad.

F. S. Adams.—I do not know the condition that exists in that locality, but I do know from my own experience that there is a great difference in ensilage. The man that raises this large immature corn, that does not get anywhere near ripe, does not even silk out, will not be pleased with the silo; he will go out of the business, because he will decide that he is working hard and handling a large amount of water for a very little food. In fact, in my judgment, it is an expensive way of watering cattle. The man who raises the kind of corn that is native to this climate and will come to maturity, and, after it is put into the silo in good condition, feeds it intelligently to good cows, never will give up his silo until he gives up his dairy business. That is my judgment. When silos were first built they advocated raising this large corn, as you would get such a large yield to the acre, 20 tons or more. Many farmers raised it to a large extent, and were not satisfied, and some did give up the silos. But we have learned not to judge by the bulk we are getting.

Ques. How many tons of our native corn can you raise to the acre on an average?

Ans. I think we can average 12 tons all right.

Ques. What is the condition of the corn when it is ready for the silo?

Ans. The best way that I know is to let it remain just as long as it can and have the stalks perfectly green. Just as soon as the stalks show signs of ripening off, and the ears are getting a little too hard for table use, it should be put into the silo.

Ques. How many years have you fed your stock from the silo?

Ans. Six years. I made the mistake at first of planting some of this large corn. I had a tester and weighed the milk of the cows and tested it, and kept a very accurate account both when feeding the native corn and this large corn without ears, and I made up my mind that it was not profitable for a Maine farmer to raise the large corn for ensilage.

FRIDAY, P. M.

DAIRY PRODUCTS COMPARED WITH OTHER FOOD MATERIALS.

CHAS. D. WOODS, Director Maine Agricultural Experiment Station.

The farmer should be well nourished. He grows a considerable part of his own food, and can with little expenditure of labor and money have an healthful variety. The farmers of this State and, indeed, of this Nation, have all they need to eat, and in general more than they need, but unfortunately their selection of food is not nearly as good as it might be. In order to help to a better appreciation of a class of food materials always at the disposal of the farmer, this paper has been prepared. This will be more readily understood after we see how it is that the food nourishes the body; how much nutriment there is in the different food materials; what are the different kinds of nutritive ingredients or nutrients the food materials contain; what are the demands of the body, and what kinds and amount of food materials will best meet these demands.

This means a lesson in physiological chemistry, a lesson which begins with the rudiments of the science of nutrition. These rudiments have to do with protein, fats and carbohydrates, with flesh formers, fuel values, dietary standards and the like. When these are put together, we shall be talking of the different food materials as meat and potatoes, and bread and milk, of properly balanced diet, of combinations of food to meet the demands of different people of different ages, sex, and occupation.

These fundamental principles are given at considerable length in a Farmers' Bulletin (U. S. Department of Agriculture, Farmers' Bulletin No. 23 on "Foods—Nutritive Value and Cost"), which will be sent on application to the secretary of agriculture at Washington, D. C. The following simpler discussion of this alphabet of nutrition has been used in part by the speaker in another place.

FLESH FORMERS—PROTEIN.

For breakfast this morning we had beefsteak and potatoes. With these were bread and butter and one or two cups of coffee with some sugar in it. Now this food has its use, namely, to build and repair the bodily machine and keep it running. The bodily machine is made of blood and muscle and bone and brain. The frame work of the body we will call its tissues, of which the chief is flesh, meaning by this, lean flesh, muscle, tendon and so-called animal matter of bone, and the like. In the growing body these are being built up, and in both the adult and the child they are being constantly worn out and repaired. The materials in the food which build up the body and repair its waste we will here call flesh formers, although more common names in scientific treatises are protein, proteids or albuminoids.

Now we can live on bread, meat, milk and a great many other materials. These must therefore contain the flesh forming substances. Chemical analysis shows us very clearly what those flesh forming substances are, and how much of them there is in a pound of meat or a quart of milk. To-day we have tables of the composition of food materials which show the percentages of flesh formers in all of our ordinary food materials.

But what are the flesh forming substances in food? One kind is found in the lean part of meat and makes the basis of muscle. Chemists call this substance myosin. If we take the white of eggs and dry out the water, the residue, which is called albumen, is a flesh forming substance. If we put rennet in milk and separate from the curd the water, sugar and fat, the residue consists mainly of a flesh forming substance which is known as casein. Make wheat flour into dough, knead it for a long while with water, and remove the starch and sugar and there will remain the gluten with a little oil and some other substances. This gluten is the flesh forming substance of wheat. Compounds similar to gluten occur in rye and barley and corn and rice and potatoes, and in our vegetable foods generally. If these materials did not contain flesh formers, they would have very little value by themselves alone for food.

We could not live upon them unless we used with them some other substances to supply flesh formers. Certain classes of people, including many tribes of negroes in Africa, and indeed a large number of the negroes and the poor whites in our own Southern states, subsist upon a diet which contains very little of the flesh formers. They live on a low nutritive plane. One thing that is needed for their elevation is a better balanced diet.

Chemists have devoted a great deal of study to these flesh forming substances, and find that they all contain a certain list of chemical elements which we call nitrogen, carbon, oxygen and hydrogen. The characteristic element of them all is nitrogen. They are nitrogenous substances. In the laboratory we call them all protein compounds.

To sum up,—the flesh formers, the nitrogenous substances and the protein compounds of our food are such as the myosin of lean meat and fish, the casein and albumen of milk, the materials which make up the gluten of wheat, and similar substances in other food materials, animal and vegetable. Because of the similarity of many of them to the albumen of egg, they are sometimes called albuminoids. Another name which is frequently given to them is proteids; a more common one is protein, but for our present purpose we will simply call them flesh formers. They are the materials which build up the framework of the body and repair its wastes. From them muscle and sinew, blood and bone are formed.

FUEL INGREDIENTS OF FOOD—FATS AND CARBOHYDRATES.

It is one thing to build a machine and keep it in repair. It it another thing to keep it running. For this it must have power. A steam engine gets its power from its fuel, coal or wood, as the case may be. The bodily machine derives its power from the fuel ingredients of its food. The chief fuel ingredients are fats and oils, starches and sugars. The beefsteak we had for breakfast contained flesh forming substances, but it also had more or less fat. The bread contained some gluten, but it had also starch and a little oil. The butter which we put on the bread is a fatty substance. The sugar with which we sweetened our coffee was a substance allied to starch.

The fats and oils, the sugars and starches are burned in our bodies just as truly as the coal and wood are burned under the boiler of the engine. The men who deal in abstract science tell us that all of these substances contain energy; protential energy, it is called. When the coal is burned in the furnace or the food is burned in the body their potential energy is changed into other forms, called heat and mechanical power. When the coal is burned in the furnace, its potential energy is transformed into the heat, and part of that is changed into the expansive power of steam which moves the engine, draws the railway train and keeps the wheels of the factory in motion. When the fuel is burned in the body, its potential energy is transformed into the animal heat which keeps the body warm, and into the muscular power with which muscular work is done. The fats of meat, the fat of milk, which makes butter, the oil which is abundant in the olive and in the cotton seed, and which occurs in smaller proportions in wheat and corn and particularly in nearly all of our food materials, are fuel ingredients of food. The starch which makes up the bulk of the nutritive material of wheat and rice and corn and potatoes, and the sugars, of which there is a little in wheat, considerable in milk and a large amount in the sugar cane and sugar beet, are, likewise, fuel ingredients. Chemists group sugars and starches together and call them carbohydrates.

The carbohydrates and the fats or oils are the chief fuel ingredients of the food. They all consist of three chemical elements, carbon, hydrogen and oxygen. The chief of these is carbon, and hence the fats and carbohydrates are called carbonaceous food materials. The carbonaceous food ingredients, then, are the ones that serve for fuel, while the nitrogenous ingredients are the flesh formers. This is not the whole of the story; indeed, it is only a small part of it, but it is the most essential part. We ought, however, to tell a little more and explain that the flesh formers can also serve as fuel. A dog can live on lean meat and get from it what is needed, not only to build his body and keep it in repair, but can also burn it and utilize its potential energy. For that matter we do the same thing with all the flesh formers of our food. When we get through with them for building material, and, indeed, without using them for building material, we burn them in the body, and they supply us with heat and strength. In other words, the flesh formers can fulfill the two great purposes of nutrition, the building of tissue and the yielding of energy. But the fats and the carbohydrates cannot build tissue. The carbohydrates can be changed to fats in the body and can with the fats be stored in the body in the fatty tissues, i. e., the tissues which hold fat, but the fat is stored there for fuel. It is the reserve fuel which the body keeps for its needs. From this fact, namely, that the flesh formers can also serve as fuel, but the fats and carbohydrates, or fuel ingredients, cannot serve as building material, there is one very important inference. We need, and, for proper nutrition, must have a large enough proportion of flesh formers in our food.

FUEL VALUES OF FOOD.

The values of the different food materials and of their several ingredients for serving the body as fuel may be measured by their ability to furnish heat when burned. Their fuel value is readily learned by burning the materials in an apparatus called a calorimeter and measuring the heat produced. In this process of measuring the fuel value of different substances, advantage is taken of the fact that it requires a definite amount of heat to raise a pound of water one degree. The heat unit used in these measurements is very nearly the amount of heat necessary to raise one pound of water four degrees Fahrenheit. This unit of fuel value is called the calorie. Instead of a heat unit we might use a unit of mechanical power, as a foot ton, which is the power that would raise a ton one foot. One calorie equals 1.52 foot tons, nearly. In other words, the heat which would raise the temperature of one pound of water four degrees Fahrenheit would, if transformed into mechanical power, suffice to lift 1.52 tons one foot. The fuel value of a pound of starch or sugar (carbohydrates) is very nearly 4.1 calories. The fuel value of a pound of fat is about 9.3 calories, or two and one-fourth times that of the same weight of carbohydrates. A pound of flesh formers (protein) has about the same fuel value as a pound of starch or sugar.

DEFINITION OF FOOD.

Food may be defined as material which, when taken into the body, serves to either build tissue or yield energy. This definition is broad enough to include all the ordinary food materials, since they usually contain both flesh formers and fuel constituents. It includes meat and bread, because they both build tissue and yield energy. It includes sugar and starch and alcohol because they yield energy although they do not form tissue. It excludes meat extract, tea, coffee, pepper and spices, because they do not build tissue or yield energy, although they are frequently useful adjuncts to food.

INGREDIENTS OF DIFFERENT CLASSES OF FOOD MATERIALS.

Usually foods contain both flesh formers and the materials which serve as fuel. Olive oil, butter, lard, starch, sugar, and a few other materials consist almost entirely of fuel ingredients and serve almost wholly to yield energy in the form of animal power and heat. A few foods, such as codfish and white of eggs, consist almost entirely of flesh formers, with little or none of the materials which yield energy. Obviously a food which contains none of the flesh formers will not meet the demands of the body, for while it might furnish the needed energy for muscular work, and provide fuel to keep the body warm, it would not in any way meet the needs of the body in building new and repairing old tissues. In general, the vegetable foods consist largely of the fuel ingredients and contain relatively little of the flesh formers. A marked exception to this occurs in the legumes or pulse family of plants. The common members of this family contain relatively large quantities of the flesh formers. Familiar illustrations are found in such valuable foods as peas, beans, peanuts, lentils, etc., some of which are spoken of in detail beyond. Seeds, including nuts, usually contain relatively more of the flesh formers than do the other parts of plants. The vegetable oils are also most abundant in seeds.

The animal foods generally contain relatively large amounts of flesh formers. The fuel constituents of animal foods are chiefly fats. With the exception of milk, animal foods contain almost none of the carbohydrates. The large amount of the flesh formers (protein) which the animal foods contain admirably adapts them for the construction and maintenance of the body. The energy needed to maintain the temperature of the body and yield muscular power might possibly be furnished by the flesh formers themselves, but it is much better furnished by the nitrogenous materials. The fat (fuel constituents) of animal foods may be so combined with the protein (flesh formers) as to meet the requirements of the body without waste, but vegetable foods are especially adapted to supply the food needed for fuel.

Some of the very fat meats, as fat pork, contain little else than fat, and hence have little or no value as flesh formers, but serve as very concentrated fuel. Fat pork, butter, lard, suet and oils, such as olive and cotton seed oils, have the highest fuel value of all the more common food materials.

DIGESTIBILITY OF FOOD.

In general, the animal foods are somewhat more digestible than the vegetable foods. The protein of ordinary meats, for instance, is practically all digested when it is eaten in moderate quantities by healthy persons, but the same persons might digest only nine-tenths of the protein of wheat flour made into bread, and not more than three-fourths of that of potatoes. The fat of meats is less completely digested. The sugar and starch of vegetable foods, properly cooked, is very easily and completely digested.

THE FITTING OF FOODS TO THE NEEDS OF THE BODY.

Different people have different needs for nutriment. All are alike in that they must have protein for the building and repair of the bodily machine, and fuel ingredients for warmth and work. But they differ widely in the amounts and proportions they require, and even among those in good health, there are many who are obliged to avoid certain kinds of food, while invalids and people with weak digestion must often have special diet.

For people in good health and with good digestion, there are two important rules to be observed in the regulation of the diet. The first is to choose the things which "agree" with them, and to avoid those which they cannot digest and assimilate without harm. The second is to use such kinds and amounts of food as will supply all the nutrients the body needs, and at the same time avoid burdening it with superfluous material to be disposed of at the cost of health and strength.

For guidance in this selection, nature provides us with instinct, taste and experience. Physiological chemistry adds to these the knowledge—still new and far from adequate—of the composition of food and the laws of nutrition. In our actual practice of eating, we are apt to be influenced too much by taste, that is, by the dictates of the palate; we are prone to let natural instinct be overruled by acquired appetite; and we neglect the teachings of experience. We need to observe our diet and its effects more carefully, and regulate appetite by reason. In doing this we may be greatly aided by the knowledge of what our food contains, and how it serves its purpose in nutrition.

What kinds of food best agree with any individual is a matter to be found out by experience. Milk is for most people a very wholesome, digestible, and nutritious food, but there are persons who are made ill by drinking it; they should avoid milk. The author knows a boy who is made seriously ill by eating eggs. A small piece of sweet cake, in which eggs have been used, will cause him serious trouble. The sickness is nature's evidence that eggs are, for him, an unfit article of food. Some people have to avoid strawberries. Indeed, cases in which the most wholesome kinds of food are hurtful to individual persons are, unfortunately, numerous.

How it is that food which contains nothing unwholesome can be so harmful has always been a mystery until, within a few years past, chemistry has begun to explain the changes that food undergoes in the body. It appears that in their course through the body the constituents of the food are subject to a great variety of chemical changes, and that some of the compounds formed may be at times harmful in one way or another. Some of the compounds produced from the food in the body may be actually poisonous. Different persons are differently constituted with respect to the chemical changes which their food undergoes and the effects produced, so that it may be literally true that "One man's meat is another man's poison." Every man must learn from his own experience what food agrees with him and what does not.

On the other hand, some foods have at times a great value outside of their use for nourishment. Fruits and garden vegetables often benefit people greatly, not as nutriment merely, for they may have very little of actual nutrients, but because of the vegetable acids or other substances which they contain, and which sometimes serve a most useful purpose.

For the great majority of people in good health, the ordinary food materials—meat, fish, eggs, milk, butter, cheese, sugar, flour, meal, potatoes and vegetables—make a fitting diet, and the main question is to use them in the kinds and proportions fitted to the actual needs of the body.

Food does more than to build tissue and yield energy. What it does in other ways—its value as medicine rather than nutriment—this is not the place to discuss.

STANDARDS FOR DAILY DIETARIES.

Physiologists have attempted to estimate how much of nutriment is needed per day by people of different classes and occupations. These estimates are based upon (1) weighings and analyses of the food actually consumed by people supposed to be well nourished, and (2) actual experiments in which persons receive different kinds and amounts of food and the effects are noted. The estimates thus made of the demands of people of different age, sex and occupation are expressed in terms of nutrients and energy. The standards correspond to those that have come into common use for calculating rations for domestic animals. But, unfortunately, the number of experiments and observations made thus far with men, women and children are much less numerous than those with horses, cows, sheep, swine, dogs and other animals. Still the data at hand will suffice for general estimates. Assuming that the body requires enough of flesh formers (protein) to make up for that consumed in the body, and enough energy to supply the demands for heat and muscular work, the following proportions of flesh formers and fuel values have been suggested for the daily food of a man.

	Flesh formers, (Protein) lbs.	Fuel value, Calories.
Man with light muscular work....	.25	3,000
Man with moderately hard muscular work......................	.28	3,500
Man with hard muscular work....	.33	4,500

Of course these figures do not represent a rule or receipt to follow closely. It is not expected that any man will take a table of the amounts of nutriments and protential energy in different food materials and regulate his diet so as to eat just enough to give him just the amounts called for in these standards. The standards are useful, however, in showing what the best information of to-day, collated in this country and in Europe, indicates as to the general needs of the body for diet.

The fundamental principle of the subject has been stated in a few words:

"(1) Food is that which, when taken into the body, builds up its tissues and keeps them in repair, or which is consumed in the body to yield energy in the form of heat to keep it warm and create strength for its work.

"(2) The most healthful food is that which is best fitted to the wants of the user. To be adapted to his wants, the food must supply the different nutritive ingredients, or nutrients, in the kinds and amounts needed by the body to build up its separate parts, to repair them as they are consumed by constant use, and to yield energy in the form of heat and muscular power. The ingredients should also be supplied in forms which the person can easily digest, and which will "agree" with him. If the nutrients are not supplied in the right proportions, or if they are not in easily digestible forms, or if they yield material which does not agree with the user, injury to health and strength will result.

"(3) The cheapest food is that which furnishes the most nutriment at the least cost.

"(4) The most economical food is that which is both most healthful and cheapest."

NUTRIENTS IN FOOD MATERIALS.

The limits of this article do not allow a full discussion of all these topics. We may, however, consider briefly the amounts of nutriment in some of the more common food materials, and some of the ways in which they may be combined in a fitting diet.

The quantities of nutrients in a few food materials of different classes are stated in the table which follows. They are taken from a compilation of several thousand analyses of American food materials.* The figures show the amount of refuse (bone, etc.), flesh formers, and the fuel values, in one pound of each. It is understood, of course, that the figures for each material represent the average composition, and that the different specimens of the same material may vary considerably in composition. These variations are wider in meats than in most vegetable foods.

CHEMICAL COMPOSITION OF A FEW COMMON FOOD MATERIALS AS FOUND IN THE MARKETS.

Food materials.	Refuse.	Water.	Protein.	Fat.	Carbo-hydrates.	Ash.	Fuel value per pound—calories.
	%	%	%	%	%	%	
Whole milk	......	87.0	3.3	4.0	5.0	.7	325
Skimmed milk	......	90.5	3.4	.3	5.1	.7	170
Butter	......	......	......	82.4	......	......	3475
Cheese, whole milk	......	34.3	26.1	33.5	2.3	3.8	1940
Cheese, skimmed milk	......	45.7	31.5	16.4	2.2	4.2	1320
Beef chuck, medium fat	16.8	56.1	15.8	10.5	......	.8	735
Beef loin, medium fat	13.1	58.2	16.7	11.1	......	.9	780
Beef ribs, medium fat	20.8	43.8	13.5	21.2	......	.7	1145
Beef round, medium fat	7.2	60.7	18.3	12.8	......	1.0	880
Veal cutlet	4.0	65.6	20.0	9.5	......	.9	775
Veal loin	17.3	57.2	16.0	8.6	......	.9	660
Veal shoulder	19.5	56.8	16.2	6.5	......	1.0	575
Mutton leg, medium fat	18.4	51.2	14.9	14.7	......	.8	900
Mutton loin	16.0	42.0	13.0	28.3	......	.7	1435
Mutton shoulder	22.5	47.9	13.4	15.5	......	.7	995
Pork loin, fresh, medium fat	16.3	42.8	14.0	26.2	......	.7	1365
Smoked ham, medium fat	14.4	34.9	13.3	33.4	......	4.0	1655
Chicken and fowl	26.6	47.2	14.0	11.5	......	.7	745
Eggs	11.2	64.8	13.3	9.8	......	.9	660
Blue fish	48.6	40.3	9.8	.6	......	.7	205
Cod fish (fresh)	29.9	58.5	10.6	.2	......	.8	205
Oysters, out of shell	......	88.3	6.0	1.3	3.3	1.1	230
Corn meal, bolted	......	12.4	9.3	2.4	74.9	1.0	1665
Rolled oats	......	7.2	16.6	7.2	66.9	2.1	1855
Wheat flour	......	12.0	11.4	1.1	75.1	.4	1655
Wheat bread	......	35.3	9.4	1.2	53.0	1.1	1210
Potatoes	15.0	66.3	1.9	.1	16.0	.7	335

*Bulletin 28 of the Office of Experiment Stations, U. S. Department of Agricul ture, "TheChemical Composition of American Food Materials" by W. O. Atwater and Chas. D. Woods.

Meats.—Meats vary greatly in composition with the kind, breed, age, fatness and other conditions of the animals. There is also a very great difference in the chemical compositions of the different "cuts" or portions of meat from the same animal. One important variation is in the proportion of bone. This is practically inedible, except as it may be utilized in making soups or gelatin.

Beef.—This is the most important kind of meat. It ranks, however, among the more expensive of the animal foods. It is an especially valuable source of flesh formers.

Veal and Mutton.—In general, veal is leaner and mutton fatter than beef. Comparing market prices with nutritive value, the cost of the nutrients in veal or mutton is not greatly different from those in beef.

Pork.—Pork is the fattest of all meats. Salt pork, backs and other fat cuts, contain very little else than fat. The fat of these makes on the average 87 per cent of the weight, the remainder being chiefly water and ash, with very little protein; the latter being in narrow "streaks" of lean and the rind. Ham is leaner but it contains a good deal of fat. Shoulder is much like ham, except that it has relatively a little more bone. Fresh sparerib contains a good deal of lean meat but it is still a very fat food. Pork is generally the cheapest of meats, but it must be noticed that it contains relatively little of the flesh formers, and in consequence can not take the place of lean meat, fish, skim milk, beans and peas.

Fish.—The ingredients of the flesh of fish are essentially the same in kind as those of beef or mutton. The chief difference is that flesh of fish contains relatively less fat and more water than ordinary meats. The fatter kinds of fish, as herring, mackerel, salmon and shad, approach quite nearly to medium fat beef. As found in the markets, fish generally contain more bone and other inedible material than do most other meats. Canned salmon compare favorably with meats in composition.

Poultry.—The flesh of chicken, fowl, goose, duck and turkey contains considerable amounts of flesh formers and a fair amount of fat. They are valuable because of their protein as well as their flavor and tenderness, and when the market price is not too high, are desirable sources of animal flesh formers.

Eggs.—The eggs produced on the farm are easily turned into money and hence do not form a very large part of the farm dietary. Eggs contain large amounts of flesh formers, and in the seasons in which they are abundant and of low market value, are economical kinds of food.

Vegetable Foods.—So far as the proportions of actual nutriment are concerned, the vegetable foods differ from the animal foods mainly in two respects. (1) The vegetable foods throughout generally contain less of the flesh formers and more of the fuel ingredients; (2) the vegetable foods are generally not as completely digested as the animal foods. There are, however, exceptions to these rules.

Wheat Flour and Bread.—Flours differ greatly in their chemical composition and their nutritive value with the kind of wheat and the process of milling. Bread flours made from spring wheat are usually richer in flesh formers (gluten and other protein compounds) than pastry flour from winter wheat. Wheats grown in the northwest are richer in flesh formers than those grown in California and the east.

A pound of average bread flour contains .113 pounds of flesh formers, and has a fuel value of 1,640 calories. A pound of bread made from this flour in the usual way would have about .095 pounds flesh formers and a fuel value of 1,200 calories. The bread contains more water than the flour; a pound of flour will make a pound and a third of bread. This accounts for the higher nutritive value of the flour as compared with bread, weight for weight. Bread is a material of relatively high food value. One pound of bread has as many calories of fuel value as seven pounds of skim milk, but it has less flesh formers than three pounds of skim milk. Three pounds of ordinary wheat bread would furnish .285 pounds of flesh formers, and have a fuel value of 3,600 calories, practically the flesh formers and fuel value needed for a day, by a man at moderately hard work.

Corn meal, oat meal and rice.—Corn meal contains less starch and more flesh formers, weight for weight, than wheat flour. Oat meal has a higher fuel value while corn meal has practically the same fuel value as wheat flour. Rice and rice flour have much more of starch and less of flesh formers than wheat flour or corn and oat meal.

Beans and Peas.—These vegetable foods contain relatively large amounts of flesh formers, and serve admirably as sources of these most important nutrients. Larger amounts of these seeds should be grown and consumed on the farm.

Potatoes.—Like nearly all of the vegetables, potatoes have more or less inedible portion or refuse, as the skin, adhering soil, etc. The amount of this refuse varies greatly. The refuse is greatest in amount in small, scabby potatoes, and decreases with the increase in size and smoothness. In a number of observations made in dietary studies, on the average about one-seventh of the weight of the raw potatoes was thrown away in preparing them for the table. Potatoes are a staple article of food. They are about three-fourths water and contain relatively little of protein compounds, but the starch gives them a fairly large fuel value. The protein compounds are made up to quite an extent of substances other than the true albuminoids, and are in consequence not so well fitted for the needs of the body, as the same amount of flesh formers in milk, beef, or wheat flour. The fuel value of a pound of potatoes is about the same as that of one pound of whole milk or two pounds of skim milk. It would, however, take about two pounds of potatoes to furnish the same amount of flesh formers as a pound of whole or skim milk. To furnish .28 pounds of flesh formers for the day's food, a man at moderately hard work would require fifteen pounds of potatoes. This amount of potatoes would furnish 4,875 calories of fuel value or one-half more than the above cited standard calls for. Mixing mashed potatoes with cream or butter makes a palatable dish, but, from the standpoint of nutritive economy it is not advantageous, since the potatoes already have too much fuel ingredients and too little of the flesh formers. On the other hand, the typical New England dish of codfish and potatoes is one of the most rational that could be devised, because the nutrients of codfish are almost entirely flesh formers and supply exactly what the potatoes lack to make a well balanced diet. For the same reason meat and potatoes go well together, especially when the meat is reasonably lean.

But fat meat, especially fat pork, is not a proper material to be eaten with potatoes, unless the flesh formers are supplied in some other way.

Beets, turnips, cabbage, etc.—All of these vegetables are important, both from their food value and from the fact that they afford that change of diet which is so desirable for proper assimilation of food and the maintenance of good health. They deserve to be grown in much greater abundance on the farm, and should constitute a much more important part of the daily diet than they do in many farmers' families.

Fruits.—The chief value of fruits is not in their nutritive ingredients, for the importance of these is very small. They contain considerable quantities of vegetable acids and salts. It is the common belief that these, and especially the vegetable acids, are very useful, though their value is more on account of their indirect action than on account of the nutriment which they supply. Just what this indirect action is, no one can state with any certainty, though a great deal has been written about it. Fruits of all kinds, from small fruits to apples and pears, deserve to be freely grown and as freely used in the diet of the farmer.

Butter and Cheese.—Butter and cheese both vary greatly in composition, but on the average:

	Flesh formers.	Fuel value.
A pound of butter contains..........	None.	3,475 calories.
A pound of full cream cheese contains,	.260 lb.	1,965 calories.

Butter furnishes none of the flesh formers, but it has a very high fuel value because of the fats which it contains. A pound of butter fat is probably of no greater value for nourishment than an equal weight of fat of beef or mutton, or pork, or olive oil, or other oils used for food.

Cheese is, in one sense, concentrated milk, for cheese made from whole milk contains the same ingredients as the milk from which it is made, although there is, of course, a loss in the manufacture. This loss consists largely of milk sugar; in other words, it is greater on the side of the fuel ingredients than on that of flesh formers. It would take eight pounds of whole milk to furnish the same weight of flesh formers as a pound of cheese, but six pounds of milk have as large fuel value as one pound of cheese.

Cheese does not enter into our dietaries nearly as much as is desirable, and what cheese is eaten is for the most part eaten without being cooked. There are numerous ways in which cheese can be cooked. While almost any cheese will give a good result in cooked cheese dishes, there are some preparations in which it is particularly desirable to use skim milk cheese. Skim cheeses are as nutritious, except in fat, as whole milk cheese.

Old cheese can be grated and eaten with bread. It is also a good addition to mashed potatoes, to oat meal and wheat porridge and mushes, to rice, sago, tapioca, and other foods relatively rich in starch and poor in protein. A little grated cheese added to a clear soup improves it from the nutritive standpoint and to many it improves the flavor as well. Its use in the "Welsh rarebit," ranging from the simple toast and melted cheese to the complex "Golden buck" is not nearly so common as it should be.

Fondue is a famous foreign dish, and although it has many ingredients, is really not much trouble to make. Cheese cakes, cheese souffle, macaroni and cheese, and cheese omelets may be named as illustrations of the numerous ways in which cheese may be cooked. All cheese dishes should be served very hot.

Milk.—Cows' milk contains all of the nutritive ingredients needed for food. It also contains them in just about the proportions appropriate for proper nutrition. Add to this the fact that the nutrients of milk are very easily and completely digested, and we have the essential explanations of the familiar fact that milk is a "complete" or "perfect" food.

Cows' milk varies greatly in composition, but the average is such that a pound of milk contains:

Water	.870 ℔.
Fesh formers:	
Protein	.033 ℔.
Fuel ingredients:	
Fat	.040 ℔.
Carbohydrates (milk sugar)	.050 ℔.
Mineral matters (ash)	.007 ℔.
Total	1.000 ℔.

The protein (flesh formers) consists mainly of casein, which makes curd when it is treated with rennet, but it has also some albumen, which is very similar to white of egg. With the fat we are very familiar in the form of butter. The sugar of milk is less sweet, but has about the same nutritive value, weight for weight, as cane sugar.

The protein, fats and carbohydrates in a pound of average milk will, when burned in the calorimeter or in the body, yield about 325 calories. In short, one pound of average whole milk contains .033 pounds of flesh formers, and has a fuel value of 325 calories. It contains rather more of the flesh formers in proportion to its fuel value than the standards above suggested call for. Eight pounds, or four quarts, of whole milk would furnish about .26 pound of protein, and has a fuel value of 2,600 calories, or a little more of the flesh formers and five-sixths of the fuel value which the above standard calls for in the day's food of a man at light muscular work.

Milk is generally the cheapest source of animal protein at the command of the farmer. The fat which it contains is, however, an expensive form of fat. A pound of butter fat in milk, which ought to make a pound and a fifth of butter, is worth to the producer from fifteen to thirty cents, according to the locality and season. As compared with the fat of meat the butter fat has a new flavor and brings a higher price, but for actual nutriment of people in good health and with good digestion, there is no physiological evidence to show that one is more valuable than the other, weight for weight.

The following table compares the digestible nutrients in a quart of whole milk and a few other food materials.

WEIGHTS OF DIFFERENT FOOD MATERIALS WHICH FURNISH THE SAME AMOUNT OF DIGESTIBLE NUTRIENTS (.26 LB.) AS ONE QUART (2.13 LBS.) OF AVERAGE WHOLE MILK.

Kind of food material.	Weight lbs.	Kind of food material.	Weight lbs.
Beef chuck	1.0	Smoked ham	.6
Beef loin	.8	Fowl	1.0
Beef ribs	.8	Eggs	1.1
Beef round	.9	Blue fish	2.5
Veal cutlet	.9	Cod fish	2.4
Veal loin	.9	Oysters (solids)	2.5
Veal shoulder	1.2	Corn meal (bolted)	.3
Mutton leg	.8	Rolled oats	.3
Mutton loin	.6	Wheat flour	.3
Mutton shoulder	.9	Wheat bread	.4
Pork loin	.7	Potatoes	1.5

To one that has been accustomed to look upon milk as a beverage such figures as those of the table are surprising. Few people realize that a pound of whole milk contains as much nutriment as a pound of fish or a pound of oysters, and that a quart of whole milk equals in the amount of digestible solids, a pound of beef, a pound of veal or a pound of chicken.

It is a very common notion that eggs are a very concentrated food. One used to hear the statement frequently made that an egg was equal to a pound of beef. It takes seven or eight eggs to weigh a pound and it takes a pound and an eighth or eight or nine eggs to furnish the same weight of nutrients as a quart of whole milk.

Skim milk.—Even after average milk is skimmed it still contains nearly ten per cent (one-tenth of its weight) of solids or nutritive ingredients. The amount of fat left in skim milk varies greatly with the method of skimming. Ordinary, open, shallow pan setting leaves anywhere from one-tenth to one-half of the original fat of the milk in the skim milk. Deep, closed setting removes the fat much more completely, so that Cooley skim milk has from a trace to three-tenths or five-tenths of one per cent of fat. Separator skim milk has usually less fat than that from deep closed setting. It is not far from an average to say that in a pound of average skim milk there are, flesh formers .034 pound; fuel value, 170 calories, or a little more of the flesh formers than whole milk, and about one-half the fuel value. This assumes that average skim milk, has three-tenths of a per cent of fat. Skim milk with .01 per cent of fat would have very nearly the same amount of flesh formers and a very slightly lower fuel value, but the difference in the nutritive values of the two would be very small. Skim milk from ordinary shallow setting is, of course, worth more for nutriment because less of the milk fat is removed.

The value of skim milk as food on the farm is not generally appreciated. Taken by itself, it is rather "thin" and, as people say, "does not stay by." The reason for this is simple; one has to drink a large quantity to get the needed nourishment, and further, it is so readily disposed of that it does not satisfy the sense of hunger. But when eaten with bread, or used in cooking, it is a food material the value of which is not at all appreciated by the farmer. A pound of lean beef contains about .180 pounds of flesh formers, and has a fuel value of 870 calories. Two quarts and a half, or five pounds, of skim milk will furnish the same amount of flesh formers, and have nearly the same fuel value as a pound of round steak. Two quarts of skim milk have a greater nutritive value than a quart of oysters; the skim milk has .14 pounds of flesh formers, and a fuel value of 680 calories, while the oysters contain only .12 pounds of flesh formers, and have a fuel value of 470 calories. The nutriment in the form of oysters would cost from thirty to forty cents, while two quarts of skim milk would have a market value of hardly more than two or three cents. An oyster stew made of one part oysters and two parts skim milk would owe its value for nutriment more to the milk than to the oysters. Bread made with skim milk would have much more of the flesh formers than when made with water. A lunch or meal of bread and skim milk is a very nutritious one, as the following computation shows:

ONE MEAL OF BREAD WITH SKIM MILK.

	Amount.	Flesh formers. Pounds.	Fuel value. Calories.
Bread	10 oz.	.06	755
Skim milk	1 pt.	.03	170
		.09	925

Corn meal is deficient in flesh formers. Indian pudding, made of corn meal, sugar or molasses, and skim milk, makes a nutritious and fairly well balanced food. The ways in which skim milk can be utilized in cooking are almost endless, and, as we shall see later, the flesh formers thus added to the daily rations are of the utmost importance.

There are especial reasons why skim milk is more valuable than people ordinarily suppose. The diet of people in this country is apt to be one-sided. Our food generally has too much of fats, sugar and starch, and too little protein—too much fuel ingredients and too little flesh formers. To put it in another way, there is not enough material to build and repair the bodily machine, and too much fuel to run it. This seems to be the case in the food of farmers, although very few accurate studies of farmers' dietaries have been made. The following results of studies of the actual dietaries of farmers' families in

Connecticut and Vermont are cases in point. "One swallow does not make a summer," nor do half a dozen. These dietaries do not show the average food consumption of farmers' families. But they are nevertheless interesting.

FLESH FORMERS AND FUEL VALUES OF TWO FARMERS' DIETARIES.

	Flesh formers. Pounds.	Fuel value. Calories.
A Connecticut farmer's family....	.24	3,770
A Vermont farmer's family.......	.18	3,090

Farmers are learning about well balanced rations for their stock. They know that if they are going to feed their cows profitably, they must give plenty of protein. It is time they understood that the same rule applies in the nutrition of themselves and their families. For the cattle they must buy wheat bran, gluten and oil meals, and grow clover and other legumes. For their own table they need more of nitrogenous foods like lean meat, fish, beans, peas, oat meal and especially milk. And one of the best things to furnish the needed protein is skim milk. There are many ways of eating milk aside from drinking it. Cookery affords almost unlimited scope to utilize this most excellent source of flesh formers to the farmer.

A few of the ways in which skim milk may be used in cooking are as follows: In the preparation of soups such as potato, celery, tomato, green pea, and green corn soups; fish, lobster, clam and oyester chowders, bisques and stews, skim milk will equally well replace the whole milk that the directions for preparing usually call for. Skim milk makes as good white soups as whole milk. Bread mixed with skim milk is more nutritious than that made with water. All kinds of quick biscuit, griddle cakes, etc., can be made with skimmed as well as with whole milk. In most kinds of cake skim milk will be found a perfect substitute for whole milk. If the skim milk is sour so much the better for cake and quick bread making, as only half the cream of tartar called for in the recipe will be needed.

Sweet skim milk can be used to advantage in making rice and Indian puddings, custards, squash and pumpkin pies and the like, in the preparation of chocolate or cocoa as a drink, in the making of sherbets and other ices, and in dozens of other ways which will readily occur to housekeepers.

There are many uses to which sour skim milk can be put so as to utilize it as a food for man. It helps the leavening of all "quick-raised" breads, griddle cakes, ginger bread, cookies and doughnuts, and at the same time adds materially to the nutrients of these foods. Bonny-clabber and cottage cheese are two common and favorite ways of using sour skim milk.

People who use a good deal of sour skim milk in the summer time sometimes cannot get the milk to sour in the winter, as it acquires a decayed odor and unpleasant taste without developing acidity. All fermentations of milk are caused by bacteria. In summer the bacteria which cause milk to sour are very abundant in the air and milk; no matter how carefully it is kept, it becomes inoculated and by their rapid growth is soured. In winter there are very few of these organisms in the air and milk may be freely exposed without any of this kind of bacteria getting into it. Milk that has soured in a normal way in the summer will contain millions of these minute plants which cause milk to sour. The addition of a little sour milk to sweet milk will inoculate the sweet milk and souring will go on rapidly, in winter as well as in summer. Acting upon this and using sour milk as a starter, milk can be made to sour at any time of year.

Many of the ways in which cheese can be used in cooking demands a "lean" or skim milk cheese. Very much of the waste skim milk should either be made into skim cheese by itself or, mixed with whole milk, made into half cream cheese.

In the following table skim milk is compared with a few other food materials as a source of protein.

WEIGHTS OF DIFFERENT FOOD MATERIALS WHICH FURNISH THE SAME AMOUNT OF DIGESTIBLE PROTEIN (.28 LB.) AS ONE GALLON (8.5 LBS.) OF SKIMMED MILK.

Kind of food material.	Weight lbs.	Kind of food material.	Weight lbs.
Beef chuck	1.8	Blue fish	2.9
Beef loin	1.8	Cod fish	2.7
Beef ribs	2.1	Oysters, solids	4.8
Beef round	1.6	Corn meal, bolted	3.5
Veal cutlet	1.4	Rolled oats	2.0
Veal loin	1.8	Wheat flour	2.9
Veal shoulder	1.8	Wheat bread	3.5
Mutton leg	1.9	Potatoes	18.7
Mutton loin	2.2	Cattle foods.	
Mutton shoulder	2.1	Corn meal	4.8
Pork loin	2.0	Wheat bran	2.2
Smoked ham	2.2	Ground oats	3.1
Fowl	2.0	Cotton seed meal	.8
Eggs	2.2	Gluten meal	.9

SKIM MILK AS A FOOD FOR STOCK.

On a large farm it will not be possible to use all of the skim milk as food for the family—much will still remain to be otherwise cared for. Skim milk is an indispensable food for calves, an excellent food for pigs and poultry and a valuable food to use in connection with the foods produced on the farm which, while rich in starchy matters, are for the most part very deficient in the flesh formers or proteid matters. Skim milk has about the same nutritive ratio as gluten meal and can be used to add protein to a ration and make a well balanced ration. The table compares skim milk as a source of protein with several concentrated feeding stuffs. It will be seen that a gallon of skim milk furnishes as much of protein as 4.8 pounds corn meal, 2.2 pounds wheat bran, 3.1 pounds ground oats, .8 pound cotton seed meal and .9 pound linseed meal. The three rations which follow illustrate the ways that skim milk can be used as a part of the ration for a milch cow.

THREE RATIONS FOR MILCH COWS PER 1,000 POUNDS LIVE WEIGHT, USING SKIMMED MILK AS A SOURCE OF PART OF THE PROTEIN.

Food Materials.		Nutrients.		
Kinds.	Weights—Pounds.	Protein—Pounds.	Carbo-hydrates—Pounds.	Fat—Pounds.
Clover hay	10	.72	3.6	.18
Field corn silage	30	.54	4.1	.21
Corn meal	2	.12	1.2	.06
Wheat bran	4	.50	1.5	.12
Skim milk, 2 gallons	17	.56	.9	.05
		2.44	11.3	.62
Mixed hay	10	.47	4.3	.13
Sweet corn stover	10	.43	3.3	.10
Corn meal	4	.24	2.4	.12
Wheat bran	4	.50	1.5	.12
Skim milk, 3 gallons	25.5	.84	1.3	.08
		2.48	12.8	.55
Field corn silage	30	.54	4.1	.21
Timothy hay	10	.36	4.4	.16
Corn meal	3	.17	1.9	.09
Wheat bran	2	.25	.8	.06
Skim milk, 4 gallons	34	1.12	1.7	.10
		2.44	12.9	.62

At ordinary prices milk is the cheapest animal food to be found in our markets. It is unwise for one practicing economy to scrimp on the milk supply. If this is true of the man in town who has to pay from six to eight or even ten cents a quart for his milk, it is doubly true of the farmer who rarely obtains more than three cents per quart for the milk which he sells and who is obliged to pay higher for his animal foods than people living in cities. As has been pointed out, the farmer's dietary is apt to be too wide, that is, to contain too much of the fuel ingredients, fats and carbohydrates. The fat of milk is that which determines its value very largely in the market. It consists of the elements, carbon, hydrogen and oxygen drawn by the plants from the air. Obviously, in selling butter fat the farmer is not robbing his land of valuable fertilizing ingredients.

It is probably poor economy for a farmer to use very much of butter fat either in the form of cream or butter. It is no more valuable as a food than other fats which cost less and for the most part it has a ready cash value in the markets. To sell butter fat, to use large quantities of skim milk in his diet and utilize the remainder by feeding it to stock, preferably calves, hens or milch cows, is the most rational way for the farmer to dispose of the products of the dairy. At some times and in some locations it may be advantageous to sell both protein and fat in cheese, but ordinarily this is not the most economical form of dairying.

REMARKS BY DR. A. W. HARRIS,

President University of Maine.

Mr. President, Ladies and Gentlemen: As the professor was talking about skim milk, and advising us to sell the cream and drink the skim milk, I thought of a little opera that was famous a few years ago, in which there was a play something like this: "Skim Milk Masquerading as Cream." Now if I were to attempt to talk to you at a very great length or depth in dairy matters, I think you would conclude that this was a case of "skim milk masquerading as cream." Last summer, with some other gentlemen, I made a trip across the State of Maine, at least across a part of it, and I noticed a great many things with regard to the farms. I think I was more impressed with this fact than any other,—it was certainly a wonderful thing that the farmers could get a living on them, managing them as they did. I was very certain they did not get much of a living, at any rate, if they got a living at all. I have travelled over the country and have had the same experience come to me time and again, as I looked out on the farms, and saw what the farmers were doing. And then I wonder where all the wealth of this great country is. There is a great deal of it, and yet sometimes it seems to be spread out fearfully thin.

I believe the great trouble with our agriculture, if there is any trouble, is not that the farming itself is at fault, but that the farmer is at fault. He does not do his farming well enough. I am not prepared to say why the farming is not good, but I think I am prepared to point out one respect in which farming, like other lines of business, might be enormously improved. I believe we could get very much better returns from farming, and all other occupations, if men were more careful in their counting and measuring. Let me illustrate. Once in a while my wife gets into trouble with something that she is cooking, and she will come to me and ask me if I can help her. Now I am not a cook, but when I do succeed in helping her it is almost invariably because I have had a training which leads me to follow rules more carefully. If a pound is mentioned I use a pound, if a quart I use a quart. A woman in her cooking is very likely, if she is to use a pound, to take *about* a pound, and if it is a quart, and she has no measure handy, she takes *about* a quart. If she uses flavoring she puts it in to taste, which means a good deal o-day and a little to-morrow. Now, unfortunately, or fortunately, I suppose, for the man, cooking may be carried on very successfully in that way, but business cannot be carried on successfully in that way. When a man carries on his farm in a happy-go-lucky manner, uses the cream, and throws away the skim milk because it is less trouble, he is paying a good round price for his convenience. A great part of success in business comes out of watching the details, and the man, and the farmer, who is not able to watch details and improve methods, will never make a great success. It is the man who sees the little things and understands their importance who makes a marked success.

We have made great improvement in agriculture. I have been as much interested, perhaps, in regard to agriculture, in the question of why the boys leave the farm, as in any other. I had a new solution of that question given me a while ago. Although it is not the one I want to lay stress upon it is so interesting that I want to tell it. A man from out West said that it was too healthy in Maine. If a man would only die at a reasonable time, so as to let the boys have a chance to get on to the farm, there would be some boys on the farms. But everywhere the men were so old and lived on the farm so long that the boy never got a chance until he was an old man himself. I do not know but there is some truth in this, but I am interested in the question from another side. I wonder why it is that the boys do not go on to the farm? The following solution has been given, and I think it has a good deal of encouragement in it. The statement is made, and I have no reason to doubt it, that although a whole generation has gone by since the agricultural colleges were established, and the population of the Union has about doubled in that time, no more men are necessary to-day to produce its food than were necessary thirty years ago. As many men will produce food for twice the number of people. That means that there has been an enormous improvement in methods, for remember that during all that time we have been exhausting our soils. The virgin soil has almost disappeared in this country. If we are to have great success in the future in agriculture, we must do our work well, in competition with other countries, and to do that I believe we need to lay unusual stress upon the means of education. Such work as this, the stirring up of even a few men to think about their business, is a great gain. Such work as the agricultural papers are doing, carrying new ideas week by week into thousands of families, such work as we are attempting to do at Orono, is of much value.

But I believe that it is high time, too, that some such information was carried into our common schools. I understand that the complaint is that already too much work is put upon the children in the common schools. I think that is probably true, but I am not sure that all of that work is in just the right line. I think if a boy is to live his whole life on a farm he might very well drop out some of the things taught him, and learn some things to help him in making a living. And if it is worth while to help a man to make a living, it is worth while to help the woman who spends nearly all of the living. We sometimes forget that the women spend two-thirds of the money. If it is worth while to teach a man how to supply the table, it is worth while to teach a woman how to use the supplies which he provides for the table. I trust the time is not far distant when there will be some instruction which will help a woman to do her work more easily and accomplish better results.

The lesson I want to impress upon your minds is that for agriculture there is no fertilizer so important as brains, and for the improvement of agriculture there is nothing so much needed as education.

MR. F. E. JEWETT.

Mr. President, Ladies and Gentlemen: Secretary McKeen wishes me to tell you something of the way in which I made my butter that has secured the highest score at this conference. I shall probably put forth some ideas that you will not agree with, and I have gone out of the regular line that some people have taught for years past. You remember last fall at Skowhegan Mr. Waterhouse said, "Keep as near 60 degrees as you possibly can." That may be all right with Brother Waterhouse, in his section, but I cannot make it work with me. I experimented with that a long time, and tried to get as near the standard as possible, but I could not succeed well with 60 degrees. The next point for me to determine was at what temperature to ripen my cream and to churn it. It has taken me considerable time to find that out. Of course you know that in different localities cream has to be treated differently, and for different herds. I have been experimenting some three years, trying to get *just right.* I have not succeeded yet, but I hope to sometime. For this lot of butter, I set my cream at 68 degrees, and left it at five o'clock at that temperature. I judged from the weather that it was not going to be a very cold night, and I thought that would be about right, according to the other experiments that I had made. The next morning when I got around to churn that cream it was at 60 degrees. It had cooled down to that. In stirring it I found that it had just the right aroma. Mr. Parker of the De Laval separator, told me three years ago while at Norway that when cream is just right to churn to get a nice flavor a very pleasant aroma will rise from it. He told me as well as he could what it was like and how to get it. He can tell you that part better than I, as he is older and has had more experience. I found by stirring my cream in the morning that it had a very pleasant odor. I go by the sense of smell more than by taste. I put it into the churn and heated it up to 65 degrees. The way I heat my cream is by introducing a steam jet into the cream. I churned it at that temperature, and it came in 40 minutes to the granule that I thought was right. I commenced to draw off the buttermilk, but it was not quite ready, some of the butter would go with the buttermilk. I knew that I had the right granule and I thought I had the right flavor, so rather than to churn that any more and spoil the grain I put in about ten gallons of cold water. That made the buttermilk draw all right. The water was at about 50 degrees. After drawing the buttermilk all out and letting it drain so that but very little came from it, I proceeded to wash the butter. I washed that butter at 55 degrees; one washing was sufficient. After I had drained the water out I weighed out my salt, which was three-fourths of an ounce to the pound, and salted the butter in the churn, revolving my churn so that the butter was all in one mass. Then I took it out on to my worker and worked it dry. Then I stamped it, put it into my refrigerator and froze it up, and brought it down here the next morning.

Ques. How long did you work it?

Ans. I worked it until the water was out, and I thought it was just right. I cannot say how long. Butter can be worked too much, so as to make it soft and salvy.

Ques. What are the farmers feeding?

Ans. The farmers in our section are feeding ground corn and oats considerably, some cottonseed, quite a lot of shorts, and a very little gluten.

Ques. How much butter did you have in the churning?

Ans. I had 175 pounds.

Ques. How warm was it when it was worked?

Ans. I suppose it must have been at about 55 degrees, because I washed it at that.

Ques. What was the percentage of fat in the cream? Was it separator cream?

Ans. It was separator cream, containing about 25 per cent fat, I think.

Ques. How old was your cream, from skimming?

Ans. I separated it Monday forenoon and churned Tuesday forenoon.

Ques. Do you use any kind of a starter for the cream?

Ans. Only the heat.

Ques. Was it sour any?

Ans. I could not tell you, as I go by the sense of smell. It had a pleasant aroma.

Ques. Do you think the cream had thickened any?

Ans. Yes, sir. The cream, after stirring it, was just as smooth as velvet, no bubbles in it at all.

Ques. You have an idea there was an acceptable acidity to the cream?

Ans. There must have been.

Ques. Do you think that your being able to wash the butter entirely clean with one washing might have been a benefit to it?

Ans. I think there is such a thing as washing the flavor from the butter if you wash it too much. All you want to do is to wash the buttermilk out.

Ques. How does the last of the water look as it runs from your butter?

Ans. I suppose you mean the drippings. It is clear.

Ques. Don't you lose quite a percentage of the salt in the working of your butter when the salt is put in in that way?

Ans. I reckon that about one-fourth of the salt goes to waste, but I think I can get it into the butter more evenly by salting in the churn, and it is a great deal quicker way.

Ques. Do you ever have any mottled butter when you salt it in that way?

Ans. Mottled butter is caused by too cold water coming in contact with the warm butter. I never have had any trouble with mottled butter, when I have paid attention to the washing of it.

Ques. I refer more particularly to the condition that we sometimes get in dairy butter when the buttermilk is worked out, and the butter is not washed at all. We have supposed that this was caused by the unequal distribution of the salt.

Ans. In about all the dairies that I have seen the cream is churned too long so that the butter comes in one solid mass. That might be the reason for getting mottled butter, or uneven distribution of the salt might be the cause. You know the salt will bring out the color that is in the butter. For instance, take two lots of butter, and have one entirely fresh and the other one salted, and let them stand three or four hours, and the one with the salt will be quite a number of shades darker than the one that is fresh.

Ques. I cannot understand how you can take perfectly sweet cream at night and warm it to 68 degrees, then let it cool down to 60 and have it sour in the morning.

Ans. It is ripened in the morning, but I cannot tell you how it is done.

Ques. With the cream right from the separator of course it was warm to start with. Did you cool it?

Ans. The cream that I commenced on, after it came from the separator and got into the tank had cooled down to about 65 degrees. Of course it heated up to 85 while running through the separator. I let it stand at 65 degrees until night, and then heated it to 68 degrees and left it at that temperature.

Ques. Perhaps heating it up acts as sort of a starter. In taking it from the Cooley cans I hardly see how that could have been done.

Ans. From the Cooley cans you would have to warm it up and let it stay warm longer than from the separator.

Ques. If in the morning you had found the cream too warm what would you have done?

Ans. I should have put a little cold water around the tank, and stirred the cream until it cooled down to the right temperature.

Ques. You would not have put water into the cream?

Ans. No, sir.

Ques. You said that you churned at 65, and at the close of the churning it must have been not far from 68, and yet you introduced water at 55 degrees. Was not this dangerous?

Ans. I do not think so, while the buttermilk was in the churn.

Ques. Was not that an exceedingly low temperature for washing butter?

Ans. I do not think so.

Ques. Did your butter close readily?

Ans. Very readily. Yes.

Ques. Can you tell us why too cold water spots the butter?

Ans. I will tell you what Mr. Harris told me last fall. I asked him about that particular thing, and he said it sort of freezes the outside of the granule so that the salt does not get into it. Very cold water will turn the outside of the butter white.

FRIDAY EVENING.

MANAGEMENT OF THE DAIRY HERD.

By N. J. BACHELDER, Secretary New Hampshire Board of Agriculture.

In the business of dairying many questions arise, each of itself insignificant, but in the aggregate of such magnitude and importance as to determine the success or failure of the enterprise. The dairyman, who is a thinking man, and none other has a right to the name, is constantly striving to solve these problems that he may increase the profits of his business and add to the general intelligence of his class. Our splendid system of experiment stations furnishes some aid in this direction, and through the investigation of those stations new light is annually being shed upon this, the most complex of all farm operations. In progressive dairying there is opportunity for the use of as great intelligence and skill as are required in any productive industry or any industrial pursuit. One of the most intricate and delicate features of this business is the management of the dairy herd, and, since the establishment of creameries and the extension of milk routes, it has become the leading feature in dairying.

The nearly one million cows in New England are now about entering their winter quarters where, for the next five months, they will be entirely subject to the law of the owner, and the laws under which these cows are kept will have a great deal to do with their performance at the pail. The law of heredity does not cover all the requirements for a profitable dairy herd. While the world's famous producing dairy cows have been able to accomplish those wonderful feats by a combination of inherited and acquired qualities, both heredity and development being necessary, the problem immediately before us is in regard to the dairy animals already in existence and upon our own farms and in our own stables to-day. We are confronted with a problem that needs immediate solution, and the sooner we get down to a practical business basis in the discussion of these matters the more useful and helpful will those meetings be made.

The subject under consideration at this time, the management of the dairy herd, includes, as we understand it, only the handling of the animals, and yet the stabling and feeding are so closely connected that we can hardly fail to give each of these subjects a passing notice in the discussion of this matter. The climate of New England is such as to require the stabling of dairy animals for about six months in the year, and the chief requisites in this matter are economy, health and comfort. The old plan of building barns for the storage of fodder, tools and animals under the same roof is open to serious objections, although such barns already in use will not be discarded. The modern and most satisfactory plan is to have the animals kept in a single story structure adjoining the storage barn and with the air space above the animals open to the roof. When boarded over the backs of the animals, and especially when boarded up in front, there is necessity for careful and thorough ventilation, which is seldom accomplished. The stable for the dairy herd should be light, clean and dry.

A basement stable is not a suitable place for dairy animals. Proper attention to these matters will do more to prevent the appearance of bovine tuberculosis in dairy herds than the enactment of any law or the appropriation of any sum of money from the State treasury. Give the animals light, dry, well-ventilated stables and the tubercle bacillus cannot develop.

Some of the people present to-night were present nearly one year ago when we discussed this subject of bovine tuberculosis in another part of the State, and they may be interested to know the result of an experiment that we are trying along this line. In stating the result, as far as it has been obtained, I do not know but that I am disloyal to my own state, for the statement that I am about to make has never been made in New Hampshire, and has not been given to the public, as the experiment has not yet been completed.

On the 7th day of last June we were invited to take action in a herd of thoroughbred Holstein cattle, twelve out of twenty-one of which had reacted to the tuberculin test. I visited the farm and saw the barn in which the cattle had been kept, which was the most expensive stable that I have ever seen in New Hampshire. It was built in the most expensive way, and was especially provided for keeping the animals warm. Out of the number that had reacted (twelve), two were old animals, and were so badly diseased that a physical examination would detect it, and they had been killed. Nine of the remaining ten were in a field quite near the buildings. They were all thoroughbred Holstein cows, under four years old, and as fine and healthy a lot, to all appearances, as I ever saw. I remarked to the owner that it was *not the policy of our board to destroy such cattle as that.* He seemed to disagree with me very decidedly in regard to what should be done, and remarked that if we did not kill the animals, he should. In the course of our conversation I said that I had often thought that I would like to try the experiment of taking such cattle and putting them under proper sanitary conditions, to see what the result would be. He seemed to become interested, and said, "You may take the cattle and welcome; the only conditions being that you shall kill them all before they leave your hands, give me the credit of furnishing the cattle for the experiment, and let the people know the result." I took them home, and nine of them were isolated on a back farm, where they would not endanger any other cattle. I kept them in a well-ventilated barn, gave them all the sunshine, light and exercise that seemed desirable, and at the end of three months I applied the tuberculin test to the entire ten. One of the ten was a bull that weighed 2,000 pounds. Of course we kept him in the barn. These cattle had been kept in a stable without any exercise. They were tied up in the fall and for five months were not unhitched from their stanchions. The condition in which we placed them was quite a change. On applying the tuberculin test, at the end of three months, four failed to show any reaction; the other six reacted about the same as at first. Those that passed the test we still have in our possession, but we released them from quarantine, put them into another barn, and the product from them is being used, the same as from other animals. One of the six that reacted the second time was the bull. We killed him and examined him thoroughly, and all the evidence of disease that we were able to find was a tubercle no larger than a marrowfat pea. It was on the outside of the meat and came off with the hide, and we used the meat, as it was perfectly proper and right to do. The other five cows are still in the same place, and will be tested next week, at the end of six months. Those that pass the test the next time we shall keep, those that react we shall kill and destroy.

I speak of this at this time to show what I believe to be the result of proper sanitary conditions surrounding those cattle. They had been shut up in a stable so close that the neighbors said they had been into the barn in the coldest day in winter and seen the water, formed from the breaths of the cattle, dropping down from the ceiling. It was just the place to develop bovine tuberculosis, and just the place where they should not have been kept in order to be maintained in a healthy condition. The result that we have already obtained in this experiment is interesting, and we expect it to be more so. The cattle will all be killed before leaving our possession, but I expect that one-half of them will come out all right and be serviceable animals to keep. And I make the statement now which I made last winter, and which I believe is being verified more and more every day,—it is not necessary, in fact, it is very extravagant, to kill every animal that reacts to the tuberculin test without any regard to the conditions under which it has been kept, or the condition of the animal.

Considerable evidence can be found in favor of earth or clay floors for the animals to stand upon, and some advocate stone or brick set upon edge, but all these are open to the objection of coldness and possible dampness, and no better floor can be had than a wooden floor.

The gutter behind the animals should be of such distance from the stanchion as required by the size of the animal, to allow her to stand upon the platform rather than in the gutter. From 2½ to 4 feet apart is about the right distance, according to the size of the animal, and some form of cattle tie should be adopted that will allow the animal freedom both in a vertical and side movement. All forms of stanchions are open to objection and that should be selected having the least. A strap permanently worn about the animal's neck, and provided with a snap to attach it to a few inches of chain so arranged as to move up and down upon an upright joist, is a comfortable and favorite arrangement. Always require an animal to keep the same stanchion and always provide protection from the animal on either side by making separate cribs.

In regard to feeding the dairy herd there is but one correct principle, and that is to feed all each individual animal can digest and assimilate of those fodders and grains which contain the requisite proportions of protein and carbohydrates at the least cost, taking into consideration the health of the animal and the manurial value resulting from the feeding. To do this requires good judgment and an intelligent understanding of the composition and cost of the feeding material on the market, or produced on the farm, for in the latter case it is worth exactly what its value would be in the market, irrespective of the fact that it may have cost more or less.

The dairyman's business is to procure his feed from the cheapest source, whether it be from the produce dealer, or from the soil of his own farm. Speaking in a general way, we believe that the cultivated fodder crops now grown in New England should be doubled in quantity and that they can be profitably increased to this extent by the adoption of intelligent and progressive methods. Through the judicious use of chemicals, rotation of crops and farm machinery, great things can be accomplished in New England agriculture. The production of crops is not now under discussion, but the economical feeding of the dairy herd as one of the features of management. In considering the combinations of feed for the dairy, we should constantly keep in mind the fact that the digestible nutritive elements of feeding stuffs and grains undergo no change in the different methods of curing and preparing, and that the methods of harvesting have more relation to the cost of the operation than to the quality of the nutritive elements of the product, when done in a proper manner in either case. The digestible nutritive elements in the green corn, dried corn, shredded corn, siloed corn or husked and ground corn are practically the same, and the different appearance and effect are due simply to the different substances with which they are connected. It is sometimes difficult to understand that the digestible protein in the dried corn fodder is the same as the digestible protein in the ensilage from the same corn, but such is the well-established fact. The judicious feeder considers the nutritive elements of the feed, rather than the feed itself, in compounding the ration for the dairy herd, and requires a proper bulk to the ration, as well as nutriment. We here give the composition of various feeding stuffs, the first column representing the total organic matter, the second the digestible protein, the third the digestible carbohydrates and the fourth the digestible fat.

Clover silage	25.4	2.0	13.5	1.0
Corn silage	19.5	0.8	11.6	0.7
do Wis. analyses	24.2	1.3	14.0	0.7
Sorghum silage	22.8	0.6	14.9	0.2
Corn fodder	55.1	2.6	33.3	1.1
do Wis. analyses	66.8	3.7	40.4	1.2
Corn stover	56.5	2.0	33.4	0.6
Alfalfa hay	84.2	7.6	37.8	1.3
Blue grass hay	80.2	5.8	38.4	1.6
Cow pea hay	79.7	9.3	38.4	1.2
Crab grass hay	78.	5.0	39.7	1.0
Marsh hay	86.9	3.5	44.7	1.7
Millet hay	86.3	4.5	46.4	1.0
Mixed grasses hay	79.4	3.6	42.7	1.0
Oat hay	84.9	4.3	46.4	1.5
Oat and pea hay	81.7	6.0	43.2	1.5
Orchard grass hay	81.0	6.9	40.3	1.9
Pea hay	78.5	7.6	40.0	1.5
Prairie hay	81.3	3.5	41.8	1.4
Red clover hay	78.5	6.5	34.9	1.6
Red top hay	86.7	6.6	48.8	1.3
Timothy hay	82.4	3.0	43.9	1.2
Timothy and clover hay	80.4	4.7	39.4	1.4
Sheaf oats	71.5	4.0	36.0	1.7
Barley straw	80.1	0.9	41.3	0.6
Oat straw	85.7	1.6	41.4	0.7
Rye straw	89.7	0.8	42.7	0.4
Wheat straw	86.2	0.8	37.9	0.5
Carrots	10.4	1.0	7.1	0.3
Mangels	8.0	1.0	4.8	0.3
Potatoes	20.1	1.4	16.1	0.1
Red beets	10.5	0.9	7.6	0.1
Rutabagas	10.2	0.9	7.1	0.2
Sugar beets	12.6	1.1	9.3	0.1
Sweet potatoes	27.9	0.9	22.2	0.3
Turnips	8.7	0.6	5.5	0.2
Barley	86.7	9.5	66.1	1.2
Brewer grains—dry	88.7	16.2	35.5	5.3
Brewer grains—wet	23.3	3.9	9.5	1.3
Malt sprouts	84.5	19.8	36.2	1.7
Buckwheat	85.4	7.7	49.2	1.8
Buckwheat bran	86.5	7.4	30.4	1.9
Buckwheat middlings	82.2	22.0	33.4	5.4
Corn	87.6	6.3	64.8	5.0
Corn and cobmeal	83.4	6.5	56.3	2.9
Corn bran	89.6	7.4	59.8	4.6
Germ meal	86.0	9.0	61.2	6.2

Gluten meal	90.5	29.5	39.6	12.8
Gluten feed	90.8	18.6	48.3	11.1
Atlas gluten meal	90.6	26.7	31.1	12.8
Cottonseed	79.6	9.8	27.9	16.9
Cottonseed hulls	87.2	1.0	26.2	1.8
Cottonseed meal	84.6	36.9	18.1	12.3
Cow peas	82.0	18.3	54.2	1.1
Flaxseed	87.2	18.5	26.0	27.4
O. P. oilmeal	85.1	28.3	32.8	7.1
N. P. oilmeal	84.1	27.2	32.9	2.7
Cleveland oilmeal	84.6	32.1	25.1	2.6
Oats	86.0	9.1	44.7	4.1
Peas	86.9	18.0	56.0	0.9
Rye	86.5	8.3	65.5	1.2
Rye bran	84.8	9.7	48.0	1.6
Wheat	87.7	9.2	64.9	1.4
Wheat bran	82.4	12.6	44.1	2.9
Wheat middlings	84.5	12.2	47.2	2.9
Wheat shorts	83.6	11.6	45.4	3.2

The following table gives the manurial value of a number of fodders and grains:

Gluten feed	$11 00
Gluten meal	15 00
Malt sprouts	13 00
Dried brewers grains	12 00
Wet brewers grains	3 00
Wheat bran	12 00
Rye bran	10 00
Wheat middlings	9 50
Wheat shorts	7 50
Buckwheat middlings	5 00
Cotton-seed meal	24 00
Linseed meal	19 00
Corn meal	6 50
Oat meal	5 50
Barley meal	5 75

It is calculated that 75 per cent of the manurial value in the feed may be recovered, with proper attention to its preservation.

The most economical feed for the dairy herd can easily be figured out from these tables, and the cost of each article in the market, the requirements of the animal system being comparatively well established.

I have conducted experiments in feeding when a change from an unbalanced to a balanced ration has increased the product ten per cent without adding one cent to the cost of the feed. The most practical method of restoring fertility to an exhausted farm located away from a large center of population, is the judicious selection and feeding of nitrogenous grains and a studious saving of the elements of fertility resulting therefrom.

We have thus briefly considered the essentials of stabling and feeding as a preliminary to what we have to say upon the handling of the dairy herd, the essential feature of our subject.

Man, as well as animals, is subject to the influence of environment in a greater degree than is generally supposed. The symmetrical proportions and polished contour of an elegant structure are no more the result of producing, in material form, the conclusions of a master mind than is the eloquent and gifted orator the result of superior training and constant practice. In the common walks of life we see this principle exemplified in a great variety of ways, and thousands of people to-day are occupying positions of great responsibility and honor for the reason that their education, training, and environment has been such as to qualify them for those positions, rather than because of any superior natural abilities not possessed by others. In the animal kingdom the same principle holds true, and the application of constant, persistent effort for the development of certain physical qualities will accomplish wonderful results. It is this agency, including feed, that has produced our various types of thoroughbred cattle, so unlike in appearance and in performance, but originally from the same source—an animal that could hardly yield milk enough to rear her offspring and whose beef to-day would hardly be entitled to a scoring. Selection, feeding and handling have produced these results. Much can be accomplished in a dairy herd in a single winter along the line of development, through proper handling. Two dairymen, one skillful and faithful in attention to details, and the other not, will care for the same herd of cows in the same barn and use the same kind and amount of feed during a period of six months, and the former will send to market ten per cent more product than the latter. I know it because I have tried it, and I believe there is an alarming indifference in this important matter. Ten per cent is a good profit in any business and means a vast amount of money in the dairy industry when reckoned only upon a basis of those to whom this improvement is possible.

One of the serious mistakes made by farmers and dairymen is the failure to apply business principles to their vocation. When we are dealing with so complex and delicate a machine as a well bred dairy animal, the most exact regulations should be followed and the best business rules adopted. Every successful business man has certain rules which are never broken and which are almost as sacred to him as his religious or political creed. He succeeds mainly because he has these inexorable laws upon which his action is based. Let the dairyman have similar laws in the management of his dairy herd and be as strenuous in regard to their enforcement. The first and most important of these would be regularity. Regularity in feeding, watering, milking. Not *about* the same hour, but *exactly* the same hour every day while the herd is kept in the barn. I read within a few days of a certain railroad that ran its trains with so much regularity that it was said that conductors, brakemen and engineers always set their watches by the arrival of the trains at the end of the line. Have posted in the dairy stable not only the exact hour, but the exact minute, that every operation in caring for the herd shall be made. It is surprising how quickly a herd will become accustomed to such treatment and how restive and uneasy they become under any change, however slight. One hour's delay beyond the usual time of feeding will cause a shrinkage in butter fats equal in value to the cost of milking the herd. One hour's delay in milking will cause a loss of nearly the same amount.

Cleanliness in the dairy stable is a business rule sadly neglected. An inspection of more than 500 dairy stables in New Hampshire has impressed this fact firmly. Filthy milkers, filthy stables and filthy dairy animals, because of neglect, are a standing menace to healthy dairy products. More children are killed every year through the development of bacteria in milk from these filthy sources, or from cans and other utensils improperly cleaned, than from the tubercle bacillus about which so many heart-rending stories have been told. There is more danger at present from filthy milk than from tuberculosis milk, and any action of a state or city that will secure a milk supply uncontaminated by filth, (for when once in the milk no amount of straining will remove it), will tend to the general health of the people and largely increase the consumption of milk. Every dairy animal should be kept scrupulously clean and every milker should wear garments made for the purpose and frequently and regularly washed.

The stable should be thoroughly whitewashed at least annually, and the stable floor should be sprinkled daily with plaster. This will destroy germs and add to the healthfulness of the dairy herd as well as to the product.

The dairy herd needs a moderate amount of exercise. The system of providing water for dairy animals in the stable and keeping them tied by the stanchion from fall till spring is attended by serious objections. There should be a covered yard or sheltered yard into which the animals should be turned every day in the winter, with perhaps an occasional exception, and there they should get their supply of water. They may not yield any more milk during a single winter for this treatment, but they will keep in better health, digest their food better and more of it, will be less liable to various diseases and will give more healthy milk because the animals themselves will be more healthy. No system of keeping animals invites the development of tuberculosis to a greater extent than constant confinement in the stable. The tubercle bacillus is generally taken into the animal system through inhalation and finds lodgment in the throat and lungs. A moderate amount of exercise will frequently cause such action of the lungs as to destroy the germ, when if allowed to remain quiet even in a well-ventilated stable, the same germ would grow and develop and cause tuberculosis because there was no impediment to its development. The cow will stand higher feeding with less danger to the mammary glands if reasonable exercise is given.

Few dairymen comprehend the advantages of gentleness in the dairy stable and dispatch in milking. While no one has yet been able to fathom the exact process by which the milk is formed, it is well established that rough treatment and slow milking effect both the quantity and quality of the production. A well-bred dairy animal is more susceptible to these influences than one of the beef type, for the very qualities determining her value as a dairy animal are those most easily affected by these harmful influences. A quick tempered person or a slow milker will waste for the owner of the herd the entire value of his services. These are matters of no trifling importance when considered in the aggregate, and will make more, rather than less, than ten per cent in the yield of any first-class herd in a single winter, and when applied to the herd for a series of years will tend to fix and intensify the dairy qualities of succeeding generations. Study and investigation of this intricate branch of agriculture reveals the fact that no business offers an opportunity for the exercise of greater intelligence and skill and a more profound study of the principles underlying it than the feeding, care and management of a herd of well-bred dairy cows. And the more we study and investigate the more will we be impressed with the truth, before expressed, that success depends upon the application of the most rigid business rules to this, the most complex of business matters. Promptness, regularity, integrity and dispatch are the words posted over the desk of many a successful business man and a recapitulation of an argument for success in dairying would be largely embraced in these four words. Promptness in recognizing the possibilities of a good dairy animal under proper treatment, regularity in supplying her needs, integrity in the management given her,—for an attempt to cheat her cheats ourselves,—and dispatch in according her full measure of credit as well as in extracting her revenue. She is the animal fitted beyond all others for reviving the agriculture of New England, for she responds more than any other to the intelligent and skillful management upon which all business success depends. She can be developed to greater usefulness and profit by breeding, by feeding, or by care and management, and the least of these things should not be beneath the notice of any New England dairyman, whether he is producing milk, cream, butter or cheese for the market, and whether he numbers his dairy animals by the half dozen or by the hundred. We have no right to say that the dairy is unprofitable until we have applied business principles in a business way to all its operations.

One of the ways in which this business qualification should be applied is in disposing of unprofitable dairy animals and replacing with better animals. It requires no little courage to sell or kill a favorite animal that one has raised and petted, or that has been purchased and is admired for her beauty, docility or other desirable qualities, but if she fails in performance at the pail it must be done. A manufacturer does not hesitate to change his machinery when some other kind is invented that can be used with greater economy, although the former may have been of his own invention. We admit there will be greater attachment to an animate object, like a beautiful dairy cow, than to any piece of cold machinery, but business rules do not give much consideration to sentiment, and the successful management of the dairy herd requires business practices rather than sentimental action if we are in it for the dollars and cents that are in it. The cow that is purchased to put in the place may cost twice the amount received for the one disposed of, and probably will, but wise expenditure of money is always true economy.

Another matter of importance under the head of business matters in the management of dairy cattle is the constant personal attention of the owner, and I have never yet known of any business that did not require this qualification. This includes not only a knowledge of how the details of the business should be executed, but how they are being executed every day in the year. The most successful business men of this country are the men who have followed the details of their business the closest, and the most successful dairymen are those who have been the first in the dairy barn in the morning and the last to leave it at night. It is a rare exception when a dairy herd is managed successfully in any other way, and such a course need not be beneath the dignity of any intelligent dairyman depending upon his business for a livelihood.

In closing an argument of this nature it is customary to recapitulate and in a few words state the substance of the case. We can do no better in this direction than to quote the perverted saying of the French monarch, and say as dairymen—"The dairy, the dairy, we are the dairy."

I thank you for your patient attention.

JOHN F. TALBOT—We have assembled here from different parts of the State for the purpose of learning something in regard to agriculture, in the line of dairying. If none of us have gained ideas that we can carry home with us, surely we have lost all that we have paid out, and the time that we have spent. But I do not believe that such is the case with any of us. We have not come to such an interesting meeting as this, to go home with the idea that we have obtained nothing by our efforts. Now what are the things that we have learned? It has been said here by some one that a great many things have been said at this meeting which he did not believe. I am not going to state it that way. I believe that it is all true, but I think many things have been said which will not apply to us all in all our circumstances and conditions. But we have heard enough so that we can sift out that which does apply to us, and make use of it upon our farms. Three points have been mentioned which will apply to us all, whether in the State of Maine, in Denmark, or wherever we may be. These are cleanliness, sunlight and ventilation, and they are essential points to be observed in dairying. They are the very things that the animal itself seeks if left to itself; she will find a clean place to lie down, and it will be where there are no cold drafts, and where she can have plenty of light from the sun, or in the shade if it be in the summer time.

Another idea has been brought out here which seems to me to be very important,—the cheapness of transportation as one means of lessening the expense of our crops. Cheapness in transportation is a subject that has not been discussed very much, and yet it seemed to me when the concentration of creameries was spoken of here, that the cost of transportation was quite an obstruction. We have not the railroad facilities, and our highways are in bad condition, and unless we do something towards lessening the expense of transportation, we cannot compete in the dairy business in any great measure.

This brings in the matter of good roads, and it seems to me as though the Board of Agriculture would do well to bring up this matter in some of their institutes or meetings of this kind.

Dr. G. M. Twitchell—I have enjoyed very much the past hour, as I have listened to the practical suggestions, so clearly enforced, of my old friend from New Hampshire. The law of success is uniform; but we fail to recognize this fact, which should ever be before us, and to seek for its application. I believe that law has been clearly expressed in the admirable lecture which we have heard this evening.

Voted, That the thanks of the Board be extended to the railroads, express companies, and hotels for courtesies shown;

also to the citizens of Bangor for kindnesses extended during the meeting.

The following resolution was presented by Mr. C. E. Wheeler of Chesterville:

Whereas, There once existed an organization, established by law and prospered for a while with a good degree of success, but which from declining interest has become extinct; and believing the dairy prospects of the State have become duly encouraging to warrant a revival of the same; therefore,

Resolved, That at some future day a meeting of the dairymen of the State be held and the old organization be revived and placed in good and reliable standing; and that a committee of three be appointed by the chair to take the necessary measures to procure the charter of the above organization, and report at a dairy institute to be held at Winthrop in January, 1898.

This resolution was adopted, and a committee appointed as follows: J. H. Moore, Winthrop; F. S. Adams, Bowdoinham; C. E. Wheeler, Chesterville.

J. W. Dudley—In looking over the audience this evening, I have been thinking that we should have had a crowded house instead of the few that are present. But I have also thought of the fact that the able talks to which we have listened all through these meetings will be printed in our report, and the benefit will reach beyond the present. I find among the readers of the reports in my section those who are thoroughly interested and enthusiastic, in the work of the Board, although they are not able to attend these meetings. So I feel that we are doing a grand work for the State in this way.

I feel that we have had a successful meeting, and I hope that our meetings in the future may be as great a success as this one has been. This is the third dairy meeting that I have attended, and I can see that there is a growing interest in this line of work in the State of Maine. I thank you all for the kind attention which you have given the speakers.

INCREASING FERTILITY BY CLOVER GROWING AND BY TILLAGE.

Lecture Delivered at Institutes, by Mr. T. B. TERRY of Ohio.

Stenographic Report.

Mr. Chairman, Ladies and Gentlemen: You know, of course, that three elements are required to make our soils fertile; these are nitrogen, phosphoric acid, and potash. Now you can get these elements in different ways. You can purchase grain and feed it on your farms; or you can buy fertilizers in bags, and when you do this you buy them to get one, or two, or all three of these elements, and for no other purpose. But the trouble with these ways, particularly with the last one, is that they are too expensive. It costs too much to buy the fertility; we do not get enough for our product so that we can stand the drain. We are paying a large mortgage on our crop before we get it, in buying the fertility.

I come before you to-night with a cheap, practical plan for getting this fertility for just about nothing,—I might even say for less than nothing. I will try to explain it to you so that you can understand it fully. I have said that three elements were required to feed the soil, to make it fertile. I wonder if you have ever thought about the difference in these elements. There is quite a difference. If you burn up anything that will burn you send up into the air all the nitrogen which it contained, and in the ashes that remain on the earth you have all of the phosphoric acid and potash. Why is this? Simply because the air is the great store-house for nitrogen. The time was when all nitrogen was in the air, but little by little, by nature's processes, some of it has been transferred to the earth, to make it fertile. Now all mineral matter originally came from the earth, and phosphoric acid and potash are classed as mineral matter. So when anything is burned the elements go back where they came from, the nitrogen to the air and the mineral matter to the earth. I have said that the air is the great store-house for nitrogen. You know, of course, about how much nitrogen there is in the air. Eighty per cent of the air you are breathing here to-night is free nitrogen. More than three-fourths of all the air that surrounds the world is nitrogen. If you have 100 acres of land there must be something like a million dollars worth of nitrogen above it in the air. Don't you wish that you could get that all at once and make use of it? But that you cannot do.

This you can do, however: by growing clover in a regular rotation you can transfer as much of this nitrogen in the air to the soil as you may want on the land to produce as good a crop of grain as can stand up on it. You may transfer the nitrogen in the air to the land by the growing of clover; that is the greatest value that the clover plant has for us. Clover has the ability to feed on this free nitrogen in the air, and that is the most costly element in the fertilizers which we purchase. We pay sixteen cents a pound for nitrogen, and only about one-third as much for phosphoric acid and potash. The clover has the ability to feed on this nitrogen to grow itself, and after the plant has grown you have the nitrogen in the large tap roots of the clover. Thus in the growth of clover above ground the nitrogen that was in the air before you grew the clover is absorbed by it, and when it is plowed under, or cut for hay and fed out and the manure returned to the land, you have the nitrogen in an available form for your following crops, corn, potatoes, or whatever you choose to put in. Corn, wheat, oats, and such crops cannot get any of this nitrogen out of the air, although they grow in this atmosphere which is more than three-fourths nitrogen. They were not organized that way, they simply cannot do it. But clover acts as a middleman to transfer the nitrogen from the air to the soil and put it in an available form for other crops; and it is the only middleman that always works in the interest of the farmer.

Now it is possible, by systematic work along this line, by growing clover in a regular rotation once in three or four or five years, as may be found best on your farm, practically to get out of the air all the nitrogen that is needed on your farms for ordinary farm crops. You cannot do it all at once, perhaps not in five or ten years, but systematic work in this direction will result in getting all you want in time, there is no question about that. It was a much disputed point until quite recently, but now it is practically settled.

At an institute in New York state two years ago, after I had been telling the farmers there how we had been managing for some four or five years, getting nitrogen out of the air by means of the clover and furnishing to the money crops that followed all the nitrogen they wanted, Prof. Roberts got up and made this statement: "Mr. Terry, you have solved this nitrogen problem on your farm for all time." Now that means something. If we can get this nitrogen for ten years, or twenty years, or a lifetime, it is a large item, but think of forever getting all the nitrogen we want out of the air, free!

But that disposes of only one element, the most important one, however. We have two more, the phosphoric acid and the potash. How shall we get these to balance the nitrogen in order to make our land fertile in all of the elements? Did you ever notice how the different crops that you raise on your farms grow? Where the roots feed? Let us think a moment about this. Turn over a grass sod and the soil that you turn over is all full of little fibrous, feeding roots. It is all held together and tough with roots. These are the feeding roots of the grass. You find the feeding roots of wheat, corn, oats, and all such crops near the surface, in a mass. Now does your clover grow that way? No, you know it does not if you ever thought anything about it. It has a tap root. At first, when the plant is small, just starting, there are some fibrous roots in the soil getting sustenance there, but as soon as the tap root gets down through the soil you find hardly any fibrous roots in the surface soil where the feeding roots of your corn are. The little fibrous roots of the clover go downward, almost straight down, from the large tap roots, starting out from the lower part and working down into the subsoil to a considerable depth. In the hard pan where I could not dig in the spring of the year after getting down two feet, but would have to pick, I have traced them four feet deep. In porous soil I have traced them as far as eight feet down. These little fibrous roots that you would hardly notice with the naked eye unless they were wet, come out from the large tap root above and work down perhaps hundreds of feet in the aggregate. I have dug a ditch ten feet deep and sprayed the side with a fine mist, and then I could trace the roots, I could see them distinctly. What were they doing down there? They were getting food, of course, to build up the plant. Where is the storage part of the plant? In the large tap root which is up in the surface soil. It takes three elements to build up the clover plant. The nitrogen it gets out of the air. Where does it get the phosphoric acid and potash? It must get these down where the feeding roots are; it cannot get phosphoric acid and potash to any extent out of the surface soil. What is the result after we have grown a heavy crop of clover? We have brought down nitrogen out of the air, and we have pumped up mineral matter from the subsoil. We have brought these three elements together, in the soil and on it, in just about the right proportions to feed the following crops, corn, potatoes, or whatever you choose to put in. None of the elements, to any extent, were in the surface soil before you grew the clover, all of them are there after you have grown it.

You might ask where this mineral matter in the subsoil that the clover is able to pump up comes from. Well, it often exists in the subsoil naturally. Subsoils will very often analyze about as rich in plant food as the surface soil, but the plant food is not in an available condition, especially for other crops than the clover. And then there is a tendency for the fertility to work downward with the drainage water. Whenever we have a wet season the rain, soaking into the earth, takes the fertilizing matter down with it. Clover steps in and reverses the operation, pumping it up to the surface again, so that the surface feeding crops can make use of it.

Now on many soils it would not be possible to get all of the mineral matter, in particular, that you would want in order to grow as large crops of grain as could stand up on your land, in this way. No, we must supply a little more mineral matter in some other way than would be supplied by ordinary methods of culture. You can buy a little if you want to, but there is another way to get it, a cheaper way usually. I wonder if you know how much fertility there is in an average acre of soil to the depth of one foot. I cannot tell you exactly what is in your soil, of course, but I can give you very nearly what is in the average soil. Prof. Roberts told us last winter in an institute in New York state that on an average New York farm, as near as he had been able to figure it, taking the result of a good many analyses, there were about 4,500 pounds of nitrogen, 6,300 pounds of phosphoric acid, and 24,000 pounds of potash. Just think of the enormous amount! And then if you go down three or four feet, as far down as the clover roots can easily get the fertility in all soils, no matter how hard the subsoil, you have two or three times as much.

With all this enormous amount of plant food in the soil and subsoil, why is it that you do not get larger crops? Why must you put on some plant food? Simply because this is not in an available condition, it is dormant; only a little is made available by natural processes each year. If you want any more you have to work for it, and you can get it if you are willing to work for it and work understandingly. This is where the tillage comes in. There are three or four points in tillage, which, if you will pay close attention to them, will enable you to liberate more dormant plant food in the soil to go with what the clover can get for you, and on any soil that has a reasonable amount in it you may be able to get all that you want.

The first point that I would speak of is making the soil finer than is ordinarily done, working it down finer where you are preparing a seed bed for a crop. I am not speaking of this in the line of making a good seed bed, but in the line of liberating the plant food by thorough pulverization, working the ground always when it is dry, not when it is wet. Work it very fine, rolling and harrowing, rolling and harrowing, until you get it down almost to road dust. You can liberate more plant food in this way than would be done by ordinary tillage. Of course the more clay there is in the ground the better results you would get, along this line. Land that is exceedingly sandy would not be benefited much by tillage, there is not much plant food to liberate, but you have very few soils where good tillage will not show the results of which we are speaking.

The second point is one not so generally understood as the first one, that is, the rough stirring of the ground at least once or twice when you are preparing for a crop, and also once or twice when you are cultivating a hoed crop. You may have noticed that nearly all of the implements on the market do not stir the ground very much; even the plows are made now with long, sloping mould boards that turn the furrow very easily, and the harrows are nearly all of the same class,—the spike tooth harrows, the smoothing harrows, the disc harrows, Cutaway, Acme, all move the ground but very little, just as little as possible and still stir it. Why were they built in this way? Simply because they draw easily. We farmers demanded a tool that would draw easily, and condemned anything that drew hard. We have not stopped to think of the work that we wanted done, and to get the tool that would do that work, but we have taken the tool that would draw easily. These are all good tools that I have spoken of, but we want some implement that will do rougher stirring. The spring tooth harrow will do this line of work better than the ordinary cultivator. Suppose you take a large two horse cultivator with teeth five or six inches wide and put horses enough on it to go tearing through the soil, you can just imagine that you see that soil tumbling around every which way. What is the result? You bring new particles of soil in contact with each other, largely. They are thrown around in all directions, while with the other implements of tillage they are scarcely moved at all. What the practical result is I know from long experience. It liberates more plant food. I have asked a number of the leading agricultural chemists in the United States whether, from their standpoint, this would be the case, and they have said at once that it would. We can see readily how this rough stirring would result in liberating more plant food. We try to do quite a little of this work, both when we are preparing the land for the crop and when we are cultivating the crop at first. The first cultivation after the crop comes up is of this character.

The third point in tillage is frequent stirring of the ground while the crop is growing, almost constant stirring of it. As Prof. Roberts says, "Keep the cultivator teeth hot." That conveys the idea. I suppose that we cultivate our potatoes, if the season is at all dry, from twelve to sixteen times. We do not keep any account of the number of times. If we get through them and there is not something else pressing we commence again and keep stirring the ground. Some one asked a noted orchardist of New York state, at an institute which I attended, what he fertilized his orchard with. He said, "With cultivators, gentlemen, with cultivators." If it is a wet season of course our potatoes will grow so that we cannot get through them after six or seven weeks, but in a dry year, when the tops hardly cover the ground, we continue the cultivation until the tops actually are half dead. Keep stirring the ground. I have had a team cultivating when we were digging at the same time for early market, in the same field, in a dry season. You must remember that by this long continued cultivation we are not only taking care of the crop, but we are liberating plant food for one or two or three crops following, to a certain extent. This fact was not proved until quite recently, but it has been proved at the New York Experiment Station thoroughly, and I know it from our own experience.

The other point in tillage that has been beneficial to us I mention with some caution. It might be of use to you and it might not. That you must find out for yourselves. We have found a gradual deepening of the soil to be beneficial along this line of liberating more plant food. We have been gradually increasing the depth of our soil for some twenty years, and we are going to plow a little deeper next spring than we ever have before. We shall keep this up just as long as we can turn the furrow with any plow that is made. This is beneficial for our soil, which is mostly a clay loam, and for our crops,—potatoes, wheat, and clover. Whether it would be best on your soil, for the crops that you grow, is a question that you must find out for yourselves. Theoretically it looks like this: The bringing up of a little subsoil, perhaps half an inch or so of new, raw subsoil, every time we break up a field in a rotation, and exposing it to the action of the sun and frost tends to liberate more of the plant food in the subsoil than would be done if it were left packed in the bottom of the furrow. That is the way I should explain it theoretically, and I know practically that it does pay us.

Now some of you might say that this plan that I have outlined is very good from a scientific standpoint, but you would hardly believe that a farmer could manage so as to get all of the plant food that he could make use of on his farm in this way,—by the growing of clover and tillage. Some of you, when you got out-of-doors and were talking among yourselves, would say that you thought that was a pretty wild statement. So let me explain a little further what I know about this. I know a great deal more about the practical side of the question than I do about the scientific side, because practically my whole business life has been spent in this direction. We began farming twenty-eight years ago on land that was run down in available fertility. At least, it would not produce a half way paying crop of anything. It was originally fairly good land, not excessively good, but producing from sixteen to twenty bushels of wheat per acre when it was first cleared, many years ago, and other crops in proportion. But it had been farmed in a somewhat careless manner; it had been rented for years. Practically everything had been taken off and nothing put back, and the available fertility in the soil was just about exhausted. The corn crop on that land the year before we moved on to it, when the tenant was managing it, was never harvested, it was not worth harvesting. He had eight bushels of wheat per acre that year, and I well remember his remark to me that that was a pretty good yield for that farm, the best yield he had had for some years. The year after I moved down there I think I mowed over, all together, about forty-five acres, and all the hay after it was put into the barn would just about measure twelve tons, and it is safe to say that half of that was weeds. On the poorest of the land I mowed, raked and loaded all day, and drew the hay to the barn at night on a one horse wagon with one horse. That is an exact statement of fact; and I might add that my wife loaded the hay.

You can readily see that with crops as poor as that we could not afford to hire any help. Perhaps I had better tell you also, so that you can see that the bringing up of this land has been done without the use of capital, that when we first went on to the farm we were in debt $3,700, on which we had to pay seven per cent interest. We had one horse, one wagon, nine cows and three tillage implements, and that is practically all. Our debt was all the farm was worth, really more than it was worth. If a man can start on a farm in that condition, without any capital or any sort of a chance, as it would seem, and manage to bring the land up by making use of the principles that I have been talking to you about, certainly these principles must be practical. If we could live, and increase the fertility of that soil at the same time, and finally pay off the debt and improve the farm, certainly it must be a practical plan. But I assure you, my friends, there was some pretty hard sledding the first three or four years. Some of my friends who knew how we were situated financially, used to ask me what in the world we lived on anyhow. I told them that we lived on the little potatoes that we could not sell and on hope; and we did not eat many of the potatoes either. That was the condition under which we began. By the merest accident I sowed some clover seed the first spring; there was not much of it, but it grew better than the timothy that was on the other end of the field, and I noticed that I got a little more hay there. And when I fed that clover to the cows in the winter I saw that the cows gave a little more milk than they did on the timothy hay. And later, when we plowed the field, one-half of which had been sowed to timothy and one-half to clover, I got fully as good results from the clover end of the field as I did from the timothy end, although we had put a little dressing on the timothy end, all that we had. Here were three points which it seemed to me were worth looking into. We were hard up and struggling for some way out, and we thought we could see it along this line. Here was more hay to the acre, better hay, and increased fertility over what the timothy had given us. This was an accidental experiment. I will tell you how it came about.

I began spreading the manure next to the road, back and forth. It was a long field, sixty rods long by fifteen or sixteen rods wide. Why did I spread the dressing next to the road first? Simply because if I had any corn that was good I wanted it where people would see it. When I got as far as the timothy extended I had no manure, and none was put on the clover end. When I came to harvest the corn I saw that I had just about as good corn on the clover side as on the timothy side with the manure, although of course there was not a great deal of it, as we had only nine cows and one horse, and they were only about half fed. The hay was poor and weedy and we had no money to buy grain to feed the cows, and we could not expect very much. We began studying, thinking and observing along this line, and the result was that after a while we divided the part of the farm that could be cultivated, about thirty-five acres, into three nearly equal parts, something like twelve acres in a piece, and commenced a regular three years' rotation, sowing clover once in three years. The next question was, what money crops shall we put in to make use of the plant food that the clover obtains for us? We could have grown corn, and we did grow corn the first year or two; then I decided to grow potatoes. There were two or three reasons; one was that in selling potatoes from the land we sold mostly water, and that was better than selling plant food. And then we could get more money per acre out of the potatoes, and we had but little land. Also, our land is better adapted to growing potatoes than it is to growing corn. So we began growing clover, potatoes and wheat. The wheat was grown because we wanted some grain crop to seed our clover with. We grow winter wheat and sow clover with it. At first we did not sow the wheat but sowed the clover alone, as the land was not rich enough to grow two crops at once. We sowed clover alone for two or three years, until we got the land in a condition so that we dared to put on the wheat. The first crop of wheat brought us twenty-three bushels, which was, perhaps, a larger crop than had been grown on the farm for many years. As soon as we got the matter arranged and started we settled on this regular rotation of clover, potatoes and wheat, and we have kept it up for a great many years, depending on the clover, with the tillage, to furnish the plant food in an available form to grow the two money crops that follow, the potatoes and the wheat. We have not brought any fertility on to the farm, practically. Some grain was purchased at first, but the manure from this grain was all put on to seven acres. The rest of the land certainly has had no outside fertility, and those seven acres are no better than the rest. We have not bought any fertilizer whatever except by way of experiment. Five or six years we have used a little on strips through the field, to see the effect.

The land has been brought up gradually, in and of itself, by following the methods that I spoke to you about at first. What is the result? Thirteen years from the time we began we had the driest season that has been known in Ohio for perhaps fifty years, at least since I can remember. This was the year 1881. That year on one-half of our cultivated land, seventeen and one-half acres, we had over $1,700 worth of potatoes and wheat. Eleven and one-half acres of wheat brought us, as I remember, $655 for the wheat and $90 for the straw, fed out in the barn together with purchased grain; and six acres of potatoes brought us $967. On another six acres we had $471 worth of potatoes that year. And this was only thirteen years from the time we commenced on that run down land. The land was called worn out. It was not worn out, it was simply run down in available fertility in the surface soil. In the way it was managed it was not bringing any crop, but as we managed it we got a crop without putting anything on from outside, practically.

At that time our state board of agriculture was offering a prize for the best detailed report of the best and most profitably managed farm of fifty acres or more in the State. We sent in the report of our farming for the years 1881 and 1882, and if you will look in the annual report of the Ohio State Board of Agriculture for the year 1882, you will find that we got the fifty dollar prize. We had thirty-eight bushels of wheat per acre in 1881, instead of eight. Adding the thirty makes a big difference to the profits. And for potatoes we received $160 per acre, instead of raising potatoes that did not more than bring back the seed.

We have kept working right along that line ever since. In the fall of 1881, with the wheat money, or a part of it, we paid the last $500 of the debt on the farm, and of course we paid a good deal more in interest. Every dollar of that money was dug out of that land, that was so run down when we started. Then we felt encouraged to work harder along this line. We have now on the farm everything that we have any desire for in the way of improvements. We have gradually put these improvements on, as we could pay for them. Everything that has been added has been paid for, cash down. In 1883 we built a new home, a year or two later a new tool house, and a year or two later a new barn. We had first to pump the money out of the land, and then we put it back in these improvements. We are now paying for a fire insurance of over $10,000 on the buildings and contents. I do not say these things to boast, but to show you that I know what I am talking about. Every dollar of that money has been drawn from that farm. All money which has been earned in outside ways has been kept entirely separate. Remember the conditions under which we started, and note the result that we have obtained, and tell me whether it is not a practical plan that I have come before you with to-night.

If this were an exceptional instance, if I were the only man, it would be somewhat different. All over the country we have farmers who have done well along this line, some of them perhaps better than I; making use of the clover and the tillage to get the fertility out of the air above and the subsoil below, and to liberate some of the dormant plant food in the soil. Of course in time the plant food of the soil will be exhausted,—the mineral matter will give out, the nitrogen supply never will. Some time we shall have to add mineral matter to the soil, because there are only just so many pounds in it, but remember how much Prof. Roberts found in an acre of soil. It will be a long time before the supply will be diminished very much. I do not worry about that, and particularly when we are making such large profits out of the crops we are growing that we can easily afford to buy mineral matter if it becomes necessary. But I do not think it will be necessary in my children's day, or my grandchildren's day.

I think I made the remark at first that the fertility which we got by clover growing, on the plan that I had to give you here to-night, would cost less than nothing. Let me explain that a little. There is no coarse food that you can grow that has a feeding value equal to clover hay. Good clover hay cut in bloom and nicely cured comes the nearest to being a perfect food, of anything in the line of fodder that you can grow. In 100 pounds of good, early cut clover hay you have about eight pounds of digestible protein, and that is the element that goes to form muscle, flesh and blood. You buy wheat bran, and oil meal, to get it. One hundred pounds of timothy hay contains a little less than three pounds of digestible protein, 2.9.

You see that the clover hay, if it is cut early, is worth decidedly more per ton than timothy or hay made from other grasses, and you can grow more to the acre by mowing it twice in a season; at least *we* can, invariably.

So you see that while you are bringing up the fertility of the land by the growing of clover you are actually doing it for less than nothing, because you get better hay and more of it than with the grasses. I suppose that we have more than $2,500 to show now for the saving along this line in the feeding of our horses for the past twenty-five years. The clover being so nearly a perfect food, it has taken $100 worth less of grain per year to keep our horses in good condition than it would have taken if we had fed timothy. Two thousand five hundred dollars is quite a little sum to show in favor of clover, and this is only one little point. We are leaving out all the fertility to the soil that it has brought us. There is no hay that can be grown that is better for young stock, for cows giving milk, and for horses, except drivers, than this same clover hay.

There is one point that I would like to have you notice particularly; this work of renovating a run down farm cannot be done all at once. A lady said to me the other day, "To hear you talk, it would seem very easy to do this." Now it is not easy, of course. One is apt to forget the years of struggling that we had at first. It went very slowly at first, it was five or six years before we saw much gain. But after we fairly got started the gain came faster, and now it actually just about runs itself. There is no trouble about it at all. We continue the rotation, and put on the good tillage, and our crops grow right along. It took us twenty-five years to get up to our largest crop. Three years ago we had the largest crop of wheat that we had ever grown, the largest on record anywhere in our part of the State. We averaged forty-seven and three-fourths bushels per acre on all the land sown. That same land twenty-five years before, the year after I moved on to the place, I offered a neighbor the use of if he would plow it and put in a crop. I wanted to seed it in the fall, and had but one horse, and I thought I could get a neighbor to plow it and take the crop that he could grow for the pay. He said, "I know that land too well. I would not plow it for all that it would produce." Twenty-five years later we raised forty-seven and three-fourths bushels of wheat per acre upon it. Last year we had only about twenty-seven bushels. You know the conditions have to be exactly right; one snow storm would cut off the yield ten bushels on as heavy a crop as that.

Another point; unless you take the very best possible care of the clover you must not expect any such returns along the line of increasing fertility as I have been telling you about. We had to learn a great deal along this line by experience. We could not learn any of these things that I have been telling you about from books or papers at that time, practically. We had to learn to take care of the clover. As we saw that it was doing us good, we had courage to take better and better care of it, and the better care we took, the better returns we got from the following crops. First, we had to learn not to sow timothy with the clover. It was the custom to sow quite a large quantity of both seeds. I did this at first, but gradually worked out of the timothy, and for perhaps fifteen years we sowed clover alone. The last three years we have been sowing a little timothy, about a quart, as there are some places on our farm that are quite clayey, and there the clover will not do as well as the timothy. But practically our fields are clover. We had to learn to keep the stock off from this clover, never to turn them on under any circumstances. If we wanted to feed off the clover we should mow it and take it off, and not allow the stock to tramp on it and injure the roots. We had to learn not to let the weeds grow in the fall and rob the young clover plants of food, but to run the mowing machine over the land and keep them down. We have been doing this for about eighteen years. About the 20th of August we mow the fields, cutting the weeds before they have gone to seed, and clipping off the clover and letting it lie as a mulch.

And then we had to learn to topdress the poor spots in the field, where the clover would not grow. We realized what the clover was doing for us, and we just took care of it well enough to get a big crop, making it grow where it would not grow otherwise. I began by putting all of the manure on the money crops, that is the common practice. But I soon saw that I was working in the wrong direction; it was better to put it on the

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renovating crop, and grow that anyway. If I got a good crop of clover there was no trouble about fertility for the following crops. Our clover gets together for us on an acre of land more than fifty dollars worth of plant food, at market prices. That is nearly two tons of pretty good fertilizer per acre. As we manage the clover we get about one and one-half tons of hay on the average, in the fall after the grain is taken off. You could not, perhaps, grow quite as much here. In a dry season it would not do that, and in some wet seasons we get more. That is the amount of the crop in the fall. We do not take that off very often. We generally cut it and let it go back to the land. If it grows up a second time we cut it again, when it is about four inches high. We are working to enrich the land, and put the clover in such shape that it must go through the winter all right and grow a good crop the next year, whether it is wet or dry. The first cutting will give us on the average two and one-half tons of hay, and the second crop that same season will give us one and one-half tons. That is what we got this year,—four tons in the two cuttings. And after that there is a crop about two feet high to cut as a mulch, which amounted to one ton last fall. This, with the four tons taken off, gives us five tons of hay per acre. While the clover is growing the root growth amounts to about two tons per acre. In dry weather I have taken a square rod and dried the roots and weighed them, and then figured from that, and the result would be about two tons of dry matter per acre. Adding this to what we have above ground, gives us seven tons.

The chemist tells us that this is worth about eight dollars and twenty cents a ton, so we have about fifty-seven dollars worth of plant food grown on that acre of land, by growing the clover. If we cut the hay and feed it out we lose a little, but not very much on our place because we have cement floors and not a drop of the manure goes to waste, it all gets back on to the land. We have fifty dollars worth of plant food just as surely as though we had bought fifty dollars worth of fertilizer; in fact, more surely than if we had bought the fertilizer, because there is never any cheating about the clover, it comes right up to the analysis every time. And more than that, we get the humus supplied with the clover, which we do not get with the fertilizer, and that is a very important item. The clover furnishes vegetable matter also, and when you buy fertilizers and depend on them you do not get this vegetable matter.

Perhaps I ought to say one word more. I have been telling you how we have succeeded on the farm, and I have been keeping right to the subject that we have up for discussion to-night. There have been other causes, however, for our success. We have done other things besides growing clover and practicing good tillage, and these other things have helped, too; I would not like to lose sight of that. We have carefully saved the manure. It is all kept under cover until it goes on to the land, and it is kept on a cement floor so that not a drop can leach away, and we use land plaster in the stable twice a day so that none can evaporate in the form of ammonia and escape in that way.

Then we had to tile drain some of our fields before we could make the clover grow. The roots would freeze out and we would find the clover on the top of the ground.

So there have been other reasons for our success besides the growing of clover and good tillage, but I am perfectly safe in saying that if we had done everything else that we have done and had grown timothy, had sown no clover seed but simply had grass in our rotation, I would not be here to-night, and you never would have heard of me. Nor would we be out of debt on our farm; I do not see how it could have been done. Our success has been due very largely to this wonderful ability of the clover plant to get fertility for us for nothing, out of the air above and the subsoil below, which we could turn into large crops that we sold for money.

DISCUSSION.

Ques. What is the character of the soil where you have been growing this rotation?

Ans. In a single word, clay loam would express it as nearly as possible, although some portions of the field are quite heavy clay, and other portions run off into sandy loam that does not need drainage.

Ques. Is it rocky?

Ans. Not what you would call rocky. There are parts of the farm where we plow up cobble stones, and stones supposed to have been brought down from the North by glacial drifts.

Ques. Where the land is rocky is it necessary to tile drain?

Ans. Where there are many stones the natural drainage is sufficient.

Ques. From what you have seen of the central part of this State would you expect that it would be necessary to drain much of the land?

Ans. I have not been on to the land and examined it carefully enough so that I would like to answer that question. If you have a subsoil that is retentive of water, so that your clover freezes out and your crops injure in a wet season, you would need to tile drain.

Ques. In starting in this line of clover growing what would the advantage be of plowing under the first crops of clover rather than cutting them?

Ans. By plowing under you would be sure of getting all the clover produced, for fertilizing, but as a rule it is wiser, undoubtedly, to cut the clover and feed it, particularly if you have a large stock. It is better to get the feeding value out of it first, and then the manurial value, but that is not the way we did. We plowed under the second crop for a great many years.

Ques. Have you always taken off the first crop?

Ans. Nearly always. Sometimes if we did not need it we left it on the poorer parts of the field. We took off what we needed to keep our five or six horses and one cow, for quite a term of years, and all the rest was plowed under. We did this partly because there was not much money in keeping stock at that time, and partly because we wanted to add to the vegetable matter in the soil just as fast as we could. We were getting from $100 to $150 an acre for our potatoes, and we felt that we could not afford not to feed the clover directly to them.

Ques. Would you advise planting corn after clover instead of potatoes?

Ans. It would be just as well as to plant potatoes. Clover sod is an admirable place in which to plant corn, as well as potatoes. There are a great many farmers who follow the same rotation that I do, puting corn in the place of potatoes. You can put in both corn and potatoes. In that case I should follow the clover with corn, and perhaps sow rye in the corn, and plow that under the following spring for the potatoes. Then I would put in a small grain crop, oats or whatever you can raise here, and then seed down.

Ques. Do you sow your clover seed in the spring?

Ans. We sow it early in the spring, as soon as the snow banks are about gone, and let the freezing and thawing cover it. The frost will cover it better than we can.

Ques. How much seed do you put on to an acre?

Ans. We put on now about six quarts. More than that would be best where the land is at all poor. It will not all grow and it is better to put on enough. We sow the clover seed on land previously sown to wheat. The wheat is put in in the fall, and then in the spring the clover is sown. You could do the same with rye, sowing that in the fall, and sowing the clover on the rye. A better way, where land is run down somewhat, is to sow the clover alone. It would be best in that case to prepare the land in the fall and sow the clover, and it might be best to harrow it in; I do not know whether the conditions here are such that the frost would cover it properly.

Ques. Can you hold the clover on a side hill?

Ans. Yes, sir; I can hold it by top-dressing a little.

Ques. Please explain your method of tile draining.

Ans. I look the ground over and find the places that should be drained, and then lay the tiles as I have opportunty. We put them from two and one-half to three feet deep, probably averaging about two feet and ten inches. In some places we have laid them deeper than this. There were bogs where we would go even five, six, or seven feet, and one drain for a short distance was eight feet deep. But where the land was rocky we calculated to lay them nearly three feet deep. This is practically below the frost line, but not always. If the tiles are hard enough to ring they will stand the frost all right.

Mr. Hunton—In the little experience which I have had with tiles here the frost does much damage. Our frost line for all years is at least four feet, and some of the tiles will be displaced and some broken.

MR. TERRY—If the tiles are burned hard, and placed solid when they are put in I do not see how they can possibly be displaced by frost. In laying, we cut a groove at the bottom of the ditch with what I call a groove cutter. I use one with which I can walk along on the top of the bank, and cut a groove just wide enough for the tile. Then I place the tiles in solidly, and you could not disturb them by driving a team over them, unless you broke them. Then I put clay in and tramp that down, and the tiles are buried so that no frost in the world could ever disturb them. If the tile is hard it will be there 100 years from now just as good as when you put it in.

Ques. Is tile better than stone draining?

Ans. Stone draining, as long as it lasts, is just as good, but it is more expensive, it takes more time. Stones are used in a great many places, and will do good work, but if your time is worth anything a tile drain is cheaper.

Ques. Do you use any collars?

Ans. No, we use plain tiles. The only place in which I ever use collars is near the outlet. Here we use two-foot tiles, and put collars on so that they will not be displaced, but after we get back into the ground I have no fear of frost.

Another advantage in using tiles is that the trench does not need to be very wide. For the most of our draining we have dug the trench about ten inches wide at the top, about six inches wide at a depth of two feet, and just the width of the tile at the bottom, whether two or four inches.

Ques. Is the digging done by hand?

Ans. By hand, except that the first foot or two may be done by plowing. Where the stones do not interfere much, a team can be used on each side of the ditch, with a long evener and a chain attached to the plow. In this way you can plow down two feet, and shovel the dirt out a great deal faster than you can dig it out with a spade. But this can only be done when the ground is reasonably dry.

Ques. How near together do you lay these tiles through your field where it is quite level?

Ans. Where our land needed tiling we were obliged to lay them as near together as two rods. As we came to the upper end of the slope, on a little lighter soil, we branched them out fan-shaped, putting them farther apart. But where there is a clay subsoil two rods is about right. They will usually drain well about one rod on each side, if laid about three feet deep. Of course the deeper the tiles go the more surface they will drain, but it costs more to lay them deep, as in our subsoil it is about as hard to dig the last foot for a four feet drain as it is to dig the other three feet. It is usually more economical to put the tiles nearer together and not so deep.

Ques. What is the cost of the tiles per rod?

Ans. Two-inch tiles can be bought for about eighty cents a hundred feet. Those are what we use mostly for laterals on heavy clay land where there is a reasonable fall. If the land is very level larger tiles must be used. On the prairies in the West, where it is almost a dead level, we use nothing less than four-inch tiles.

Ques. Do you regard this underdraining as essential in securing a clover crop?

Ans. On a part of our land it was absolutely necessary. We could not get a uniform crop in any other way. One of the things that I rather like to boast of is that I laid every tile on the farm with my own hands, and did nearly all the work on days when most farmers would have thought it too bad weather to work out-of-doors. If the first cut of the ditch was opened when the ground was not frozen, we could work in it in quite cold weather. I managed to get money enough in some way to get the tiles, and I never felt happier in my life than I did in those days when I came home with a load of tiles and hauled them down into the field, where we could put them in place in rainy weather. Whether we got a crop or not was a matter of luck until we drained the places that needed it.

Ques. In Chamberlain's book on drainage, I notice that it speaks of draining some places without any outlet. Does that work well?

Ans. Yes, sir; we have quite a number of places drained without any outlet.

Ques. Were the tiles laid the same distance apart as in the other drains?

Ans. These were small places on a side hill, where there was not much land to drain, never more than one-quarter of an acre, and we did not have any regular system. The outlets are the worst part of the whole business; they require constant attention. I dared to do something that no one else had ever thought of. In laying the tiles I carried them down to low ground which was quite porous, and just filled up the drain, leaving no outlet; taking care to put in quite large tiles at the lower end, so that if they did fill up it would take some time for them to become completely filled. Not one of those drains has ever bothered us a bit. We have one drain that drains a depression that has no natural outlet. It is what we call a "pot hole," supposed to have been caused by the settling of a large glacier, and the soil drifting around it; as the season grew warmer the ice melted and left the hole. It was in the best field that we have, where we have grown fifty bushels of wheat per acre. In order to drain it in a natural way it would be necessary to cut through a bank ten feet deep, digging about eighty rods at that depth. This would be very expensive. I had offered experts quite a sum of money if they would drain the place and guarantee success, but I could not get any one to do it. About a quarter of an acre of the crop was destroyed every season by the water, and my wife got rather exasperated and said to me, "I would drain that place if it cost a thousand dollars." I began to think that perhaps I would better try it, and I went to studying over it in earnest. I knew that there was a little gravel ridge across the field, perhaps ten rods wide, because in a dry time the crops would wither there sooner than on the rest of the field. I started in the direction that I should have to go to drain the place naturally, and went through that gravelly place. I found that the water level in the gravel would barely furnish me drainage, and I laid my tiles perfectly level from the bottom of the hole, about two feet below the water. I put in four-inch tiles, and closed the ditch, without any outlet. At the upper end I put in a lot of two-inch tiles branching out in every direction, so as to gather the water quickly; and the probabilities are that that drain will work all right for a hundred years. In this way we have saved our crops.

Ques. Would that work just as well on a larger scale?

Ans. It would not answer to have too large a volume of water, because there would be so much sediment in it that the drain would fill up faster. Ours troubles us only one year in three, when we grow potatoes. In clover or wheat it does not trouble.

Occasionally, if there is gravel below, and the water level is at quite a depth, a well can be sunk and the tiles run into that. We tried that once and it worked well in dry weather, but when the wet weather came the water came up instead of going down, and we had to fill up the well.

Ques. Please explain how you protect the outlets so that they will not cause trouble.

Ans. The best plan is, not to use mason work, but to sod the ground. The sods will rise and fall with the frost. We use two-foot lengths of sewer pipe, perhaps three for each outlet, with a collar at one end of each, and build up around the outlet with heavy sods. The frost cannot displace these pipes so that the water will not go through. We never plow near the outlet, but leave the sods.

Ques. Do you think it advisable to plow as deep on sandy land as on clay?

Ans. We plow deep for all of our crops, but we have no sandy land. Deep plowing would not be advisable on light, sandy land, and I am not sure that it is advisable for any of you at all. That is a question that you must decide for yourselves. I know that it has helped us to liberate plant food.

Ques. In plowing would you advise turning the sod down, or using a subsoil plow, and just loosening it?

Ans. Subsoil plowing has not paid us since we have been growing clover. I think it must be that the clover roots loosen the subsoil sufficiently. A gradual deepening of the surface soil has paid us. Subsoil plowing does not bring any of the subsoil up to the surface and expose it to the action of the sun and frost directly, while the deep plowing does bring it up, a little at a time.

Ques. What is your average depth of plowing?

Ans. We plow about nine inches deep, but that is for potatoes. They like a cool, deep soil, while corn wants its roots near the surface.

Ques. How deep do you plant potatoes?

Ans. About four inches below the surface.

Ques. Would you advise the raising of cow peas?

Ans. They would not be of any use to you, practically. Five hundred miles south they are all right. In southern Missouri they are a perfect success, but Maine is too far north. You can grow the Canada pea if you prefer. That will help you some along this line, but not as much as the clover.

ABSTRACT

OF

CATTLE COMMISSIONERS' REPORT.

A summary of the business of 1897 shows that your commissioners have attended three hundred and fifty-two inspections, embracing almost every county in the State. During the year, two hundred and eighty-seven farms have been visited, and sixty-five stables have been inspected; and as a result, four hundred and fifteen head of cattle have been condemned and destroyed* at an appraisal of $18,122.00 and twenty-eight horses have also been condemned and destroyed at an appraisal of $1,085.00, the total appraisals of the year being $19,207.00.

In our last bi-annual report the business of 1896 was compared with that of the previous year, showing that in 1895 forty-three head of horses were condemned and destroyed at an appraisal of $1,927.50, and seventy-nine head of cattle were also condemned at an appraisal of $2,459.00, the total amount of appraisals for that year being $4,386.00. In 1896 forty-five head of horses were condemned and destroyed at an appraisal of $1,967.00; and two hundred and two head of cattle were also condemned at an appraisal of $7,063.50, the total amount of appraisals for that year being $9,030.50, amounting in the two years to $13,416.50, for which the bi-annual appropriation was ten thousand dollars, out of which was expected to be paid for all horses and cattle condemned and destroyed, and also all pay and expenses of the three commissioners. It is a very

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*Of this number 160, or 38 per cent, were killed in January; 273, or 65 per cent, in January and February; and 312, or 75 per cent, in January, February and March.

B. W. McKEEN.

significant fact that while the number of horses destroyed during 1897 was less than that of the previous year, the number of cattle condemned has largely increased, and that the appraisals of 1897 alone exceed the appraisals of the two previous years by over six thousand dollars.

The bi-annual appropriation for 1897 and 1898 is fifteen thousand dollars. The sum of ten thousand dollars was by special enactment to be devoted to the work of the year just closed, the remaining five thousand (the usual annual appropriation) to be reserved for the business of 1898. It must be apparent upon the face of it, however, that no commissioners who ever have been, or who are ever likely to be appointed, can do twenty thousand dollars worth of work with five thousand dollars, or who can pay out of ten thousand dollars the net sum $9,623.00 for horses and cattle actually destroyed, and with the balance of $376.50 pay all the other expenses of the commission, including salaries, etc., and keep within such an appropriation. For the benefit of all those who have been unfavorably affected by the limited appropriation of 1897, it should perhaps be explained what facts and figures were presented to the "Committee of Agriculture" before whom our board appeared at the lest session of the legislature.

During the months of January, February and March, and up to the time of adjournment of the legislature, an unprecedented amount of work had been demanded of our commission, so that up to the date of March 31, 1897, there had been condemned and destroyed three hundred and twelve head of cattle and eight horses, the appraisals on which amounted at that time to $14,624.00, and it will be observed that this amount exceeded by over one thousand dollars the whole amount of appraisals for the two preceding years of 1895 and 1896.

These facts were all in the possession of the "Committee of Agriculture," and also the "Board of Agriculture," from whom came the major part of the opposition to any increased appropriation, and it was well understood by all concerned, that allowing nothing whatever for the expenses of the commissioners up to that time, there would be but about $2,500.00 left for the use of the Cattle Commission, to carry on and complete the work of 1897. Among the causes leading up to this unusual amount of work, were the unwarranted and mischievous statements that had been freely circulated by interested parties that "fifteen or twenty per cent of our bovine population were affected with tuberculosis," while one-tenth of that estimate would have been much nearer the truth; and the motives for such mis-statements have been recently referred to by Dr. J. M. Parker of the Massachusetts Commission; in a paper prepared by him, he said, "It has seemed to me sometimes as if there had been too much anxiety among certain veterinarians to increase and exaggerate such danger as there might be, not so much for the good of the public as because the more the people become panic-stricken, the greater the likelihood that their pocket books would be fattened."

This condition of affairs in Maine rendered the work of our Commission for the past year much more embarrassing than for any previous year, as the law was still in force, and under its provisions we were in duty bound to answer all reasonable calls for inspections of herds or stables, and with less funds than ever before to continue the work before us, and work, too, that we realize has been imperfectly though impartially performed, from the fact, mainly, that the funds at our disposal were entirely insufficient for us to enlarge and extend such work beyond actual and voluntary notices of suspected cases, or enable us to inspect or quarantine certain herds where we have every reason to believe that diseased animals are being sheltered, and from which young stock are being sold for breeding purposes and their dairy products scattered broadcast without any restraint whatever. The depletion from our dairy herds of many of their best cows for export to "Brighton Market" still continues; as the good reputation of Maine cattle renders the business profitable to many of our drovers, who make weekly shipments of selected animals which, as a rule, contain no very old, young, or "farrow cows," while the class of cows sold are not being replaced by the saving and raising of their heifer calves, that are taken along each week even in larger numbers than the cows. During 1897, Maine sent to Brighton eleven thousand nine hundred and fifty-seven head of her best cows, while but comparatively very few are being brought into Maine, and these principally for breeding purposes, all of them having been first tested with tuberculin, and proofs furnished before any permits are granted. This brings us to the consideration of the requirements of our neighboring states, our inter-state agreement being that all cattle going out of Maine shall also be tested by men vouched for by the Cattle Commission that they are competent and honest in the discharge of such work; and if we could believe that all who have been employed were to be trusted, the fact that out of approximately twelve thousand animals said to have been tested during the past year, only four of them had proved to be diseased, it would be a most wonderful exhibit for any state to make; for the cold fact remains that only four animals tested for Brighton have been reported to our Commission by all the veterinarians in this State during 1897. We are very free to say, however, with all the facts and information from reliable sources in our possession, that if the larger number of cattle had been coming into Maine, instead of going out of it, but very few of them would have been admitted.

By the recent action of the "Massachusetts Cattle Commission," our former inter-state agreements and regulations have been so changed that in future the proper testing of all cattle brought into Massachusetts, shall be done by men appointed by their board, and "they will only accept the tests of such men as they approve of," as will be seen by their last annual report, in which they say:

"The question of the advisability of placing quarantine restrictions on cattle coming into a country or state is one that is thoroughly well established. In Europe quarantine regulations and the requirement of the tuberculin test is very general. On this continent both the United States and Canadian governments require it, and it is also required by several of the different states before cattle are permitted to pass their borders. Unfortunately, the difficulties in its enforcement are great. The alternative consists in the Board appointing their own agents to do the testing in the various states from which the cattle are generally shipped. Consequently, at a meeting of the Board, held October 2, it was decided that the Board should appoint their own agents to do the testing on cattle coming in from without the state; and in pursuance with this decision the following letters were prepared, and will be issued as soon as the list of out-of-state agents is completed:

LETTER TO AGENTS.

Boston, January 1, 1898.

Dear Sir:—The Massachusetts Board of Cattle Commissioners is of the opinion that, in order to protect the cattle owners of Massachusetts from bovine tuberculosis to the greatest practicable extent, the work of testing cattle outside the state, to be brought into Massachusetts, should be done in the most careful and efficient manner possible.

In order to perfect this branch of our work as far as we are able, it has been decided to consider those testing cattle with tuberculin, for farmers and dealers, to be brought into this state, as our agents outside of this Commonwealth, and this Board will only accept the tests of such men as we approve of.

All tests are to be made at the expense of the owners or buyers, and not at that of the Massachusetts Cattle Commission.

Each tested animal must have an ear-tag, furnished by this Board at cost; the number on the ear-tag must correspond with the number on the certificate; and the appearance of the animal must also agree with the description of the certificate, otherwise the certificate will be considered valueless.

You have been approved of by the Massachusetts Board of Cattle Commissioners to test neat cattle to be shipped to Massachusetts, and we will continue to accept your tests as long as we are of the opinion that they are being made in a careful and conscientious manner; if at any time, however, we have reason to be dissatisfied with your work, we retain the privilege of summarily dropping your name from our list.

We also request you to keep us informed as to the source of the tuberculin you use, the strength of the solution and size of dose, all of which must meet with our approval.

Per order,

Massachusetts Board Cattle Commissioners.

LETTER TO DEALERS.

Boston, January 1, 1898.

Dear Sir:—The Massachusetts Board of Cattle Commissioners is of the opinion that, in order to protect the cattle owners of Massachusetts from bovine tuberculosis to the greatest practicable extent, the work of testing cattle outside of this state, to be brought in here, should be done in the most careful and efficient manner possible.

In order to perfect this branch of our work as far as we are able,, it has been decided to consider those testing cattle with tuberculin, for dealers and farmers, to be brought into Massachusetts, as our agents outside of this Commonwealth, and this Board will only accept the tests of such men as we approve of.

A printed list of the men we consider reliable will be furnished on application. This list may be revised from time to time, as new applicants may be added or men who prove either dishonest or incompetent are dropped from it.

All tests are to be made at the expense of the owners or buyers of the animals, and not at that of the Massachusetts Cattle Commission.

All neat cattle over six months old brought into the state purporting to have been tested will be quarantined and tested, unless such test has been made by an authorized out-of-the-state agent of the Massachusetts Board of Cattle Commissioners.

Each tested animal must have an ear-tag, furnished by this Board at cost; the number of the ear-tag must correspond with the number on the certificate; and the description on the certificate must also agree with the appearance of the animal, otherwise the certificate will be considered valueless.

Per order,

Massachusetts Board Cattle Commissioners."

In several instances this season and last the Commissioners have also been summoned long distances to inspect cases of reported glanders, where there proved to be no reasonable excuse for such report, and for the guidance and instruction of persons having suspicious cases, we will briefly give such characteristics and symptoms of the disease as should enable those not acquainted with this dangerous malady in horses to diagnose it correctly. It may be at once stated that the designation "glanders and farcy" are employed to distinguish two forms of one disease; or, in other words, that they are two diseases essentially identical, however dissimilar their external manifestations. They are characterized externally by certain alterations in the skin and the mucous membranes of the respiratory passages of the head, consisting chiefly of ulcerations, and the formation of a special kind of purulent matter, and induration of the glands. These two forms of the affection may be observed in the same animal singly or simultaneously, and the contagion of glanders may produce farcy by transmission from a diseased to a healthy animal, as farcy may produce glanders. The fact that this contagious malady, while peculiar to horses may also be transmitted to mankind, renders it a constant menace to every man, woman and child in the community.

Glanders and farcy is a malignant and fatal disease, that finds its origin in a contagious principal, a special micro-organism, and is transmissible to all domestic animals except to cattle. Sheep are also especially susceptible to infection. In man the most common mode of its propagation is inoculation, by the virus gaining access to the blood by coming in contact with an abrasion of the skin, or wound of the mucous membrane, and being absorbed into the system, but the bacilli do not appear able to penetrate through the uninjured skin or mucosa. The period of incubation by inoculation is from three to five days. Acute glanders may terminate in two weeks, while the chronic form may continue for years and the horse be apparently as well able to work or drive as ever, with no apparent derangement of health or condition.

It is an unquestionable fact that glandered mares have given birth to colts with the disease, that is, that the bacilli can pass from mother to foetus, and past experience has demonstrated the uselessness of all medical treatment to cure or prevent the disease. According to duration, glanders may be spoken of as acute or chronic, the latter is the common, acute the rarer form.

There are three characteristic local symptoms of chronic glanders: 1st, The nasal discharge, (generally from the left nostril); 2d, enlargement of the submaxillary lymphatic gland, and 3d, ulceration of the pituitary membrane.

The character of the discharge is noteworthy, and has long been looked upon as characteristic of the disease. The discharge usually comes from the nostril in which the ulcers are situated; if it is from both nostrils, then ulceration will be found in each of them. Unlike the discharge of acute or chronic catarrh which may be at first transparent, and later opaque and viscid, flowing slowly, or snorted out in lumps, it is glutinous, and adheres to the skin and hair around the nostrils, forming soft, greasy-feeling crusts of a deep brown color, which adhere to the fingers when touched. It afterwards becomes purulent and assumes a peculiar greenish tint, sometimes rusty or streaked with blood; as a rule there is no odor from the discharge, although in old chronic cases it may become very fetid.

The alteration of the submaxillary gland (under the jaw) is inseparable from the chancrous ulcers in the nose. One or both glands may be affected, according as one or both nostrils discharge and have ulcers, and if only one nasal cavity is affected, then the gland on the corresponding side is involved. The gland is largely increased in size, and is always irregular to the touch, lumpy and nodulated over the surface. It becomes hard and fixed to the jaw, but never softens to suppuration.

The ulcers or chancres are developed in the texture of the membrane, from the size of a millet seed to that of a small pea, and perfectly defined. To the eye they appear as little round bodies of a yellowish color, slightly projecting beyond the level of the membrane, which at their margin is pale or inflamed according to the progress of the disease. They are rapidly developed, and in two or three days liquefy, becomes softened, the epithelium covering them is detached, allowing the pus to escape leaving a small concave depression. This stage constitute confirmed glanders.

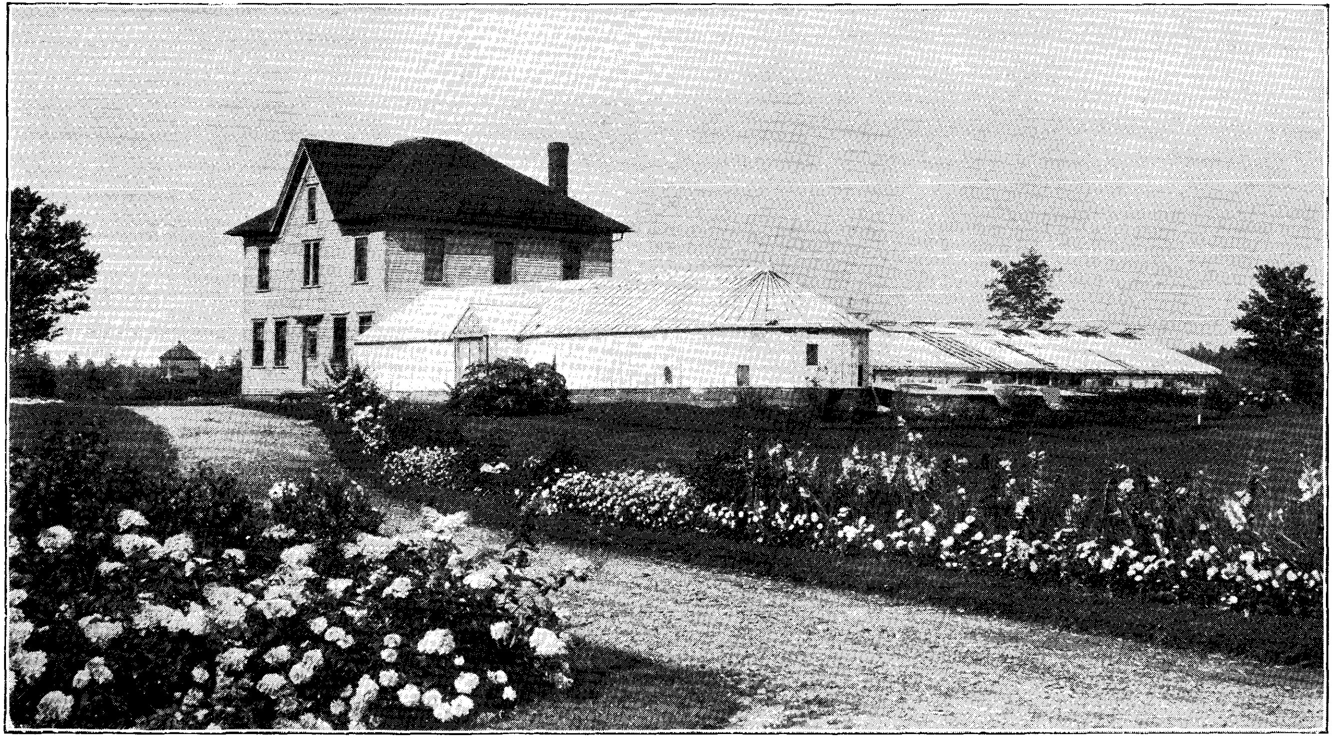
In farcy, the local symptoms consist in the appearance of superficial indolent tumors or "farcy buds" on the skin in various parts of the body, and which soon ulcerate and become chancrous, constituting the specific feature of the malady. Some begin to form altogether beneath the skin, which is only affected when they begin to ulcerate. They are generally found where the skin is thinnest and most sensitive, particularly around the eyes, nostrils, and lips, inside the legs, upper part of the shoulders, flanks, inside the thighs, and abdomen. Once developed these tumors invariably result in ulcerations. At first, each, considered separately, is a small hard body, slightly projecting beyond the skin, not very painful, but surrounded by a doughy swelling. In two or three days the tumor increases in size, and commences to soften in the center, so that in four to ten days, if punctured, gives exit to a small quantity of thin, yellow, oily-looking pus, characteristic of this affection. The farcy ulcer has no tendency to heal like an ordinary sore, and if not interfered with it extends by destroying the tissues around its margin, which has a peculiar jagged border and hard base, as well as marked depression in the center of the ulcer.

While glanders is very common among horses that are kept in narrow, ill-ventilated stalls, and often, under such circumstances assumes a very malignant character, closer and more thorough examination has pointed to the fact that the very best hygienic conditions were not in themselves sufficient to prevent an outbreak of glanders, when a diseased horse chanced to come among them and that the disease extended from animal to animal, and unfavorable hygienic conditions were simply important aids in the extension of the disease.

Not only does it appear that the poison of glanders is communicated by immediate or direct contact of the diseased with the healthy; it is in addition tolerably certain that it may be propagated by mediate or indirect contact; that is, by some intermediate bearer of the virus which, being charged with the infected material, conveys it to the still healthy. The external media acting in this manner are the harness and clothing of diseased horses, the wood-work, fittings and utensils of stables, as also the similar accessories of railway cars in which such animals have been placed. Glanders is also supposed to be propagated by the acts of coitus and suckling, that in some instances it may be regarded as the result of hereditary transmission and that the poison may be conveyed into the system through the medium of food or drinking water.

The power of life, or the period during which after separation from its source of origin, the virus of glanders will retain its activity is variable. It is destroyed when mixed with water at a temperature of 133 degrees Fahrenheit, also when brought in contact with such chemicals as carbolic acid, chlorine, sulphuric acid, etc. In one case the dried nasal discharges of an animal suffering from chronic glanders conveyed the disease to a healthy horse in the form of acute glanders and farcy, when placed in the stable previously occupied by the diseased, two months after the removal of the latter, and acute farcy has been produced after inoculating with dried mucus taken from a glandered horse six weeks before.

It would always be a wise precaution, before placing healthy animals in stalls or stables of unknown character, or boxes tenanted by strange horses, that they first be thoroughly cleansed and disinfected.



GREENHOUSES.

ANNUAL REPORT

OF THE

Maine State College

Agricultural Experiment Station.

1897.

The Bulletins of this Station will be sent free to any address in Maine. All requests should be sent to

Agricultural Experiment Station,

Orono, Maine.

TABLE OF CONTENTS.

STATE OF MAINE.

A. W. Harris, Sc. D., President of the University of Maine:

SIR:—I transmit herewith the Thirteenth Annual Report of the Maine Agricultural Experiment Station for the year ending December 31, 1897.

CHARLES D. WOODS,
Director.

ORONO, Maine, December 31, 1897.

MAINE

AGRICULTURAL EXPERIMENT STATION

ORONO, MAINE.

THE STATION COUNCIL.

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Director Charles D. Woods	*Secretary*
Benjamin F. Briggs, Auburn	*Committee of Board of Trustees.*
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James M. Bartlett	*Members of the Station Staff.*
Lucius H. Merrill	
Francis L. Harvey	
Fremont L. Russell	
Welton M. Munson	
Gilbert M. Gowell	

THE STATION STAFF.

The President of the University.

Charles D. Woods	*Director*
James M. Bartlett	*Chemist*
Lucius H. Merrill	*Chemist*
Francis L. Harvey	*Botanist and Entomologist*
Fremont L. Russell	*Veterinarian*
Welton M. Munson	*Horticulturist*
Gilbert M. Gowell	*Agriculturist*
Lucius J. Shepard	*Assistant Horticulturist*
Ora W. Knight	*Assistant Chemist*
Andrew J. Patten	*Assistant Chemist*
Mrs. J. Hamlin Waite	*Stenographer*

ANNOUNCEMENTS.

ESTABLISHMENT OF THE STATION.

The Maine Agricultural Experiment Station was established in accordance with chapter 294 of the Public Laws of 1885 "for the purpose of protection from frauds in commercial fertilizers, and from adulterations in foods, feeds and seeds, and for the purpose of promoting agriculture by scientific investigation and experiment."

In March, 1897, Congress passed an act establishing experiment stations in the several states. The Maine legislature of 1897 accepted this grant and made the Maine Agricultural Experiment Station a department of the State College or, as it now is, the University of Maine.

THE OBJECT OF THE STATION.

The purpose of the experiment stations is defined in the act of Congress establishing them as follows:

"It shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states or territories."

INSPECTIONS.

In accepting the provisions of the act of Congress, the Maine legislature withdrew the state appropriation for the maintenance of the Station, and thereby did away with the original purpose of the Station so far as it related to the "protection from frauds in commercial fertilizers, and from adulterations in foods, feeds and seeds." In place of this, special laws regulating the sale of commercial fertilizers, concentrated commercial feeding stuffs and agricultural seeds, and the inspection of chemical glass-ware used by creameries, have been enacted, and their execution entrusted to the director of the Station.

The station officers take pains to obtain for analysis samples of all commercial fertilizers and concentrated commercial feeding stuffs coming under the law, but the organized co-operation of farmers is essential for the full and timely protection of their interests. Granges and other organizations can render efficient aid by sending, early in the season, samples taken from stock in the market and drawn in accordance with the station directions for sampling.

There is no provision made by law for the analysis of agricultural seeds. Seeds, taken in accordance with the station directions for sampling, will be examined for $1 per sample.

THE AIM OF THE STATION.

Every citizen of Maine, concerned in agriculture, farmer, manufacturer, or dealer, has the right to apply to the Station for any assistance that comes within its province. It is the wish of the Trustees and Station Council that the Station be as widely useful as its resources will permit.

In addition to its work of investigation, the Station is prepared to make chemical analyses of fertilizers, feeding stuffs, dairy products and other agricultural materials; to test seeds and creamery glass-ware; to identify grasses, weeds, injurious fungi and insects, etc.; and to give information on agricultural matters of interest and advantage to the citizens of the State.

All work proper to the Experiment Station and of public benefit will be done without charge. Work for the private use of individuals is charged for at the actual cost to the Station. The Station offers to do this work only as a matter of accommodation. Under no condition will the Station undertake analyses, the results of which cannot be published if they prove of general interest.

STATION PUBLICATIONS.

The Station publishes annually a report covering in detail its expenses, operations, investigations and results, and bulletins giving popular accounts of the results of station work which relate directly to farm practice. The bulletins are mailed free to all citizens who request them. The annual report is bound with that of the Board of Agriculture and distributed by the Secretary of the Board. This combined report can be obtained by addressing the Secretary of Agriculture, State House, Augusta, Maine. It is usually ready for distribution in August of each year.

CORRESPONDENCE.

As far as practicable, letters are answered the day they are received. Letters sent to individual officers are liable to remain unanswered, in case the officer addressed is absent. All communications should, therefore, be addressed to the

Agricultural Experiment Station,
Orono, Maine.

The post office, railroad station, freight, express and telegraph address is Orono, Maine.

The telephone call is "Bangor, 27-3."

Directions, forms and labels for taking samples, and charges for examining fertilizers, feeding stuffs and seeds for private parties can be had on application.

Parcels sent by express should be prepaid, and postage should be enclosed in private letters demanding a reply.

Remittances should be made payable to the undersigned.

CHAS. D. WOODS, Director.

ACKNOWLEDGMENTS.

Acknowledgment is hereby made for the following gifts to the Station during 1897:

One keg Laurel Green.—Nichols Chemical Company.

Seeds of Montreal Muskmelon.—R. Brodie, Montreal, Canada.

Apple cions: King, York Imperial and Tinmouth Seedling. —L. M. Macomber, North Ferrisburg, Vt.

Apple cions: Nickels Seedlings.—John Nickels, North Searsport, Me.

Apple cions: Wagener.—C. W. Taylor, Penn Yan, N. Y.

Rocky Mountain Plum and Cherry cions.—F. S. Fairfield, Orono, Ontario.

Apple cions: Monroe Sweet.—J. W. Dudley, Mapleton, Me.

Cuttings of willows, twenty-eight varieties of Cannas and ten varieties of Dahlias.—L. H. Bailey, Ithaca, N. Y.

One pound Bovee potato, one pound Sir Walter Raleigh potato, one packet Japanese millet, one packet Early Russian sunflower and one packet Early Soja Bean.—Peter Henderson & Co., New York.

Thirteen varieties of Hungarian apples.—Division of Pomology, United States Department of Agriculture.

Eight varieties of corn and one variety of peas.—F. Barteldes & Co.

One sack Damaraland Guano.—H. J. Baker & Brother, New York.

One bottle nitragin, two hundred pounds Florida rock phosphate.—Bowker Fertilizer Company.

One plow.—S. B. Hussey, North Berwick, Me.

One Excelsior Incubator.—Geo. H. Stahl, Quincy, Ill.

One Peep O'Day Incubator.—E. F. Hodgson, Dover, Mass.

One ton gluten meal.—Glucose Sugar Refining Company, Chicago, Ill.

One barrel Worcester salt.—Kimball & Whitney, Portland, Me.

The following newspapers and other publications are kindly donated to the Station by the publishers:

Agricultural Epitomist, Indianapolis, Ind.
Agricultural Gazette, Sidney, New South Wales.
American Cultivator, Boston, Mass.
American Fertilizer, Philadelphia, Pa.
American Florist, Chicago, Ill.
American Grange Bulletin, Cincinnati, Ohio.
Baltimore Weekly Sun, Baltimore, Md.
Bangor Floral, Bangor, Me.
Campbell's Soil Culture, Omaha, Neb.
Canadian Horticulturist, Grimsby, Ont.
Chronique Agricole, Lausanne, Switzerland.
Cultivator and Country Gentleman, Albany, N. Y.
Dairy World, Chicago, Ill.
Detroit Free Press, Detroit, Mich.
Elgin Dairy Report, Elgin, Ill.
Farm Reporter, Charleston, W. Va.
Farmer's Advocate, Burlington, Vt.
Farmer's Advocate, London, Ont.
Farmer's Guide, Huntington, Ind.
Farmer's Home, Dayton, Ohio.
Farm and Home, Chicago, Ill.
Farm Journal, Philadelphia, Pa.
Farmer's Magazine, Springfield, Ill.
Farmer's Review, Chicago, Ill.
Farmer's Voice, Chicago, Ill.
Farming, Dayton, Ohio.
Florists Exchange, New York, N. Y.
Forester, Princeton, N. J.
Fruit, Dunkirk, N. Y.
Gentleman Farmer, Chicago, Ill.
Green's Fruit Grower, Rochester, N. Y.
Hoard's Dairyman, Ft. Atkinson, Wis.
Holstein Fresian Register, Brattleboro, Vt.
Homestead, Des Moines, Iowa.
Horticultural Visitor, Kinmundy, Ill.
Jersey Bulletin, Indianapolis, Ind.
Journal of the Royal Agricultural Society, London, England.

Journal of the Irish Dairy Association, Limerick, Ireland.
Louisiana Planter, New Orleans, La.
Lewiston Weekly Journal, Lewiston, Me.
Maine Farmer, Augusta, Me.
Market Basket, Philadelphia, Pa.
Market Garden, Minneapolis, Minn.
Massachusetts Ploughman, Boston, Mass.
Michigan Farmer, Detroit, Mich.
Michigan Fruit Grower, Grand Rapids, Mich.
Mirror and Farmer, Manchester, N. H.
Montana Fruit Grower, Missoula, Mont.
National Stockman and Farmer, Boston, Mass.
New England Farmer, Boston, Mass.
New England Florist, Boston, Mass.
New England Homestead, Springfield, Mass.
New York Farmer, Port Jervis, N. Y.
New York Produce Review, New York City.
North American Horticulturist, Monroe, Mich.
Northern Leader, Fort Fairfield, Me.
Ohio Farmer, Cleveland, Ohio.
Oregon Agriculturist, Portland, Oregon.
Pacific Coast Dairyman, Tacoma, Wash.
Park and Cemetery, Chicago, Ill.
Practical Farmer, Philadelphia, Pa.
Public Ledger, Philadelphia, Pa.
Rural Californian, Los Angeles, Cal.
Rural Canadian, Toronto, Ont.
Rural New-Yorker, New York City.
Southern Farmer, New Orleans, La.
Southern Planter, Richmond, Va.
Southern States, Baltimore, Md.
Southwestern Farmer, Wichita, Kans.
Strawberry Specialist, Kittrell, N. C.
Turf, Farm and Home, Waterville, Me.
Vick's Magazine, Rochester, N. Y.
Wallace's Farmer, Des Moines, Iowa.
Western Agriculturist, Chicago, Ill.
The World, Vancouver, B. C.

BULLETIN NO. 32.

THREE TROUBLESOME WEEDS.

F. L. HARVEY.

ORANGE HAWKWEED.

Hieracium aurantiacum, L.

(Order Compositae; Sunflower Family.)

HISTORY.

Orange Hawkweed, a native of Europe, was introduced into the United States a few years ago and has spread rapidly. Its occurrence in Maine has been known for over ten years. It is now widely distributed in the State and in many places has overrun grass lands, orchards, pastures and roadsides. It is sometimes grown in gardens as an ornamental plant.

DESCRIPTION.

Stem simple, erect, nearly leafless, one to two feet high, clothed with hairs, those at the top of the stem black at the base. Leaves mostly at the roots, oblong-lanceolate, toothed, hairy on both sides and without a petiole. The conspicuous heads of orange colored flowers in a flat-topped cluster at the end of the stem. Heads composed of numerous small orange colored flowers, each one of which produces at its base a small dark brown, ten-ribbed seed-like fruit, which is provided at the top with dirty white hair-like bristles, by means of which the wind spreads the numerous seeds far and wide. The plant is shown in the plate on the following page. This cut and the others used in this bulletin are from publications of the U. S. Department of Agriculture.

ORANGE HAWKWEED.

HABITS.

It is a perennial, the root stock surviving the winter. It spreads by means of runners at the base, thus rapidly extending the patch. It blossoms early, before time to cut grass. If cut early it sends up shoots from the roots which bear autumn flowers. The abundant seeds are provided with hair-like appendages which aid distribution. It monopolizes the soil, killing all grass plants and covering the surface with a dense mass of leaves. Is is not good for hay. Its only redeeming feature is its beauty, which is poor recompense for its other characters.

This plant combines all the worst features of a weed and will not yield to ordinary or careless treatment. The following precautions and remedies are suggested.

PRECAUTIONS.

Do not grow the plant in flower gardens or carry the flowers home for bouquets.

Do not buy hay or straw from farms known to be infected with it.

Do not mix the hay from infected patches with clean hay. It would be better to burn the hay from infected patches cut after the seed is mature, rather than run the risk of scattering the seed by hauling, feeding, or in manure.

Agitate the necessity of destroying patches of weeds growing along road-sides, on abandoned or neglected farms, and on waste places in towns.

Learn to recognize the plant, so as to early detect its presence on the farm and destroy it.

TREATMENT.

Cut the infested patches early before haying, if need be, to prevent early seeding, and again in the fall before the second bloom forms seed. This can be relied upon to prevent the formation of new patches by scattering seed, but will not kill the plants or prevent the spread of patches already formed. Nothing short of clean culture in some hoed crop can be relied upon to eradicate it.

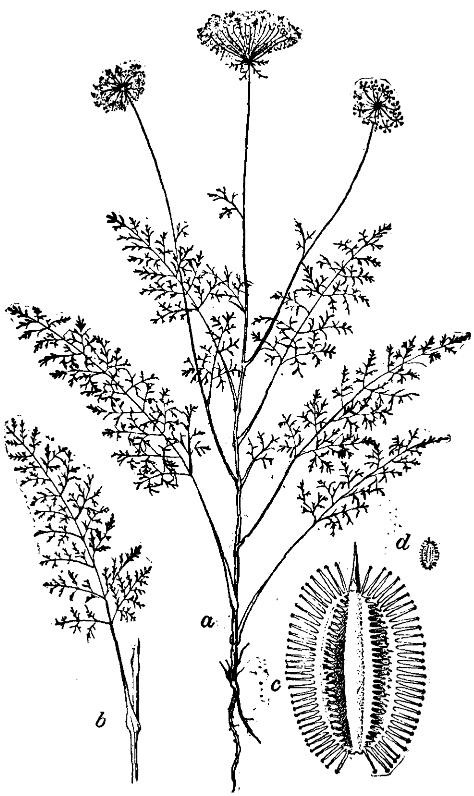
THE WILD CARROT.

Daucus Carota, L.

(Order Umbelliferae; Parsley Family.)

HISTORY.

The wild carrot is a native of Europe. It is naturalized in this country and is spreading rapidly. It is found in nearly all of the states east of the Mississippi river and also farther west. It is common in Maine in grassland, along road sides and in waste places. It has been known in the State for over ten years and has spread to many new localities and the patches in fields have become larger and more numerous. The cultivated carrot was derived from it.



DESCRIPTION.

Stem erect, one to three feet high, bristly, branching. Leaves several times compounded, ultimate divisions lance-shaped and toothed at the end. Stem leaves long, swollen at the base and clasping the stem. Ends of the branches bearing white flowers in compound umbels, which become concave in fruit. Below the flower cluster are cleft leaf-like bracts called the involucre. The bloom contracts after flowering into cup-shaped clusters of one-seeded burr-like fruits. Roots usually thickened with nourishing matter and living over winter.

HABITS.

The wild carrot is usually a biennial. It thrives in nearly all kinds of soils and climates. It flowers from June to September and does not usually seed before time to cut hay. It sends up numerous flowering shoots from the roots after haying that mature seed before frost.

The seeds are covered with a hard spiny coat which resists the weather. They are often retained in the soil for several seasons without losing their vitality. The seeds are covered with spines which become attached to the coats of passing animals, distributing them widely. The fruits remain on the stalks until after snow falls and are then broken off by the wind and blown long distances. The plant in Maine is most abundant along road sides and in neglected places from which great quantities of seeds are annually distributed to adjoining fields.

TREATMENT.

As the root is biennial, prevention of seeding for two seasons would eradicate it. The plants could be destroyed by cutting the roots off below the surface with a spade. As the plant sends out flowers from the base after haying, a single cutting would not prevent seeding. The patches should be mowed again before the second blooms are matured enough to form seeds. As sheep are said to eat it, allowing them to graze on the grasslands after haying would keep it down. The plants along roadsides and in waste places should be cut so as to prevent the seed being spread by the wind and animals.

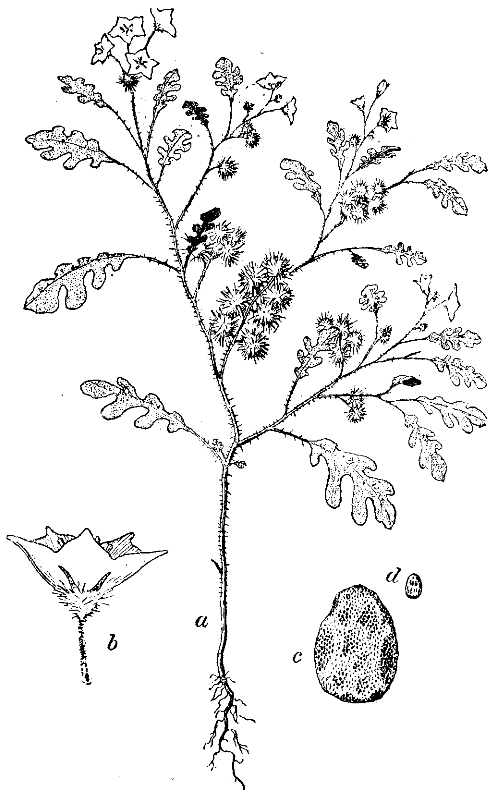
THE BUFFALO BUR.

Solanum rostratum, Dunal.

(Order Solanaceae; Night-Shade Family.)

HISTORY.

The Buffalo Bur is a native of the western plains, close to the mountains, from Mexico northward to Dakota. It was spread by buffaloes and for that reason has been called Buffalo Bur. Since the setlement of the country it has spread eastward along road sides and to long distances in seed and packing materials. It is now found in most of the states in the Mississippi valley west of the river and in many of the states farther east. It has



also appeared in Europe where it threatens to become a troublesome weed. It was detected by Mr. C. C. Carll, where western grain had been screened, at Buxton, Me., in September, 1896.

DESCRIPTION.

Stem branching, a foot or two high, horny or yellowish with copious star-shaped hairs. Leaves once or twice divided, resembling those of the water-melon. Flowers yellow, about an inch in diameter with a short tube and obtuse lobes somewhat irregular. Stamens dissimilar, the lowest longer and stouter and curved inward at the beak. Fruit enclosed and adhering to the close-fitting, very prickly calyx. Seeds thick, wavy, wrinkled. The plant is related to the Irish potato, Night-shade, Horse Nettle and Jerusalem Cherry. The plant reduced, and the flower and seed natural size, are shown in the cut which is taken from a bulletin of the United States Department of Agriculture.

HABITS.

Annual. Seeding late in northern states. Seeds not abundant. Not usual in well cultivated grounds but preferring road sides and waste places. The plant is bushy and breaks off and is blown about by the wind. It is a coarse, prickly, potato-like weed, producing round fruits covered with spines that become attached to the hair or wool of animals.

TREATMENT.

As the plant is an annual it would be destroyed in a single season if prevented from seeding. As it is liable to occur only sparingly in Maine, about railroad stations and where western grain is handled, the scattering plants may be pulled up before they seed. If it should appear in fields from sowing western grain, the patches should be carefully cut before seeding. As the plants are apt to put out flowering branches about the roots after early cutting, a second cutting may be necessary.

BULLETIN NO. 33.

FERTILIZER INSPECTION, 1897.

The bulletin gave the text of the law regulating the sale of commercial fertilizers, the manufacturer's guarantees and the analyses of manufacturer's samples, but as these figures are of only passing value they are omitted here.

BULLETIN NO. 34.

BOX EXPERIMENTS WITH PHOSPHORIC ACID FROM DIFFERENT SOURCES.

L. H. MERRILL.

Probably nine-tenths of all the commercial fertilizers used in Maine are purchased in the form of "complete" or "mixed fertilizers"—that is, they contain in varying proportions nitrogen, potash and phosphoric acid. While the majority of these goods are honestly made up, yet like many of the so-called condimental foods, they are designed to cover all probable contingencies and are hence often wastefully applied. It is evident that where but one or two of the constituents named are lacking in a soil, it is not business-like to apply and pay for three. A little intelligent experimenting on the part of the farmer will often determine what is lacking. The next care is to supply this want in the most economical manner.

The use of materials containing nitrogen, phosphoric acid or potash singly is fast growing and is to be encouraged. In the choice of these materials two things are to be considered: the availability, or the readiness with which they can be used by crops, and the cost. It is the object of this bulletin to consider some of the sources of phosphoric acid, with special reference to the matter of availability.

Nearly all of the phosphoric acid used for fertilizing purposes is in combination with lime as phosphate of lime. Three forms are in common use, viz.:

1. Insoluble phosphate of lime. This is the form in which nearly all the phosphates exist in nature and from which the other forms described below are derived. The bones of animals are made up largely of this substance and are accordingly extensively used in the preparation of commercial phosphates; but the chief source of the insoluble phosphate now used in this country is rock phosphate, large deposits of which are found in South Carolina and Florida. It is insoluble in water and, unless very finely ground, its phosphoric acid is given up very slowly to the plant.

2. Soluble phosphate of lime. When the insoluble phosphate is treated with dilute sulphuric acid, a large part is converted into a form soluble in water, hence known as soluble phosphate. It is then in a condition to be immediately used by the plant. This is the most expensive of the three forms.

3. Reverted or citrate soluble phosphate of lime. If a soluble phosphate is allowed to stand for a long time it frequently happens that much of the soluble phosphate undergoes a change, passing into a form insoluble in water, but much more available to the plant than the original insoluble phosphate from which it was derived. This is the reverted or citrate soluble phosphate. It was formerly supposed to be of much less value than the soluble form, but experience has proved that this is not the case. In fact, if a soluble phosphate is added to a soil, a large part of it reverts before the crops have had time to take it up. It is known as the citrate soluble phosphate because, unlike the insoluble form, it is readily soluble in a hot solution of ammonium citrate. This reagent is therefore employed in the laboratory to distinguish the form in question. The soluble and the citrate soluble are often classed together as available.

There is another phosphate, not so generally used, in which the phosphoric acid is combined with iron and alumina instead of with lime. In its original condition it is not only insoluble in water and but very slightly soluble in hot ammonium citrate, but it is even less available to the plant than the corresponding salt of lime. A phosphate of this description is quarried at Redonda, a small island in the West Indies, and is known as Redonda phosphate or Redondite. It is a characteristic of this phosphate that at a high temperature it loses water, and at the same time becomes largely soluble in ammonium citrate. On long standing a reverse action takes place, the phosphate passing again to the insoluble condition. It is probable that the reversion is more rapid when roasted Redonda has been applied to the soil. Comparatively little of this phosphate is sold, yet on account of the high percentage of phosphoric acid which it carries and the ease with which it may be converted into the citrate soluble condition, it would prove a valuable fertilizer if it is as available to the plant as the chemical analysis would seem to indicate.

A series of experiments has been carried on at this Station to determine the relative value of three forms of phosphatic materials to eight common crops; and also, at the same time, to determine the varying ability of different crops to appropriate phosphoric acid from the same source. The phosphates used were:

1. Acidulated Florida rock. That is, a rock phosphate that had been treated with sulphuric acid, a large part of its phosphate being thereby converted into the available form. This sample contained 20.60 per cent. total phosphoric acid, of which 16.90 per cent. was available (14.97 per cent. soluble, 1.93 per cent. citrate soluble.)

2. Crude, finely ground Florida rock (Floats), containing 32.88 per cent. total phosphoric acid, none of which was soluble, with only 2.46 per cent. soluble in ammonium citrate. This was obtained from the commercial ground rock by stirring it with water, allowing the coarse particles to subside and then pouring off the turbid water. The "Floats" were the sediments deposited from these washings.

3. A phosphate of iron and alumina (Redonda), containing 49.58 per cent. phosphoric acid, a large part of which, 42.77 per cent. was soluble in ammonium citrate.

The plants grown were peas, clover, turnips, ruta-bagas, barley, corn, potatoes and tomatoes. The experiments were conducted in the forcing house, wooden boxes being used, each containing 120 pounds of clean sand.

Ninety-six boxes were used, twelve for each kind of plant. In the first box the acid rock was used; in the second, the crude rock; in the third, the phosphate of iron and alumina; in the fourth, no phosphate. The next four boxes were treated in the same manner, and so on to the end. Thus it will be seen that for each kind of plant there were three boxes which received the same treatment.

Such quantities of the phosphates were used that each box to which they were applied received the same total amount of phosphoric acid. To each box were also added all the ingredients that a healthy plant takes from the soil. These, together with the phosphates, were carefully mixed with the sand before it was placed in the boxes. All the conditions were made as uniform as possible in order that whatever differences were observable might fairly be attributed to the differences in the phosphates used.

When the plants were harvested they were carefully dried, weighed, and the total amount of dry matter determined for each kind of plant grown. The experiments were continued through three periods, the third period being made much shorter than the others.

In the diagram on the opposite page, the length of the black lines shows the relative amounts of dry matter produced, while the figures at the right show the actual weights, expressed in grams.

In these experiments the effect of the acid rock was very marked with all the plants grown; those receiving it, in nearly all cases, at once taking the lead and keeping it to the end. The plants were darker green in color, and the tubercles, which were developed on the roots of nearly all the leguminous plants, were larger and much more numerous. It was noticeable, however, that in some cases, especially with the clover, turnips and ruta-bagas, the good effects of the acid rock were more marked during the first few weeks of growth than at a later stage, when the roots had become more fully developed and had begun to forage for themselves. It would appear that the young plants feed but little upon the insoluble phosphates; but that the organic acids present in the sap of the roots exert a solvent action upon the insoluble phosphates in the soil, gradually converting them into available forms.

It will be noticed that in this work only the immediate effect of the phosphates has been taken into consideration, no mention having been made of the unused phosphoric acid remaining in the soil at the close of the experiment. In actual field work the good effect of the ground rock would, of course, be far more lasting than that of the acid rock.

Diagram showing relative weights of dry matter of plants grown with phosphoric acid from different sources.

Crops.	Phosphate.	Comparative Scale.	Weight.
			Grams.
Peas	Acid Rock.		501
	Floats.		367
	Redonda.		284
	No Phosphate.		261
Clover	Acid Rock.		433
	Floats.		339
	Redonda.		252
	No Phosphate.		165
Turnips	Acid Rock.		665
	Floats.		605
	Redonda.		562
	No Phosphate.		357
Ruta Bagas.	Acid Rock.		456
	Floats.		436
	Redonda.		365
	No Phosphate.		193
Barley	Acid Rock.		1015
	Floats.		514
	Redonda.		559
	No Phosphate.		437
Corn	Acid Rock.		654
	Floats.		254
	Redonda.		294
	No Phosphate.		93
Tomatoes	Acid Rock.		406
	Floats.		276
	Redonda.		236
	No Phosphate.		108
Potatoes	Acid Rock.		779
	Floats.		562
	Redonda.		467
	No Phosphate.		452
Turnips, Roots	Acid Rock.		300
	Floats.		210
	Redonda.		270
	No Phosphate.		132
Ruta Bagas, Roots	Acid Rock.		187
	Floats.		141
	Redonda.		107
	No Phosphate.		49
Potatoes, Tubers	Acid Rock.		556
	Floats.		393
	Redonda.		419
	No Phosphate.		345

Box experiments were made at the New Hampshire Experiment Station in 1893 with winter rye, the phosphoric acid being supplied by roasted Redonda, ground bone, and basic slag. The result showed that the rye gave nearly as good returns with the roasted Redonda as with the other phosphates. This result confirms the work here reported. It will be seen by reference to the diagram here given that the corn and barley (plants closely related to rye) gave better results with the Redonda phosphate than with the finely ground Florida rock.

SUMMARY.

1. Plants differ in their ability to feed upon crude phosphates.
2. Turnips and ruta-bagas gave nearly as good returns with the Florida rock as with the dissolved rock.
3. In nearly every other case the best results were obtained by the use of the dissolved rock.
4. Barley and corn appear to require an acid phosphate.
5. Except with the barley, corn, turnip roots and potato tubers, the crude Florida rock yielded better returns than the phosphate of iron and alumina.
6. When early maturity is desired, the acid phosphate can profitably be used.
7. The solubility of a phosphate in ammonium citrate is not always the correct measure of its actual value to the plant.

BULLETIN No. 35.

THE CURRANT FLY. GOOSEBERRY FRUIT FLY.

Epochra Canadensis, Loew.

(Order Diptera; Family Trypetidae.)

By F. L. HARVEY.

HISTORY AND DISTRIBUTION.

This species was first considered by Loew in 1873, from a single faded female contributed by Osten Sacken. Osten Sacken's material may have come from Maine, as he gives Norway, Maine, as the locality, the specimens having been collected by S. J. Smith. Loew gives Canada as a locality upon the authority of Mr. Provancher. How long the species had been known before it was described does not appear, but

Osten Sacken says it "seems to be common in those regions." If its habit of infesting currants was known in 1873, no mention is made of it. It is next considered by Saunders in 1883. During the intervening ten years its currant infesting habit became known and some attempts were made to determine its life history.

In 1891, Prof. Gillette found it very abundant in Colorado, infesting gooseberries, this being the first authentic account of its infesting that fruit. Prof. Gillette also added many facts regarding the life history.

We find no reference to this insect in the Agricultural and Horticultural Reports of Maine, and if it has done injury heretofore it has not been recorded.

Mr. Z. A. Gilbert says he was formerly troubled by such an insect, but stopped growing currants for a time and then resumed and has not been troubled since. Mr. D. H. Knowlton, Farmington, says his currants have been infested for several years.

It is quite certain that *Epochra Canadensis*, Loew, is a native American species, distributed throughout the northern part of the United States, and in Canada, extending from the Atlantic to the Pacific coast.

This insect is widely distributed in Maine and is capable of doing great injury to currants and gooseberries and growers of these berries should become acquainted with it and be on the lookout for its depredations.

GENERAL DESCRIPTION.

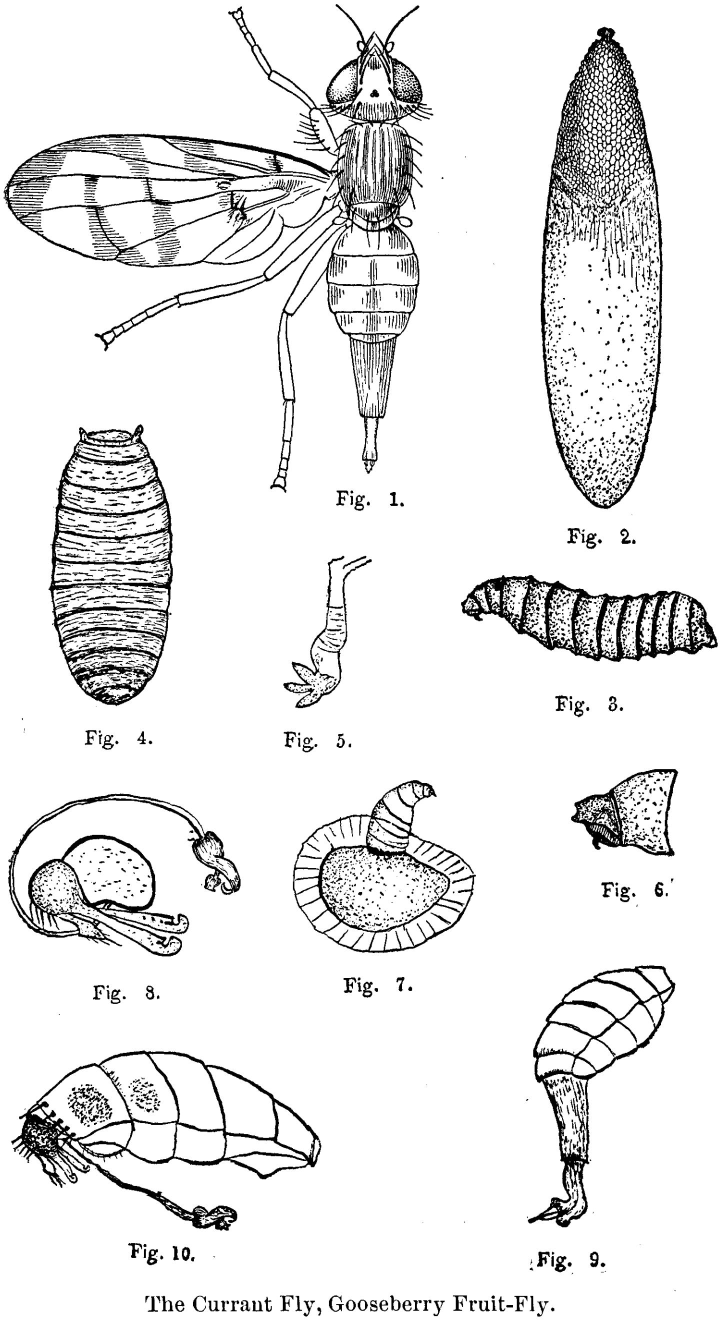
Perfect insect a two-winged fly about the size of a house fly. Pale yellow or orange with greenish iridescent eyes and dark bands across the wings. Found about currant and gooseberry bushes from the last of May and through June in Maine. Stings the currants, depositing an egg under the skin, that hatches and develops into a small white maggot causing the fruit to turn red and drop prematurely. The maggots when grown leave the fallen or hanging fruit, enter the ground, and change to the pupa state from which the fly emerges the following June.

LIFE HISTORY.

The flies emerge the last of May or early in June, depending on the season and location of the bushes. The time of emergence extends over about three weeks. The flies live about a month. They mate soon after they emerge and begin laying eggs, selecting the larger currants at the base of the bunches first and depositing eggs in the others as they attain sufficient size until the eggs are all deposited. It often happens that several currants at the ends of the bunches are not affected and later develop good fruit. Usually only one egg is laid in a currant. The flies are capable of laying at least two hundred eggs and as they live only about a month must lay several every day. The fly when about to lay an egg lights on the currant and in a nervous, restless manner keeps the wings in a constant fanning motion. She often examines several currants before finding one to her fancy. Usually one of the large currants in the upper part of a bunch that is in the shade is selected. The eggs are laid one in a place at one side of the puncture made by the ovipositor and so close to the skin of the currant that they can usually be plainly seen through it. The eggs are opalescent, white, oblong and pedicilate and about one twenty-fifth of an inch long. They soon hatch into a white footless maggot with thirteen segments to the body, the head armed with a pair of black parallel retractile hooks, the rasping organs of the maggot. The larva requires about three weeks to mature, when it is about one-fourth to one-third of an inch long.

When hatched the larva is about one-twenty-fifth of an inch long and as soon as it emerges from the egg begins to travel, often leaving a delicate light colored trail close under the skin which can be seen through it. After traversing from a third to a half the distance around the currant it locates, entering in most cases one of the seeds, disappearing entirely within it. Sometimes the larva locates near the puncture and sometimes the exit hole is on the opposite cheek from the puncture. As it grows the head finally protrudes from the seed as shown in the Plate, Fig. 7. After feeding upon the contents of a seed and having grown too large to find lodgment within it, it locates between the seeds in the pulp and then gnaws holes in the seeds, eating the contents of one after another until often half a dozen are consumed before the larva is grown. It seems to reject the coats and the clear gelatinous envelope that surrounds the seeds. The refuse of the seeds eaten turns black and becomes cemented together. A black spot becomes visible through the skin. The location of the larva can be told readily as the currant infested soon begins to show a clouded appearance where it is located and finally turns red and a black spot appears. Infested fruits ripen earlier. Often a half grown larva will be found with the head end half buried in a seed. Finally when full fed the larva gnaws to the surface and cuts a circular hole with ragged edges through the epidermis by means of which it emerges.

The larvae often leave the fruit before it drops, but fully half or more are still in the currants when they fall and remain there a greater or less time. The currants often drop before the maggots are mature. When ready to transform, they leave the currants, enter the ground under the bushes, usually less than an inch, shorten up and assume the pupa stage in which they remain, gradually transforming into the fly, until the following spring when they appear, there being but a single brood.



The Currant Fly, Gooseberry Fruit-Fly.

(*Epochra Canadensis, Loew.*)

EXPLANATION OF PLATE—THE CURRANT FLY.

Epochra Canadensis, Loew.

All except Figure 1 were drawn by the writer.

Figure 1. The female fly enlarged about seven and a half times. Drawn by Mr. J. H. Emerton from slides of the wing and ovipositor prepared by the writer and from pinned flies. The two basal joints of the abdomen are drawn as one. The real number, including the long terminal segment is seven instead of six.

Figure 2. Egg showing form, sculpture and pedicel, enlarged fifty times.

Figure 3. The larva enlarged about five times.

Figure 4. The pupa enlarged eight times.

Figure 5. The caudal spiracle of the larva much enlarged.

Figure 6. First two segments of the head showing the tubercles on the head, the rugose mouth and the rasping organs. Enlarged twenty-five times.

Figure 7. Seed of currant with gelatinous envelope showing larva protuding from it. Enlarged.

Figure 8. External genitalia of male. Enlarged twenty times.

Figure 9. Side view of abdomen of female with ovipositor protruding and bent backward in the position it takes as the egg is deposited under the skin to one side of the puncture. Enlarged.

Figure 10. Abdomen of male with genitalia and showing six segments. Enlarged.

REMEDIES.

We have had no experience with this insect as it is new to Maine as an injurious species. From a study of its life history we discover only one vulnerable point. The insect spends nearly eleven months of the year in the ground. In the winged stage it cannot be destroyed so far as we know. The eggs are deposited under the skin of the fruit and spraying would do no good. Part of the infested fruits drop prematurely and the worms remain in them for some time before they emerge and go into the ground. Based upon this last habit we would recommend gathering the fallen currants frequently and burning them. This remedy cannot be relied upon to destroy *all* the flies as quite a number of maggots leave the fruit before it falls. It can be depended upon to destroy fully half if not more and can be employed to keep them in check.

Our western correspondent, Dr. W. A. Thornton, thinks that allowing young chickens about the bushes early in the season and large fowls later after the fruit is gathered will keep them in check.

As the pupae are found only about an inch below the surface, they could be destroyed with little trouble by removing the soil to that depth from under the bushes and burying it deep or depositing it on a road or some exposed place.

Deep spading and turning to bury the pupae, or stirring the surface of the soil after cold weather so as to expose the pupae are methods worth trying.

As these flies are weak and liable to perish if any obstruction is offered to prevent their coming out of the ground, we would recommend a mulching of coarse straw or hay, several inches deep, placed under the bushes and out as far as the branches extend, and well packed.

The maggots are footless and unable to crawl much. Taking advantage of this fact we intend to try this season putting a receptacle under the bushes to catch the falling maggots and infested currants when they fall. A cheap grade of tar paper will be used. Strips will be placed each side of the row and fitted closely where they meet, and an inch cleat tacked along the outer and upper edge and at the ends. The paper will slope away from the bushes. It can be made in sections and stored for use a second season. It should be put under the bushes about June 15th and remain until the worms all leave the fruit, or about August 1st, when the fallen fruit and pupae in the receptacles should be carefully collected and burned. But few of the maggots could escape this treatment.

We have not discovered any parasites to help check the pest. Short bearing years would tend to reduce the numbers.

BULLETIN No. 36.

TESTING SEEDS.

CHAS. D. WOODS.

The law printed below was enacted last winter by the Maine legislature. The necessity for such a law is manifest. Few, however, who have not given the subject some study are aware of the extent of the inconvenience and loss to which farmers are subjected by the introduction of pernicious weeds through impure seeds. As a case in point there may be mentioned the introduction from Northern New York into West Gardiner of the King-Devil Weed, to which attention has just been called in a newspaper bulletin. This new and dangerous pest has firmly established itself in West Gardiner, has spread to the adjacent towns of Gardiner and Farmingdale, has crossed the Kennebec and has been recently reported from Winslow, twenty miles north of the point first named. The weed was undoubtedly brought in with grass seed and furnishes a good illustration of the ease with which a new pest may be established and the difficulty which may attend its eradication.

In nearly all the large countries of Europe the testing of seeds has for some years been the subject of legislative action. Seed control stations, having for their object the testing of the purity and germinative power of seeds, have been from time to time established, until there are now, in Europe alone, over one hundred in active operation. Similar stations exist also in Brazil, Java and Japan.

An Act to regulate the sale of Agricultural Seeds.

Section 1. Every lot of seeds of agricultural plants, whether in bulk or in package, containing one pound or more, and including the seeds of cereals, (except sweet corn), grasses, forage plants, vegetables, and garden plants, but not including those of trees, shrubs and ornamental plants, which is sold, offered or exposed for sale for seed by any person or persons in Maine, shall be accompanied by a written or printed guarantee of its percentage of purity, freedom from foreign matter; provided, that mixtures may be sold as such when the percentages of the various constituents are stated.

Section 2. Dealers may base their guarantees upon tests conducted by themselves, their agents, or by the Director of the Maine Agricultural Experiment Station; provided, that such tests shall be made under such conditions as the said Director may prescribe.

Section 3. The results of all tests of seeds made by said Director shall be published by him in the bulletins or reports of the Experiment Station, together with the names of the person or persons from whom the samples of seeds were obtained. The said Director shall also publish equitable standards of purity together with such other information concerning agricultural seeds as may be of public benefit.

Section. 4. Any person or persons who shall sell, offer or expose for sale or for distribution in this state agricultural seeds without complying with the requirements of sections one and two of this act, shall, on conviction in a court of competent jurisdiction, be fined not to exceed one hundred dollars for the first offense, and not to exceed two hundred dollars for each subsequent offense.

Section 5. Any person or persons who shall, with intention to deceive, wrongly mark or label any package or bag containing garden or vegetable seeds or any other agricultural seeds, not including those of trees, shrubs, and ornamental plants, shall be guilty of a misdemeanor and upon conviction in a court of competent jurisdiction shall be fined not to exceed one hundred dollars for the first offense and not to exceed two hundred dollars for each subsequent offense.

Section 6. The provisions of this act shall not apply to any person or persons growing or selling cereals and other seeds for food.

Section 7. Whenever the Director of the Maine Agricultural Experiment Station becomes cognizant of the violation of any of the provisions of this act, he shall report such violation to the Secretary of the Board of Agriculture, and said Secretary shall prosecute the party or parties thus reported.

Section 8. All acts and parts of acts inconsistent with this act are hereby repealed.

Section. 9. This act shall take effect September one, eighteen hundred ninety-seven.

RULES FOR TESTING PURITY OF SEEDS.

"Dealers may base their guarantees upon tests conducted by themselves, their agents, or by the Director of the Maine Agricultural Experiment Station; *provided, that such tests shall be made under such conditions as the said director may prescribe.*"—Section 2 of seed law.

The following rules for testing seeds are taken from those adopted by the Association of American Agricultural Colleges and Experiment Stations. The rules which have to do with germination are here omitted, and the other rules are modified, when necessary, to conform to the requirements of the law in this State for the regulation of the sale of agricultural seeds.

Directions for Sampling Seeds.—The contents of packets should be emptied out, mixed thoroughly by stirring, and small quantities taken from different parts of the mixture to make the sample.

If seeds are in bulk or in large packages, take handfuls at random from the top, middle, and bottom, and from these, after mixing, take the sample for testing.

Samples of seeds sold under specific guaranty of quality, must be taken in the presence of a disinterested and reputable witness, who shall certify that the sample was taken in his presence according to these directions. The sample must be inclosed in an envelope or other suitable package, securely fastened and sealed with wax in the presence of the witness. The names of the sender and witness must be written on the outside of package, which shall be sent to the station prepaid.

Samples shall weigh approximately as follows:

Grasses, except noted below, 1 ounce.

Clovers and all seeds of similar size, 2 ounces.

Cereals, vetches, beet "balls" and all larger seeds, 4 ounces.

Rye grasses, bromes, sorghums, and millets, 2 ounces.

All the smaller vegetable seeds, 1 ounce.

All the larger vegetable seeds except beet "balls," 2 ounces.

Sending samples.—Every sample for test sent to the Station should be in a securely fastened package accompanied by a statement certifying to the fairness of the sample, its source, etc. Blanks for this purpose will be furnished by the Station upon application. In case of guaranteed seed, the sample must be taken in accordance with directions given above.

Purity test.—All purity tests shall be made by weight from fair, average samples of seed. The minimum quantities to be used for this determination are named below and must be so drawn as to secure a thoroughly representative sample.

One gram: Agrostis spp., the Poas, yellow oat grass, tobacco.

Two grams: Bermuda grass, velvet grass, timothy, meadow foxtail, crested dog's tail, orchard grass, sweet vernal grass, alsike clover, white clover, Umbelliferae, and all the fescues except meadow fescue.

Three grams: All grass seed not enumerated above.

Five grams: Melilotus, Medicago spp., millet, lettuce, and all species of clover seed except white and alsike.

Ten grams: Cruciferae, flax and lespedeza.

Thirty grams: Buckwheat, Vicia spp., Lathyrus spp., beet "balls," sunflower, serradella, cucurbits, and all cereals except corn.

Fifty grams: Peas, beans, corn, lupines, cotton, and cowpeas.

Amounts to be taken of seeds not enumerated shall be the same as those required for seeds named which are of similar size.

Keeping Samples.—A sufficient amount of each sample should be kept in well-corked vials in a dark, dry and cool place for six months, to be used in case a retest is found necessary.

Record.—The record of seed tests shall include name of seed, source of sample, weight of sample, date of tests, percentage by weight and, as far as practicable, character of impurities.

Report Blank.—The following form used by the Station is recommended for reports of tests.

UNIVERSITY OF MAINE.

Maine Agricultural Experiment Station
Orono, Maine.

CHAS. D. WOODS, Director

..........................189....

Station No.........

Sir: The sample of seed sent to this station in a............. marked............, was received................

It contains ......per cent by weight of seed of........., common name.........., and.......per cent of impurities.

The impurities consist of: Inert matter, ...per cent; foreign seeds, ...per cent, of which.......per cent are noxious.

Choice merchantable seed of this species should have a purity of.......per cent; and should be free from..........

Remarks ....

Respectfully,

........................Director.

Accessory Apparatus.—A chemical balance weighing up to 100 grams and sensitive to 1 miligram, kept in a case, together with accurate metric weights. A standard simple dissecting microscope and a large reading glass or pocket lens. Botanical forceps and dissecting implements. An authentic collection of the seeds of the principal weeds and economic plants.

The balance, microscope and forceps are indispensable to a purity test of seeds. The collection of weed seeds is very helpful.

STANDARDS OF PURITY.

In accordance with Section 4 of the pure seed law, the following "equitable standards of purity" are tentatively suggested. They are the standards adopted by the U. S. Department of Agriculture and are based upon investigations made by the Division of Botany of that Department. They are here printed without change, and include some seeds not likely to be offered in this State. For convenience of reference the percentages of vitality, as well as percentages of purity are given.

Standards of the Purity and Germination of Agricultural Seeds.

Seed.	Purity.	Germination.	Seed.	Purity.	Germination.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
Alfalfa	98	85-90	Melon, musk	99	85-90
Asparagus	99	80-85	Melon, water	99	85-90
Barley	99	90-95	Millet, common (*Setaria italica*)	99	85-90
Beans	99	90-95	Millet, hog (*Panicum miliaceum*)	99	85-90
Beet	99	*150	Millet, pearl	99	85-90
Blue grass, Canadian	90	45-50	Mustard	99	90-95
Blue grass, Kentucky	90	45-50	Oats	99	90-95
Brome, awnless	90	75-80	Okra	99	80-85
Buckwheat	99	90-95	Onion	99	80-85
Cabbage	99	90-95	Parsley	99	70-75
Carrot	95	80-85	Parsnip	95	70-75
Cauliflower	99	80-85	Peas	99	93-98
Celery	98	60-65	Pumpkin	99	85-90
Clover, alsike	95	75-80	Radish	99	90-95
Clover, crimson	98	85-90	Rape	99	90-95
Clover, red	98	85-90	Rye	99	90-95
Clover, white	95	75-80	Salsify	98	75-80
Collard	99	90-95	Sorghum	98	85-90
Corn, field	99	90-95	Spinach	99	80-85
Corn, sweet	99	85-90	Spurry	99	85-90
Cotton	99	85-90	Squash	99	85-90
Cowpea	99	85-90	Timothy	98	85-90
Cress	99	85-90	Tomato	98	85-90
Cucumber	99	85-90	Turnip	99	90-95
Eggplant	99	75-80	Tobacco	98	75-80
Fescue, meadow	95	85-90	Wheat	99	90-95
Lettuce	99	85-90			
Kafir corn	98	85-90			

*Each beet fruit or "ball" is likely to contain from 2 to 7 seeds. One hundred balls should yield at least 150 sprouts.

EXAMINATION OF SEEDS BY THE STATION.

The law allows the dealer to base his guaranties upon tests made by himself, his agent or the Maine Experiment Station. As the Station has no funds available for this purpose, a charge sufficient to cover the cost of making the tests must be made. The charge for testing seeds for purity will be one dollar per sample, in the case of seeds of one kind. In the case of seeds sold in mixtures, the charge will be one dollar for the sample and twenty-five cents additional for each kind of seed said to be therein. Mixtures are difficult to separate and determine, and for this reason an extra charge is necessary. Seeds will be tested for purity for any person resident of the State, whether a dealer or not, at the above rates. The Station reserves the right to publish all results which prove of general interest.

Persons desiring to send seeds to the Station for testing can obtain on application, blanks similar to the following, on which to describe the sample. Directions for sampling similar to those on page 34 are printed on the reverse of the blank. The receipt of the sample will be acknowledged on the day it arrives. Usually a report can be made within two or three days.

FORM FOR DESCRIBING SEED SAMPLES.

(This form must be filled out completely or the sample may be rejected.)
(Do not write here.)

Station No.... *To the Director of the Maine*
Received...... *Agricultural Experiment Station,*
Orono, Maine.

Sir: I send you to-day, marked............., contained in a ...., a fair sample of seed, drawn according to directions on the other side of this sheet.

Kind of seed.......................................
Sold by..
At city or town of.................................
Name under which seed is sold......................
The price at which it was offered for sale.........
Name of sender.....................................
Post-office..
County...

**Witness: I hereby certify that the above-described sample was taken in my presence, according to the rules on the back of this sheet.*
Name...
Address..

* To be used when guaranteed seed is sent for test.

BULLETIN NO. 37.

FEEDING STUFF INSPECTION.

The bulletin contained the full text of the law regulating the sale of concentrated commercial feeding stuffs. The law was printed in the report for 1896, and its chief requirements are given in the article "Inspections for 1897," beyond.

BULLETIN NO. 38.

FERTILIZER INSPECTION, 1897.

The bulletin gave the manufacturer's guarantees, the analyses of manufacturer's samples and of samples collected by the Station, but as these figures are of only passing value they are omitted here. Under "Inspections for 1897," beyond, the requirements of the law and the way it was observed during the year are given.

BULLETIN NO. 39.

STOCK FEEDING SUGGESTIONS.

J. M. BARTLETT.

The valuable ingredients in animal foods are ash or mineral matter, protein, fat and a class of compounds called carbohydrates, of which starch, sugar and crude fiber are the most important examples. Although the ash or mineral matter is essential to the well being of the animal, it is abundantly supplied by most materials one is likely to feed, so what one most needs to consider in buying and using cattle foods are protein, fat and carbohydrates.

A sufficient supply of protein in the food is indispensable. The working animal depends upon it to replenish and repair its working machinery, the growing animal to make muscle and build up its whole system, the sheep to make wool and the milch cow to make the casein and albumen of its milk. No other substance can take its place, or be manufactured into protein by the body. When more protein is fed than is needed for the growth and repair of the body, the excess performs the same functions as the fats and carbohydrates. As a rule, however, this is not an economical use to make of it. It is worth but slightly more than the carbohydrates and about six-tenths as much as fats for this purpose and is, commonly, the most expensive ingredient to produce or buy.

The office of the other two substances, fat and carbohydrates, is two-fold: First, they serve as fuel and are oxidized or burned in the body to supply heat and force. The fat is worth about two and one-fourth times as much as the carbohydrates for that purpose. Second, they are used as material for making fat.

For convenience in stating the relation of protein to carbohydrate material the term nutritive ratio is used. By nutritive ratio is meant the relative amount of digestible fat and carbohydrates compared with the digestible protein. That is, if a food is said to have a nutritive ratio of 1 to 6, that means that for every pound of digestible protein it contains six pounds of digestible carbohydrate material. To find the nutritive ratio, the digestible fat is multiplied by 2¼ and the product added to the carbohydrates. This sum divided by the number of pounds of digestible protein, gives the number of pounds of carbohydrate material to one pound of protein.

It has been ascertained, by accurate experiment, that the amount of food required to keep an animal from losing weight is not materially different for different animals of the same size and species. All the food that they will *profitably* eat above that amount depends on their individual digestive and producing capacities. It is therefore evident, that a ration which would be profitable for one animal would not be for another, and no hard and fast rules can be made. For this reason the accuracy of feeding standards has been questioned by some feeders, but they certainly must be considered a vast improvement over the commonly practiced, haphazard feeding of any materials at hand. The successful and progressive feeder can, by studying his herd, learn the capacity of each animal and vary its ration from the standard to suit the individual.

The German feeding standards recommended by Wolff are the ones generally employed in this country when any standards are made use of. A so-called American standard for dairy cows, which was obtained by Woll, by means of extended correspondence with dairymen in all parts of the country and the use of averages for composition and digestibility of foods, gives a somewhat wider ration with a nutritive ratio of 1 : 6.9 and only 2.13 pounds digestible protein per day. This ration can hardly be said to be based on scientific data, and is probably too wide to give the best results in most cases. In fact some of our best dairymen in this State claim to derive the most profit from a ration having a nutritive ratio of about 1 : 4 which is much narrower than the German ration and perhaps cannot be continuously fed dairy cows with safety. Authorities quite generally agree that a one thousand pound cow, of average capacity for producing milk, should have about 2.5 pounds of digestible protein per day and it would be questionable whether a Maine farmer, who is obliged to buy commercial fertilizers, could profitably feed any less to a cow of that size. At the present low prices of cotton-seed and gluten meals one can afford to feed the maximum amount of protein for the sake of increasing the value of the manure. Both of the above feeds contain fertilizing materials enough to amount to more than their cost when valued according to the valuations given to commercial fertilizers.

EXPLANATION OF TABLES.

Below are given tables which furnish the necessary data for making up rations. In table I the pounds of digestible nutrients in one hundred pounds of the coarse fodders and concentrated feeds common to this State will be found. In table II some convenient mixtures of grain are given, together with their percentages of digestible nutrients and nutritive ratios. Those with very narrow nutritive ratios are designed for feeding with such coarse fodders as timothy hay, corn silage and corn stover; while those with the wider nutritive ratio are for feeding with leguminous coarse fodders like clover hay, peas and oats, soy beans, etc. Table III gives the German feeding standards.

HOW TO USE THE TABLES.

The manner of using the tables can best be explained by an example. Suppose one wishes to make up a ration for dairy cows of 1,000 pounds live weight. For coarse fodders he has English hay and southern corn silage. By consulting table III, he finds a cow of that size needs 2.5 pounds of digestible protein, 12.5 pounds of digestible carbohydrates and 0.4 pounds of digestible fat per day. The cow will readily eat 35 pounds of silage and 10 pounds of hay. In table I he can find the percentages of digestible nutrients for southern corn silage and mixed hay. Those given for silage he multiplies by 35 and those given for hay by 10, which gives for

	Protein.	Carbohydrates.	Fat.
Southern corn silage..	.36	2.77	.16
Mixed hay	.47	4.29	.13
Total..........	.83	7.06	.29

We see from the sum of these nutrients that about 1.7 pounds more of protein, 5.5 pounds of carbohydrates and 0.1 pound of fat are needed, which can be most easily supplied with concentrated foods. Suppose we take 2 pounds each of corn meal, cotton-seed meal, gluten meal and bran. Then the percentage of nutrients of each given in the table should be multiplied by 2 which will give us a ration of the following composition:

		Protein.	Carbohy.	Fat.
Southern corn silage,	35 lbs..	.36	2.8	.16
Mixed hay,	10 " ..	.47	4.3	.13
Corn meal,	2 " ..	.12	1.2	.06
Cotton-seed meal,	2 " ..	.74	.37	.20
Gluten,	2 " ..	.67	.80	.11
Bran,	2 " ..	.25	.75	.06
Total...............		2.61	10.22	.72

TABLE I.

POUNDS OF DIGESTIBLE NUTRIENTS IN 100 POUNDS.

Coarse Fodders and Mill Products.	Protein.	Carbohydrates.	Fat.	Total nutritive substance.*	Nutritive Ratio.
Timothy	3.6	43.9	1.6	51.1	1:13.2
Red-top	4.9	45.2	1.3	53.0	1:9.8
Mixed hay (red-top, timothy & clover)	4.7	42.9	1.3	50.5	1:9.7
Hungarian	4.9	47.8	1.5	56.1	1:10.4
Orchard grass	4.9	40.6	1.4	48.7	1:8.9
Swale hay	2.4	29.5	0.8	33.7	1:13.0
Black grass	4.3	38.5	1.0	45.1	1:9.5
Oat hay	4.9	42.2	1.6	50.7	1:9.3
Oat straw	1.4	43.9	0.9	47.3	1:32.8
Corn stover	3.1	44.6	0.6	49.1	1:14.8
Maine field corn (mature including ears)	5.7	47.3	1.5	56.4	1:8.9
Maine field corn silage	1.8	13.6	0.7	17.0	1:8.4
Southern corn silage	1.0	7.9	0 4	9.8	1:8.8
Clover hay	7.2	35.8	1.8	47.1	1:5.5
Sweet corn fodder (no ears)	4.3	33.0	1.0	39.6	1:8.2
Corn meal	5.8	65.2	3.1	78.0	1:12.4
Wheat bran	12.6	37.5	3.2	57.3	1:3.5
Middlings	13.4	52.1	4.1	74.7	1:4.6
Ground oats	8.9	50.1	3.0	65.8	1:6.4
Barley	7.9	66.9	1.7	78.6	1:8.9
Pea meal	16.8	51.7	0.6	69.9	1:3.2
†Cottonseed meal	37.0	18.5	10.0	78.0	1:1.1
†Gluten meal (high in protein)	33.3	40.1	5.7	86.2	1:1.6
†Gluten meal (low in protein)	28.2	39.7	14.0	99.4	1:2.5
†Gluten feed	19.3	49.8	9.1	89.6	1:3.6
†Linseed meal	30.7	38.5	2.7	75.3	1:1.5

* Fat calculated to carbohydrate equivalent.

† These materials are subject to great variation in composition. The Feed Inspection Law now requires their composition to be stamped on the sacks, which guarantee the farmer can use, assuming the protein to be 85 per cent digestible.

TABLE II.

GRAIN MIXTURES.

Mixture Nos.	Corn meal.	Cotton seed meal.	Gluten meal.	Gluten feed.	Linseed meal.	Wheat bran.	Ground oats.	Pea meal.	Middlings.	Protein.	Carbohydrates.	Fat.	Nutritive ratio.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	%	%	%	
1	200	......	300	......	......	......	......	......	......	22.3	50.1	4.7	1: 2.7
2	200	100	125	......	......	......	......	......	......	21.2	46.8	5.5	1: 2.8
3	100	100	......	100	......	......	......	......	......	20.7	44.5	7.4	1: 3.0
4	200	100	100	......	......	200	......	......	......	17.9	44.0	4.7	1: 3.1
5	100	......	......	......	......	200	......	......	......	10.3	46.7	3.2	1: 5.2
6	100	......	100	......	......	100	......	......	......	17.2	47.6	4.0	1: 3.3
7	100	......	......	100	......	......	100	100	......	12.7	54.2	4.0	1: 5.0
8	100	100	......	......	......	100	......	......	100	17.2	43.3	5.1	1: 3.2
9	......	......	......	......	100	100	100	......	......	17.4	42.0	3.0	1: 2.8
10	200	......	......	......	100	......	100	......	......	12.8	54.8	3.0	1: 4.8
11	300	......	100	......	......	100	......	......	......	12.7	54.6	3.6	1: 4.9
12	......	......	......	......	......	100	100	100	......	12.8	46.4	2.3	1: 4.0

TABLE III.

FEEDING STANDARDS PER DAY AND PER 1,000 POUNDS LIVE WEIGHT.

	Nutritive (Digestible) Substances. Protein.	Carbo-hydrates.	Fat.	Total nutritive substance.	Nutritive ratio.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Oxen at rest in stalls	0.7	0.8	0.15	8.85	1: 11.9
Oxen moderately worked	1.6	11.3	0.30	13.20	1: 7.5
Oxen heavily worked	2.4	13.2	0.50	16.10	1: 6.0
Horses lightly worked	1.5	9.5	0.40	11.40	1: 6.9
Horses heavily worked	2.3	12.5	0.80	15.60	1: 6.2
Milk cows	2.5	12.5	0.40	15.40	1: 5.4
Fattening oxen	2.7	14.8	0.60	18.10	1: 6.0
Fattening sheep	3.0	15.2	0.50	18.70	1: 5.4
Growing cattle, age 3-6 months	3.2	13.5	1.0	17.7	1: 4.9
Growing cattle, age 6-12 months	2.5	13.5	0.6	16.6	1: 6.0
Growing cattle, age 12-18 months	2.0	13.0	0.4	15.4	1: 7.0
Growing cattle, 2 years and over	1.6	12.0	0.3	13.9	1: 7.9

RATIONS PER DAY FOR 1,000 LBS. LIVE WEIGHT, MADE UP FROM THE COARSE FODDERS AND GRAIN MIXTURES IN TABLES I AND II.

Ration Number.	Materials and Weights used for Each Ration.	Digestible Nutrients. Protein.	Digestible Nutrients. Carbo-hydrates.	Digestible Nutrients. Fat.	Nutritive ratio.
1 Milch cows.	Flint corn silage (ears glazed) ..30 lbs. Timothy hay..........10 " Grain mixture No. 1.......... 7 "	2.5	12.0	.70	1 to 5.4
2 Milch cows.	Flint corn silage (ears glazed) ..39 lbs. Mixed hay..........10 " Grain mixture No. 2.......... 7 "	2.5	11.7	.73	1 to 5.3
3 Milch cows.	Southern corn silage (no ears) ..35 lbs. Mixed hay..........10 " Grain mixture No. 3.......... 8 "	2.5	10.6	.86	1 to 5.0
4 Milch cows.	Timothy hay..........10 lbs. Corn stover..........10 " Grain mixture No. 4..........10 "	2.5	13.3	.69	1 to 5.9
5 Milch cows.	Hungarian hay..........10 lbs. Sweet corn fodder..........10 " Grain mixture No. 4.......... 9 "	2.5	12.0	.67	1 to 5.4
6 Milch cows.	Clover hay..........20 lbs. Grain mixture No. 5..........10 "	2.5	11.8	.68	1 to 5.3
7 Oxen heavily worked.	Mixed hay.......... 5 lbs. Oat hay.......... 5 " Oat straw..........10 " Grain mixture No. 6..........10 "	2.4	13.4	.64	1 to 6.2
8 Oxen moderately worked.	Southern corn silage..........20 lbs. Mixed hay.......... 5 " Oat straw..........10 " Grain mixture No. 7..........10 "	1.9	13.5	.64	1 to 7.9
9 Horses heavily worked.	Oat hay..........15 lbs. Grain mixture No. 10..........12 "	2.3	12.9	.60	1 to 6.2
10 Horses moderately worked.	Timothy hay..........15 lbs. Grain mixture No. 11.......... 12 "	2.1	13.1	67	1 to 7.0
11 Young growing cattle.	Mixed hay..........20 lbs. Grain mixture No. 9..........10 "	2.7	12.8	.86	1 to 5.5
12 Growing cattle.	Mixed hay..........10 lbs. Corn stover.......... 5 " Southern corn silage..........15 " Grain mixture No. 12..........10 "	2.1	13.4	.45	1 to 6.4

BULLETIN No. 40.

CELERY.

W. M. MUNSON.

Celery is a native of Great Britain where in the wild state it grows luxuriantly along wet ditches and in marshes. As a wild plant it has a long tapering root, its taste is acrid and its odor offensive. As a result of cultivation its leaf stalks have become solid, crisp and of an agreeable flavor, while in one variety—celeriac—the roots have become turnip shaped and edible.

Although not grown to an important commercial extent in Maine, the crop is one which may well be grown by every farmer and may in many cases prove a most profitable adjunct of the market garden.

SOIL.

The selection of soil in the culture of celery for profit is of great importance. The best soil is a deep black muck with an open, porous subsoil. It is upon such soil—often so soft that the work must be done by hand—that the famous Kalamazoo celery is grown. Soils of this character retain moisture well, are easily worked and are usually in such a location as to permit of controlling the water supply by means of irrigating ditches.

The soil should be at least sixteen or eighteen inches deep and a heavy clay subsoil, unless below the depth mentioned, should be avoided, as it will interfere with satisfactory banking of the crop. The swales or sloughs found on almost every farm, when drained and broken up into a state of fine tilth, make excellent celery land. If a certain amount of sand is mixed with the black soil it is all the better. Throughout the country there are many such swales which are now considered worthless, but which might be made the most profitable part of the farm.

The lack of such soils as above mentioned need not deter any one from growing the crop for home use, for though somewhat at the mercy of the weather, celery grown in uplands is more solid, keeps longer, and is less liable to suffer from frost than the more succulent growth on black soils, and good results may be expected from any rich garden soil.

In any case, most thorough pulverizing is essential. Celery roots naturally grow near the surface, hence very deep plowing is not necessary, except on uplands where we wish to encourage deeper growth of roots the better to withstand drouth, but the young plants are small and delicate and the whole field should be prepared as for a seed bed.

FERTILIZERS.

The fact that we grow celery for its leaves, indicates that the plant food supplied should be rich in nitrogen. In most celery growing districts stable manure is preferred if it is obtainable, as the improved mechanical condition of the soil is of importance. From thirty to sixty two-horse loads of well rotted stable manure per acre are applied and at once turned under to a depth of five or six inches.

In case the manure is not well rotted or the supply is limited, some practice making a trench six or eight inches deep where the row is to stand, and, after putting in about three inches of manure, filling with soil before setting the plants.

If the stable manure is not obtainable, concentrated fertilizers may be used, if an occasional crop of clover is plowed under to supply humus. Nitrate of soda is especially valuable. Soils which have received large quantities of stable manure are also benefitted by an occasional application of lime or gypsum.

STARTING THE PLANTS.

Celery seed is at best uncertain in its germinative power, and unless the conditions are suitable the percentage of germination is usually very low. In general we may count on from 5,000 to 10,000 plants from an ounce of seed.

For early celery the seed is sown in a mild hot bed or in flats in the greenhouse about March 1 to 15. For the home garden, if no hot bed is available, seed may be sown in rich, sandy soil in a shallow box and placed in the kitchen window.

In any case, cover the seed very lightly—not more than one-sixteenth of an inch—and keep the soil moderately moist but not wet. Many practice covering the surface with paper or with boards till the seeds begin to sprout. It is also well to soak the seeds in warm water for a few hours before sowing. There is little doubt that as a rule better results will be obtained in germinating most vegetable seeds if the soil is kept only moderately wet. Seeds must have air as well as moisture in order to germinate.

As the young plants begin to develop, transplant them into rows three inches apart, leaving about a half-inch space between the plants. In case some of the plants become too large before the ground is suitable for setting them in the field, they may be sheared back without harm. The process of "hardening off" should of course be observed. By this we mean that the plants should gradually be made accustomed to lower temperature before removal to the field.

For the main crop the seed is sown out of doors from the middle of April to the first of June. In this case a sheltered location is chosen, a fine seed-bed is prepared and the seed sown broadcast and lightly raked in, or sown thinly in drills and simply rolled. It is then well to provide a screen of lath or brush to protect the young plants and prevent destruction of the seed. If the plants are thinned somewhat in weeding, and are sheared back as they begin to grow too large, transplanting may sometimes be dispensed with, but the plants are better if handled once as described above.

If only a few hundred plants are to be grown, they may be bought cheaper than they can be raised, but if a large number are required the plants should be home grown.

CULTURE IN THE FIELD.

The plants for the main crop will be ready to transfer to the field early in July. They are usually placed six inches apart in rows five feet distant. The old practice of setting the plants in trenches is little followed at the present time.

If the rows are sufficiently far apart, the after culture is best done with a horse, but in no case should deep cultivation be permitted, as the roots extend through all the space between the rows and should not be disturbed. In short, until time of "handling," the culture need not be essentially different from that given to potatoes.

For early use the plants started in March may be transferred to the open ground about the first of June.

HANDLING.

The old custom of repeatedly "handling" or packing the earth about the growing plants has given way to more expeditious methods and it is generally conceded that one "hilling" before the final banking with earth is sufficient. This hilling should not be done till the plants have thickened considerably, about a month or six weeks before using, as after the earth is drawn about them the leaves grow tall very rapidly without increasing in diameter.

When ready to hill the plants, cultivate deeply between the rows, then draw the soil loosely about the plants with a hoe or a scraper made for that purpose. This operation makes a slight bank, not more than one-third the height of the plant, which straightens the stalks and holds them in an upright position. If the soil is in good condition, it will be unnecessary to pack the earth around individual plants by hand.

BLANCHING.

Blanching is the first step towards decay, and the exclusion of air and light and the consequent abnormal condition of the tissues render the plants, during this operation, specially liable to disease. For this reason the operation is delayed as long as possible. Plants intended for the first use are generally banked about eight or ten weeks after transplanting.

For bleaching the early crop, the use of boards is preferred to that of earth. The work is done more expeditiously, and there is less trouble from rotting. The method consists simply in placing boards about a foot wide along each side of the row with one edge close to the plants. The men then go along and raise the boards to a vertical position, placing clamps or hooks at intervals to hold them in place. A very good clamp is made by sawing two notches about an inch wide and three inches apart in a short piece of board. These clamps will then hold the boards perfectly rigid. In ten days or two weeks the celery will be ready for use and the boards are then available for use elsewhere, thus keeping up a succession.

If banking with earth is to be practiced, one of the machines made for that particular purpose will be found of advantage.

Celery intended for winter market is not usually blanched before putting into storage, though it is well to hill it up, to straighten up the leaves and make the plants compact. That intended for late fall use will of course need some attention, as from four to six weeks are required to blanch the later crop. For use before hard freezing occurs, the blanching may be done with boards, but for later use earth is to be preferred.

STORAGE.

If on well drained soil, the plants may be left in the rows till the last of November, by having some litter at hand to apply in case of hard freezing. It should be remembered, however, that if the plants are well banked, a little freezing of the tips of the leaves will do no harm, and the mistake is often made of applying winter protection too early and thus injuring the crop by keeping it too warm.

For winter storage the method in vogue in some celery-growing districts is to make, on well drained soil, beds of four to six double rows of plants with a wall of dirt between. Bank up on the outside till the tips of the leaves just show above the surface of the bed. Leave the bed in this condition till hard freezing begins, then throw two or three inches of soil over the surface. Let this soil freeze hard before applying litter, and never apply heavy covering at the first approach of cold weather. The soil in the bed is still warm, and if a heavy coat of manure is put on the top, the frost is soon taken out of the surface soil and the temperature will be high enough to induce decay. The secret of success in the winter storage of celery is to keep cool. As the severe weather of winter approaches, the covering of litter may be increased unless there is a fall of snow.

To open the beds, take the litter off from one end, break the crust of soil with a pickaxe, and remove any desired amount of the celery. Then carefully replace the covering. This plan has the merit of cheapness, and for holding plants through the winter is preferable to storage in a pit or cellar.

If the crop is to be disposed of as early as January, it may be stored in a cool cellar or pit. In this case the plants are set very closely together on loose moist loam. To avoid heating, consequent on packing large quantities of the plants together, compartments, about two feet wide by eight or ten feet long, are made by setting up boards which shall come to the tops of the plants when in place. If the plants are closely packed, so as to exclude the air, it is unnecessary to use earth between them. When plants are stored in this way, it is important that the temperature of the pit or cellar be kept as near the freezing point as possible. If, however, it is desired to hasten the process of blanching, the temperature may be raised. The soil in which the plants are placed should be moist to prevent wilting, but the foliage should always be kept dry or there will be trouble from rotting.

ENEMIES AND DISEASES.

There are comparatively few insect enemies of celery, the most important being the "Green Lettuce Worm" and the "Parsley Worm," both of which may be destroyed by the use of kerosene emulsion.

There are several fungous diseases—such as blight, leaf spot, rust, etc.,—which, however, may be held in check by the application of dilute Bordeaux Mixture or the ammoniacal solution of copper carbonate. But in case a crop is seriously injured by one of these diseases, it is safer to grow something else on the land the next season, that any spores in the soil may be destroyed.

INSPECTIONS FOR 1897.

CHAS. D. WOODS.

The station officers take pains to obtain for analysis samples of all commercial fertilizers and concentrated commercial feeding stuffs coming under the law, but the organized co-operation of farmers is essential for the full and timely protection of their interests. Granges and other organizations can render efficient aid by sending early in the season, samples taken from stock in the market and drawn in accordance with the station directions for sampling.

There is no provision made by law for the analysis of agricultural seeds. Seeds, taken in accordance with the station directions for sampling, will be examined for $1 per sample.

Directions for sampling and blanks for forwarding samples of fertilizers, feeding stuffs and seeds will be sent on application.

FERTILIZER INSPECTION.

The marked increase in the number of brands of fertilizers offered is a misfortune. The multiplication of brands adds to the confusion of the consumer and is an expense and inconvenience to the manufacturer. Although the number of brands offered in this State is small compared with those offered in Massachusetts or New York, it is far too large. There has been a steady increase since 1894 of about 20 brands a year.

About one-third of the brands of fertilizers sold in the State were, under the law of 1893, exempt from the payment of the analysis fee, as the manufacturers claimed sales of less than thirty tons a year for these brands. The law required, however, that these non-paying brands should be inspected, consequently it was possible for a manufacturer, by selling a small amount of a large number of brands, to increase the work of inspection entirely out of proportion to the analysis fees paid.

As the cost of the inspection must be met by the receipts of the license fees, the inspection of the non-paying brands restricted the amount of inspection of the regularly licensed brands. Partly to correct this evil and partly in the hope that further increase in the number of brands offered in the State might be checked, the law was so amended that the analysis fee now applies to every brand sold in the State.

Requirements of the Law.

The full text of the amended law was printed in the report of this Station for 1896. Its chief requirements are as follows:

The Brand. Each package of commercial fertilizer shall bear, conspicuously printed, the following statements:

The number of net pounds contained in the package.

The name or trade mark under which it is sold.

The name of the manufacturer or shipper.

The place of manufacture.

The place of business of manufacturer or shipper.

The percentage of nitrogen.

The percentage of potash soluble in water.

The percentage of available phosphoric acid.

The percentage of total phosphoric acid.

The Certificate. For each brand of fertilizer a certificate shall be filed annually with the Director of the Station giving the manufacturer's or dealer's name, place of business, place of manufacture, name of brand of fertilizer and the guaranteed composition of the same.

The Manufacturer's Sample. Unless excused by the Director under certain conditions, a sample of each fertilizer, with an accompanying affidavit that this sample "corresponds within reasonable limits to the fertilizer which it represents" must be deposited annually with the Director of the Station. These samples are designated in the station publications as "Manufacturer's Samples."

The Analysis Fee. The law requires the annual payment to the Director of the Station of an analysis fee as follows: Ten dollars for the phosphoric acid and five dollars each for the nitrogen and potash, contained or said to be contained in the fertilizer, this fee to be assessed on any brand sold in the State.

Duties of the Director. The law also imposes upon the Director of the Maine Agricultural Experiment Station certain duties, which are:

The issuing of licenses to such manufacturers as comply with the above named requirements.

The analysis of the samples deposited by the manufacturer.

The selection of samples in the open market of all brands of fertilizers sold or offered for sale in the State, with the subsequent analysis of the sample.

The publication of bulletins or reports, giving the results of the inspection.

In accordance with the law, two commercial fertilizer bulletins were printed during the year. The first (33) was published early in March and contained the analyses of the samples received from the manufacturers, guaranteed to represent, within reasonable limits, the goods to be placed upon the market later. The second bulletin (38) contained the results of the analyses of the samples collected in the open market by the officers of the Station, and was published in October.

One hundred and thirty-seven brands were offered in the State during the year. The station officers analyzed one hundred and thirty-two of these; the other four were offered in small amounts and samples were not drawn, either because they were not found by the collector or because the amount found in any one place was too small to insure their fairly representing the goods.

A comparison of the percentages guaranteed by the manufacturers samples and those collected by a station representative in different parts of the State, shows that, as a rule, the fertilizers sold in the State are well up to the minimum guarantee. In a few instances the particular lots of fertilizers sampled were not quite as good as they should be; there was, however, no case which appeared to be an attempt to defraud. The comparisons indicate that the manufacturers do not intend to do much more than make good the minimum guarantee, and this is all the purchaser can safely expect.

The tabular statement which follows, summarizes the comparisons of manufacturer's and station samples with the guarantee. As a rule, the manufacturer's samples are somewhat better than those collected by the station representative.

Nitrogen.

Manufacturer's samples.

Number of samples above guarantee.............. 110
Number of samples below guarantee.............. 12
Average percentage of nitrogen in 110 samples above guarantee .... .36%
Average percentage of nitrogen in 12 samples below guarantee .... .14%
Average percentage of nitrogen in all (122) samples above guarantee.............................. .28%

Station samples.

Number of samples above guarantee.............. 107
Number of samples below guarantee.............. 22
Average percentage of nitrogen in 107 samples above guarantee .... .30%
Average percentage of nitrogen in 22 samples below guarantee .... .21%
Average percentage of nitrogen in all (129) samples above guarantee.............................. .22%

Available Phosphoric Acid.

Manufacturer's samples.

Number of samples above guarantee.............. 109
Number of samples below guarantee.............. 18
Average percentage of available phosphoric acid in 109 samples above guarantee...................... 1.42%
Average percentage of available phosphoric acid in 18 samples below guarantee...................... .74%
Average percentage of available phosphoric acid in all (127) samples above guarantee................. 1.15%

Station samples.

Number of samples above guarantee.............. 113
Number of samples below guarantee.............. 19
Average percentage of available phosphoric acid in 113 samples above guarantee...................... 1.24%
Average percentage of available phosphoric acid in 19 samples below guarantee...................... .78%
Average percentage of available phosphoric acid in all (132) samples above guarantee................... .91%

Potash.

Manufacturer's samples.

Number of samples above guarantee	106
Number of samples below guarantee	17
Average percentage of potash in 106 samples above guarantee	.67%
Average percentage of potash in 17 samples below guarantee	.29%
Average percentage of potash in all (123) samples above guarantee	.52%

Station samples.

Number of samples above guarantee	110
Number of samples below guarantee	18
Average percentage of potash in 110 samples above guarantee	.50%
Average percentage of potash in 18 samples below guarantee	.28%
Average percentage of potash in all (128) samples above guarantee	.41%

FEEDING STUFF INSPECTION.

The legislature of 1897 passed a law entitled "An Act to regulate the sale and analysis of Concentrated Commercial Feeding Stuffs." In essence the law is identical with the law regulating the sale of commercial fertilizers, and is the first attempt to establish an adequate control over the sale of offals and other by-products used as food for cattle, and other live stock.

The full text of the law was printed in the report of this Station for 1896 and in Bulletin 37. In addition to the law, Bulletin 37 contained the following statements.

With the increased use of the by-products sold as concentrated feeds for cattle, it has been found, by chemical analysis and feeding tests, as well as by common experience, that there are great differences in the feeding values of goods which outwardly closely resemble each other. As an illustration the following case may be quoted: Some time ago the Station purchased a quantity of cotton-seed meal from a Bangor dealer. A few weeks later the firm offered at a somewhat reduced rate a brand which, to outward appearance, was apparently equal to the first. Yet chemical analysis showed that the first contained 52.2 per cent protein and the latter only 31.9 per cent. In other words, one, which was an unusually good article, contained over 60 per cent more protein than the other, which proved much below the average. As regards the value, the actual difference was probably much greater, since the amount of ash found in the lower grade indicated that the adulterant used was of inferior quality, and the digestibility of the protein present must have been affected thereby.

In the improvement in the manufacture of gluten meals and feeds, and the increased demand for corn oil, the percentages of fat have been greatly diminished and in most glutens the percentages of protein have been correspondingly increased. The general feeling of dissatisfaction with the existing state of things came to the front at the State Dairy Meeting held in Skowhegan in December of last year, and again later at the meeting of the State Grange. At the first of these meetings the State Board of Agriculture appointed a committee to draft a law to regulate the sale of feeding stuffs. The State Grange passed resolutions urging the desirability of such legislation. At the annual meeting of the Board of Agriculture the committee presented their report, recommending the enactment of a law in all its essentials identical with the act which was finally passed in March, 1897.

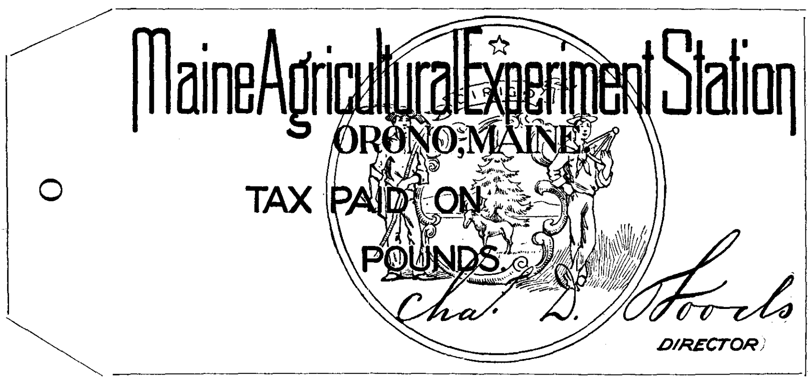
Chief Provisions of the Law.

The points of the law of most interest, both to the dealer and consumer, are concisely stated below.

Kinds of Feed coming within the Law. The law covers all feeding stuffs *except* hays and straws; whole seeds and meals of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn; brans and middlings. The principal feeds coming under the provisions of the law are linseed meals, cotton-seed meals, pea meals, cocoanut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewer's grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chops, ground beef or fish scraps, mixed feeds, and all other materials of similar nature.

Inspection Tax. In order to meet the expenses of inspection, a tax of ten cents per ton must be paid to the Director of the Maine Agricultural Experiment Station.

Inspection Tax Tag. The Director of the Station, on receipt of the inspection tax is required to furnish a tag stating that all charges have been paid. The form of the inspection tax tag to be used for the present will consist of an ordinary shipping tag, colored red, similar in design to the following:



These tags, with the number of pounds printed in, will be furnished in any quantity on receipt of the tonnage tax. The tags will be provided with strings or wires if desired. Unused tags will be redeemed at any time. Tags will be sent by express, charges for carriage to be collected.

The Brand. Each package of feeding stuff included within the law shall have affixed the inspection tax tag, and shall also bear, conspicuously printed, the following statements:

The number of net pounds contained in the package.

The name or trade mark under which it is sold.

The name of the manufacturer or shipper.

The place of manufacture.

The place of business of manufacturer or shipper.

The percentage of crude protein.

The percentage of crude fat.

These statements may be printed directly on the bag, on a tag to be attached to the package, or on the back of the inspection tax tag furnished by the Director of the Station.

A certified copy of this statement of brand must be filed with the Director of the Station.

Analysis. Whenever the Director of the Station shall so request, the certificate must be accompanied by a sealed sample of the goods so certified. It shall also be the duty of the Director to cause to be collected each year at least one sample of each of the brands of feeding stuffs coming within the provisions of this act. These samples are to be analyzed and the results, together with related matter, published from time to time in the form of bulletins.

Analyses for manufacturers, dealers and others, which are not of general interest and which are not called for by the provisions of the act, will be made on request at a price sufficient to cover the cost of analysis. The rates will be: for protein, one dollar; for fat, two dollars. Under no conditions will the Station undertake analyses the results of which cannot be published.

Although the law did not take effect till October, a copy of the above bulletin was sent in August to the entire mailing list of the Station and to all dealers whose addresses could be found in the Maine Register and who, from the nature of their business, would seem at all likely to handle feeding stuffs.

Inspectors.

In the past the Station has employed one person to collect samples in the State. Although this may prove to be the more economical method of inspection, it was deemed advisable to employ several local inspectors for the present. The following gentlemen were appointed inspectors in October and have served the Station acceptably.

Inspectors for 1897.

Arthur B. Briggs, Hartford; J. W. Dudley, Castle Hill; F. B. Elliot, Bowdoinham; A. S. Farnsworth, West Pembroke; W. G. Hunton, Readfield, Ora W. Knight, Bangor; W. H. Snow, Milo; L. O. Straw, Newfield; P. C. Wentworth, East Hiram; Chas. E. Wheeler, Chesterville; John M. Winslow, Glendon.

The law went into operation October 1. In order that dealers might have still further time to get into line with the requirements of the law, the first visit of the inspectors was deferred until after November 1. On this round the inspectors visited all dealers in their territory and reported to the

Director of the Station every one they found violating the law in any particular. These reports were made daily, and immediately upon their receipt, letters were written to the delinquents, calling their attention to their failure to comply with the law. No case of wilful violation has come to our notice. On the contrary there has been an evident desire on the part of most dealers to live up to all the requirements of the law. No samples were drawn by inspectors until January. At this time they reported very few violations of the law and it seems to be working smoothly in all respects. At the time of this writing the law is for the most part fully complied with.

The co-operation of the dealers has materially assisted in the speedy introduction of this entirely new feature in legislation. Both dealer and consumer are coming to better understand the nature of these feeds and have a clearer knowledge of their feeding values. Under date of October 1, a large commission house wrote, "It seems to us that this law must be very educational," and such it is proving itself to be. That it will be as great a benefit to both dealer and consumer as the fertilizer inspection has become, there is little doubt.

INSPECTION OF CHEMICAL GLASSWARE USED IN CREAMERIES.

Nearly all the glassware that has been examined during the year has come from dealers in dairy supplies. It is reasonable to suppose, therefore, that the butter factories have renewed their stock by purchasing tested bottles and pipettes direct from the dealers and are complying with the law in that respect.

It has been gratifying to note that a very small percentage of the goods inspected the past year was inaccurately graduated. All bottles and pipettes examined by the Station and found correct have the letters M. E. S. etched upon them. The text of the law was printed in the Report for 1896.

SEED TESTING.

The law passed by the Legislature of 1897, while it imposes certain duties upon the Director of the Station, is not an inspection law. Bulletin 36, which is reprinted on pages 32 to 38 of this Report, contains the law and rules for testing purity of seeds. This bulletin was issued in August and was sent to all dealers as well as to the regular mailing list of the Station.

TESTING DAIRY PRODUCTS BY THE BABCOCK TEST.

J. M. Bartlett.

The following pages were written with the idea of bringing together, in compact form, such information as we frequently have calls for within the limits of our own State. Notwithstanding the fact that the Station has published several bulletins on the subject, it has nothing at hand that covers all the ground. Very little that is new is presented and quite a part of the matter has been taken from other station publications. The part on testing milk is largely a reprint of Dr. Babcock's description in the Report of the Wisconsin Experiment Station for 1893.

Testing cream is given considerable attention for the reason that it is of very general interest in this State. Especial attention is called to sampling and weighing cream received at butter factories, and to a uniform system of paying for cream. Scales for weighing cream and other dairy products that cannot be accurately or readily measured for the test are suggested, and their use is earnestly recommended to all butter factories.

WHAT THE TEST SHOWS.

The Babcock Test has been before the public so many years and is so familiar to most dairymen that it seems almost superfluous to explain its object and use. Nevertheless, there are those who do not have a clear idea of just what the test means or shows, and it is for such that this brief explanation is given.

Normal milk contains from 12 to 16 per cent solid matter and 88 to 84 per cent water. The solid matter consists of fat and casein in suspension, and albumin, milk sugar and mineral salts in solution. The fat, which is practically the only valuable constituent for butter making, is the ingredient determined by the Babcock test. The sulfuric acid used in the process dissolves all the solids contained in the milk except the fat; this is separated from the solution by centrifugal force.

In churning, water and small quantities of casein and other solids separate with the butter fat and remain incorporated with it, so that after the salt is added butter contains only 80 to 87 per cent butter fat. In the Babcock test the fat is separated as pure butter fat, and contains neither water, salt nor casein.

A good quality of butter contains about 85 per cent butter fat, and this is the percentage commonly used in calculating but-

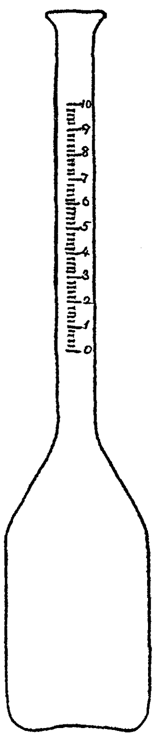


FIG. 1.

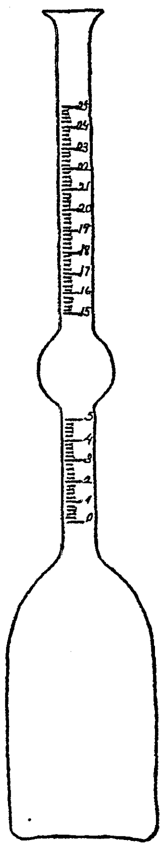


FIG. 2.

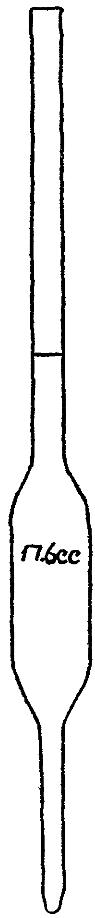


FIG. 3.

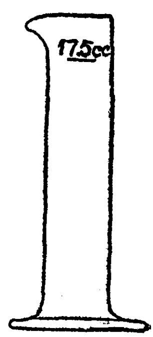


FIG. 4.

ter fat to its equivalent in butter. Suppose, for example, milk tests 4.25 per cent fat, 100 pounds of such milk contains 4.25

pounds of butter fat, which would make about 5 pounds of butter containing 85 per cent fat. If cream tests 20 per cent fat, 100 pounds of that cream contains 20 pounds of butter fat, which would make about 23.6 pounds of butter.

APPARATUS.

The principal apparatus used in the test is here described. Special forms and modifications used in determining the butter fat in different dairy products are given in the applications of the method to special cases.

The test bottles. The general form of the bottle is shown in figure 1 on the opposite page. Several different styles used for different purposes are described beyond. All of the bottles have graduated necks reading in percentages of the amount of milk or cream used. The dimensions of the scale on the necks should be uniform and the lines should run straight across the neck, and not obliquely, as is sometimes the case.

When new, the lines and numbers of the scale are usually blackened so that they are easily distinguished, but after the bottles have been cleaned a number of times the color may be washed away, leaving the lines indistinct. The color may be restored by rubbing the scale with a lead pencil, or with a cloth having a little black paint upon it.

In order to avoid the possibility of errors, the bottles should be numbered. This is conveniently done by having a number stamped on a copper ring which is slipped over the neck, or by having a spot etched on the upper part of the neck so that the number can be marked upon it with a pencil.

The pipette. The form of pipette commonly used is shown in the accompanying cut (fig. 3). That for milk should deliver 17.6 cubic centimeters and for cream 18 cubic centimeters, when filled to the mark.

Acid Measure. The best measure for general use is a graduate or cyclinder of glass, (fig. 4) with a lip to pour from. When filled to the mark it contains 17.5 cubic centimeters.

Several automatic pipettes and convenient devices have been invented for handling acid on a large scale for use in factories where a large number of tests must be made daily. These cost from $5 to $50 and are great time savers. Two very satisfactory forms that can be obtained at a moderate price may be mentioned here, one known as the Swedish acid bottle and one offered for sale by Emil Greiner, New York City. These can be obtained from dealers in creamery supplies.

Centrifugal Machine. All machines made by reliable dairy supply firms are suitable for this purpose. A machine must be capable of making 800 to 1200 revolutions per minute, according to the diameter of the wheel. A small wheel should make more revolutions than a large one. A wheel should not be less than 16 inches in diameter and need not be more than 20. Steam turbine machines are to be preferred for factories or wherever high pressure steam is available, as they maintain an even speed, prevent cooling of the bottles and supply hot distilled water for filling. They should be furnished with a speed indicator.

Sulfuric Acid. This acid should have a specific gravity of 1.820 to 1.825. It is very important that the acid used be of the right strength. If it is too weak, the curd will not all be dissolved, and will make the test unsatisfactory. If the acid is too strong, the fat is liable to be blackened, or black particles of charred matter will accumulate just below the fat column and interfere with the reading. If the acid is only slightly too strong or weak, a little less or more than the prescribed amount may be used and give good results. It is better to have the acid right and use the amount directed.

If acid is bought in the carboy, the wooden case surrounding it should never be removed, as by so doing the risk of breakage is greatly increased. All carboys or bottles in which acid is kept must be tightly stoppered, or the acid will absorb moisture from the air and become too weak for use.

One should always use the greatest care in handling sulfuric acid as it is very corrosive, causing serious burns when allowed to remain upon the skin and destroying clothes when it comes in contact with them. When spilled upon the hands or clothing, it should be washed off immediately, using plenty of water. If the color has been changed on the clothing it can usually be restored by saturating the spot with ammonia water.

Apparatus for Filling the Bottles with Hot Water. A very convenient arrangement for this purpose consists of a galvanized iron or copper tank, holding 4 to 6 quarts, with a tubulature near the bottom to which is attached a small flexible rubber tube, about 3 feet long, provided with a pinch-cock and glass or metal nozzle. For use, the tank is filled with hot water, placed on a support a foot or two above the machine; by means of the rubber tube all the bottles can then be filled without moving them from their places. The flow of water is controlled by the pinch-cock.

Sampling Tube. For this purpose several different tubes have been devised, all of which are efficient when properly used. The simplest one of all is a small metal tube about 2 feet long with a bore of about three-sixteenths of an inch in diameter. This tube is lowered slowly into the pail of milk or cream so that it will fill as it goes down, then the thumb or finger is pressed over the top opening so as to hold the contents in when the tube is taken out. The chief objection to this tube is, it has so small a bore that it holds but little cream and fills very slowly, thereby increasing the liability of letting it into the milk or cream faster than it fills and not getting a good sample.

Another form recommended by the Connecticut (Storrs) Station is a metal tube similar to the one above described with a stop-cock at the top to close it. This tube has an internal diameter of about one-fourth of an inch, bushed down to one-eighth of an inch at the lower end so the milk will not run out before the stop-cock is opened.

Still another form is the so-called Scoville Milk Sampler, which is a long metal tube with a valve at the bottom, which closes when the tube is filled with milk.

The Station uses a tube of its own design that works very satisfactorily. It consists of a brass tube about 2 feet long and five-sixteenth of an inch inside diameter. The lower opening is provided with a valve which is opened or closed by means of a small rod passing through the interior of the tube to a handle at the top. The parts are connected by screw connections so they can be readily detached and cleaned as necessary.

MAKING THE TEST.

Mixing the Sample. Every precaution should be taken to have the sample represent the milk or cream from which it is taken. Milk fresh from the cow can be thoroughly mixed by pouring three or four times from one vessel to another, but milk or cream that has stood until a layer of thick cream has formed on the top must be mixed until the thick cream is broken up and the whole mass appears homogeneous. No clots of cream should appear on the surface when the sample is left quiet for a moment. The mixing should not be too violent or carried to excess, for in this way little granules of butter may be separated or the sample filled with air bubbles, making it impossible to measure out the required quantity.

Large quantities of sour milk or cream cannot be sampled, but small lots of a pint or quart can be put in proper condition by the following treatment: Add to the sample powdered "concentrated lye" or caustic soda, (a small thimbleful to a pint of milk or cream is sufficient,) heat in a closed jar or bottle in water to about 110° to 120° F., shake thoroughly, and allow to cool to about 70° F., when it will be found to be in as good condition to measure as when fresh.

Measuring the sample for a test. When the sample has been sufficiently mixed, fill the pipette by placing its lower end in the sample and sucking at the upper end until the milk or cream rises above the mark on the stem; then remove the pipette from the mouth, and quickly close the tube at the upper end by firmly pressing the end of the index finger upon it to prevent access of air. So long as this is done the sample cannot flow from the pipette. Holding the pipette in a perpendicular position, with the mark on a level with the eye, carefully relieve the pressure on the finger so as to admit air slowly to the space above the liquid. In order to more easily control the access of the air, both the finger and the end of the pipette should be dry. When the upper surface of the liquid coincides with the mark upon the stem, the pressure should be renewed to stop the flow.

Next, place the point of the pipette in the mouth of one of the test bottles, held in a slightly inclined position so that the liquid will flow down the side of the tube, leaving a space for the air to escape without clogging the neck, and remove the finger, allowing the liquid to flow into the bottle. After waiting a short time for the pipette to drain, blow into the upper end to expel the liquid held by capillary attraction in the point. If the pipette is not dry when used, it should be first filled with sample to be tested, and this thrown away before taking the test sample. If several samples of the same lot are taken for comparison, the material to be tested should be poured once from one vessel to another after each sample is measured. Neglect of this precaution may make a perceptible difference in the results. Persons who have had no experience in the use of the pipette will do well to practice a short time by measuring water into a test bottle before attempting to make an analysis.

Adding the Acid. After the sample has been measured into the test bottle, the test may be proceeded with immediately, or it may be left for a day or two without materially changing the result; samples that have remained in the test bottles two or three weeks, and which had commenced to mould before the acid was added, have given the same amount of fat as samples tested immediately after being measured. If the sample has become coagulated, the curd should be broken up by shaking the test bottle before the acid is added. It is advisable, when possible, that the test be proceeded with immediately after the samples are measured.

The volume of commercial sulfuric acid required for a test is 17.5 cubic centimeters. If too little acid is added, the casein is not all held in solution throughout the test, and an imperfect separation of the fat results. If too much acid is used, the fat itself is attacked. The acid need not be measured with great accuracy, as small variations will not affect the results.

When all of the samples of milk to be tested are measured ready for the test, the acid measure is filled to the 17.5 cubic centimeter mark with sulfuric acid, and then carefully poured into a test bottle containing milk. The bottle is held in a slightly inclined position, for reasons given in directions for measuring the sample. The acid being much the heavier sinks directly to the bottom of the test bottle without mixing with the milk that floats upon it. The acid and milk should be thoroughly mixed together by gently shaking with a rotary motion. At first there is a precipitation of curd, but this rapidly dissolves. There is a large amount of heat evolved by the chemical action, and the solution, at first nearly colorless, soon changes to a very dark brown, owing to the charring of the milk sugar and perhaps some other constituents of the milk or cream.

Whirling the Bottles. The test bottles containing the mixture of the milk and acid should be placed in the machine, and whirled directly after the acid is added. An even number of bottles should be whirled at the same time, and they should be placed in the wheel in pairs opposite to each other, so that the equilibrium of the apparatus will not be disturbed. When all of the test bottles are placed in the apparatus, the cover is placed upon the jacket, and the machine turned at the proper speed for about five minutes. The test should never be made without the cover being placed upon the jacket, as this not only prevents the cooling of the bottles when they are whirled, but in case of the breakage of bottles will protect the face and eyes of the operator from injury by pieces of glass or hot acid. Managed in this way, no extra heat is required, as that caused by the chemical action is sufficient to keep the fat liquid. If the bottles have stood, after the acid is added, until the contents are cooled, they should be warmed to about 200° F. by placing them in hot water before whirling. The machine should be frequently examined to make certain that there is no slipping of belts or frictional bearings which may cause too slow motion and result in an imperfect separation of fat.

Filling the Bottles. As soon as the bottles have been sufficiently whirled, they should be filled to near the top of the graduated part of the stem with hot water. If practicable, distilled or rain water should be used for the purpose. The bottles are most easily filled by means of the apparatus described on page 64. If only a few tests are to be made, the water can be added with the pipette or glass cylinder. The cover should then be replaced and the machine turned for about one minute, after which the fat may be measured.

Measuring the Fat. The fat when measured should be warm enough to flow readily, so that the line between the acid liquid and the column of fat will quickly assume a horizontal position when the bottle is removed from the machine. Any temperature between 110° F. and 150° F. will answer, but the higher temperature is to be preferred. The slight difference in the volume of fat due to this difference in temperature is not sufficient to materially affect results.

To measure the fat, take a bottle from its socket and holding it in a perpendicular position with the scale on a level with the eye, observe the divisions which mark the highest and the lowest limits of the fat. The difference between these gives the per cent of fat directly. The reading can easily be taken to half divisions or in the ordinary milk bottle to one-tenth per cent.

The line of division between the fat and the liquid beneath is nearly a straight line and no doubt need arise concerning the reading at this point; but the upper surface of the fat being concave, errors often occur by reading from the wrong place. The reading should be taken at the line where the surface of the fat meets the side of the tube and not from the surface of the fat in the centre of the tube nor from the bottom of the dark line caused by the refraction of the curved surface. For instance in fig. 5 the reading should be taken from a to b and not to c or d.

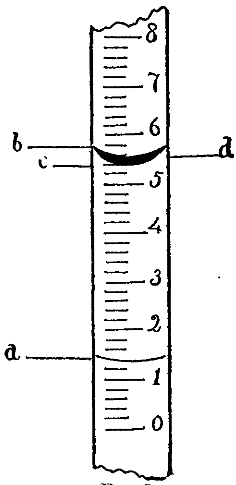


FIG. 5.

The reading may be made with less liability of error by measuring the length of the column of fat with a pair of dividers, one point of which is placed at the bottom and the other at the upper limit of the fat. The dividers are then removed and one point being placed at the zero mark of the scale on the bottle used, the other will be at the per cent of fat in the sample examined.

Sometimes bubbles of air collect at the upper surface of the column of fat and prevent a close reading; in such cases a few drops of strong alcohol (over 90 per cent) put into the tube on top of the column of fat will cause the bubbles to disappear and give a sharp line between the fat and alcohol for reading. Whenever alcohol is used for this purpose, the reading should be taken directly after the alcohol is added, as after it has stood for a time, the alcohol partially unites with the fat and increases its volume.

Whenever the fat is not quite clear, more satisfactory results may be obtained by allowing the bottles to stand until the fat has crystallized and then warming them by placing the bottle in hot water, before taking the reading.

TESTING MILK.

The original method of Dr. Babcock. The bottle usually employed for testing milk is shown in fig. 1, p. 62. It should be made of heavy glass and should hold, up to the neck, not less than 40 cubic centimeters. The neck is graduated to read in per cent of the amount of milk used. The graduation extends from 0 to 10 per cent, which is sufficient range for normal milk. The pipette for measuring milk should hold 17.6 cubic centimeters when filled to the mark. A pipette of this size will deliver 18 grams of milk of average specific gravity (1.032.) The milk is measured into the test bottle and the test made as described on pages 66-69.

The modified method. (*Bartlett.*) The method described above is the original method as announced by Dr. Babcock, and beginners and those who have had little experience are advised to follow that method. Those who are somewhat skilled in testing should use the modification of the method as given in Bulletin 31 of this Station. For convenience of reference the method is here reprinted.

After the milk is mixed by stirring or pouring from one vessel to another, the required amount, 17.6 cubic centimeters, is measured into the test bottle. It is then heated to about 70° F., if not already at that temperature, by setting the bottles in a tank of warm water. Twenty cubic centimeters of sulfuric acid (specific gravity 1.82 to 1.825) are added, and the bottle shaken by giving it a rotary motion, until the milk and acid are thoroughly mixed. The mixture is then allowed to stand not less than 5 minutes. No harm is done if it stands longer than 5 minutes and in fact, occasionally, some kinds of milk have to be given a little more time. After standing the necessary time, the bottle is given another gentle shake to mix in and dissolve any particles of curd that may have risen to the surface. Hot water is then added nearly to the uppermost mark, the bottle is put in the centrifugal machine and whirled for 5 minutes at the rate of 1,000 to 1,200 revolutions per minute. A steam turbine machine is best for this purpose, but a hand or belt power machine can be used, if hot water is put in the pan to keep the fat melted. After the whirling is completed, the percentage of fat can be read in the usual manner.

For the modified test no change of apparatus need be made; the writer, however, prefers to have the base portion of the bottle graduated, so no acid measure is required and only one pouring of the acid is necessary. By having the bottle marked at the point A (fig. 6), at which mark it holds 37.5 cubic centimeters, one can, after the milk is measured in with the pipette, run the acid in until it is filled to this point. It was found impracticable to use a bottle like the one for cream described farther on, because of the larger amount of curd in milk than in cream and the small size of the neck of the milk bottle, necessitating more space for shaking, breaking up the curd and dissolving it in the acid.

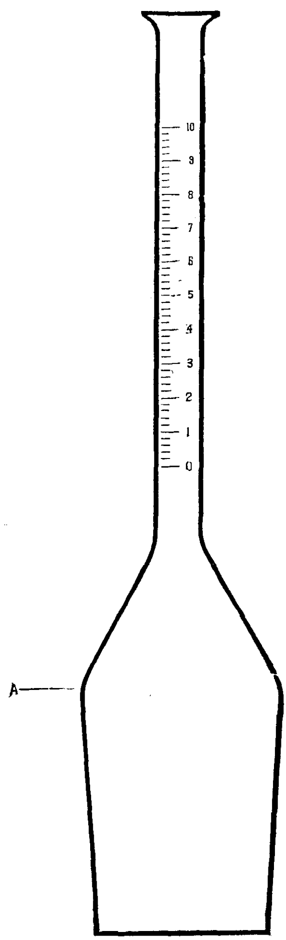


FIG. 6.

It would appear that the time required for the bottles to stand after the acid is mixed with the milk, would offset that gained by omitting the second whirling, which is made in the old method; but the writer has often found it necessary with many kinds of milk, especially with that from cows much advanced in the period of lactation, to allow the bottles to stand awhile, even when working the two whirling method, in order to get a clear separation of fat. However, every one who does much testing should have at least two sets of bottles, so there would be no loss of time by this process. When two sets of bottles are at hand, one set, charged with the milk and acid, can stand while the second set is being filled, and the second set can stand while the first is being whirled. It is much better to make 12 tests at a time than to make a larger number. Twelve are about all one can easily read before the fat begins to cool and contract in volume.

Precautions. That good results and clear separations can be obtained by the previously described modifications, the writer and others connected with the College have fully demonstrated. It is necessary, however, that certain details be strictly observed to attain success, and to make those points more prominent they are repeated as precautions.

The acid must be of the proper strength; 1.82 specific gravity at 60° F., is more universally successful than a stronger acid, though 1.825 may be used in some cases. With very rich milk, 20 to 21 cubic centimeters of acid of 1.82 specific gravity works much better than a smaller quantity of stronger acid, probably because there is less water in rich milk to properly dilute the acid than in poor milk. Rather thin milk will give good results with acid of quite varying strength. If the acid is too strong, the fat will be blackened, or black particles will appear in the lower part of the fat column. If the acid is not strong enough, the fat will appear cloudy, and white particles of curd will collect at the lower part of the column so that an accurate reading cannot be made.

The milk should not be colder than 70° F., or warmer than 80° F. when the acid is added. If the milk is too cold, the curd will not all be dissolved in the time allowed, and the fat will appear cloudy with white particles in the lower part of the column which will interfere with the reading. If the milk is too warm, the action of the acid will be too violent, the fat will be burned, and the whole column appear blackened; or if only slightly burned, black particles will appear in the lower part of the column.

The acid and milk must be thoroughly mixed together and the mixture stand not less than 5 minutes before hot water is added; otherwise a clear separation will not be obtained. It is also best to shake the bottle again slightly, just before adding the hot water, to dissolve any particles of curd that have risen with the fat.

The bottles must be whirled and heat applied as directed, or the separation is liable to be incomplete. Sometimes a cloudy fat can be cleared by heat and longer whirling.

Nearly all of the above precautions must be observed to obtain correct results by the method as originally proposed.

TESTING SKIMMED MILK, BUTTER MILK AND WHEY.

Skimmed milk, butter milk and all similar products usually contain small amounts of fat, much less than one per cent. They can be tested with the ordinary milk bottle in precisely the same manner as whole milk, with sufficient accuracy for all practical purposes. If greater accuracy is desired, however, a special test bottle which holds twice as much as the ordinary bottle can be used. In such a bottle *twice* the usual amount of milk and acid are taken and the column of fat, being double in length, can be read with greater accuracy. Each division on the scale of this bottle corresponds to 0.1 per cent. Another bottle known as the Ohlsson or "B & W" test bottle has recently been devised for testing very small percentages of fat. This bottle has two necks, the larger of which is to admit the milk to the bottle, and the smaller is a very fine tube in which the fat is measured. As claimed by the inventor, one can easily read 0.01 per cent on the tube, if it were desirable to do so. Inasmuch, however, as it is impossible to estimate to much less than 0.1 per cent by the Babcock test it is hardly worth while to read so fine as .01 per cent.

By exercising very great care the writer has been able to obtain results with this bottle that compare very well with the gravimetric method down to .05 per cent. In order to do this the following precautions must be observed: The bottle must be perfectly clean, otherwise small particles of fat will adhere to the walls and not be removed by the centrifugal force. Twenty cubic centimeters of sulfuric acid, specific gravity 1.82, must be used, and the milk warmed to about 70° F. before the acid is added. The machine must run 5 minutes at about 1,000 revolutions per minute, and the bottles be kept at a uniform temperature, either by steam or hot water, during the time. The reading of the scale should be taken immediately after the whirling is completed and before the neck of the bottle gets cold, otherwise some of the fat will adhere to its walls and be lost.

This bottle is quite delicate in structure and therefore easily broken, and should only be used by persons who have had considerable experience in handling glassware.

TESTING CREAM.

Cream is a little more difficult to accurately test than milk. The chief reason for this is that it contains a much higher percentage of butter fat, and an error in sampling or measuring out the portion for the test makes a greater difference in the result. It also has a greater consistency than milk and is more liable to froth when given the mixing necessary to make it homogeneous. Cream that is frothing cannot be accurately measured in a pipette, because the air bubbles occupy space that should be filled with cream.

The Original Method of Testing Cream. Sweet cream, such as is ordinarily obtained from the cold deep setting process of raising, can be tested without difficulty by practically the same method as that which is given for milk on pages 66-69, the only modifications necessary being in the bottles and pipettes used.

Test Bottles. Two styles of test bottles adapted to this purpose are in general use. One, a bottle designed at this Station for testing both cream and milk, and described in Bulletin No. 3, Second Series (fig. 2, page 62) has a long, small neck with a bulb and a scale reading from 0 to 25 per cent. The other is the so-called Connecticut Station bottle, described in Bulletin 117 of that Station. This bottle is similar to a milk bottle except that it has a wide neck with a scale reading from 0 to 30 per cent.

A new bottle, which the writer prefers for testing cream, was described in Bulletin 31 of this Station. While this bottle can be used in the same way as the other cream bottles, it is particularly designed for use in the modified method. The bottle and a way to use it are described on pages 78-79.

Pipettes. The pipette used for cream is practically the same as the one used for milk, except that it is graduated to hold 18 instead of 17.6 cubic centimeters. A cubic centimeter pipette is also very convenient in handling thick cream.

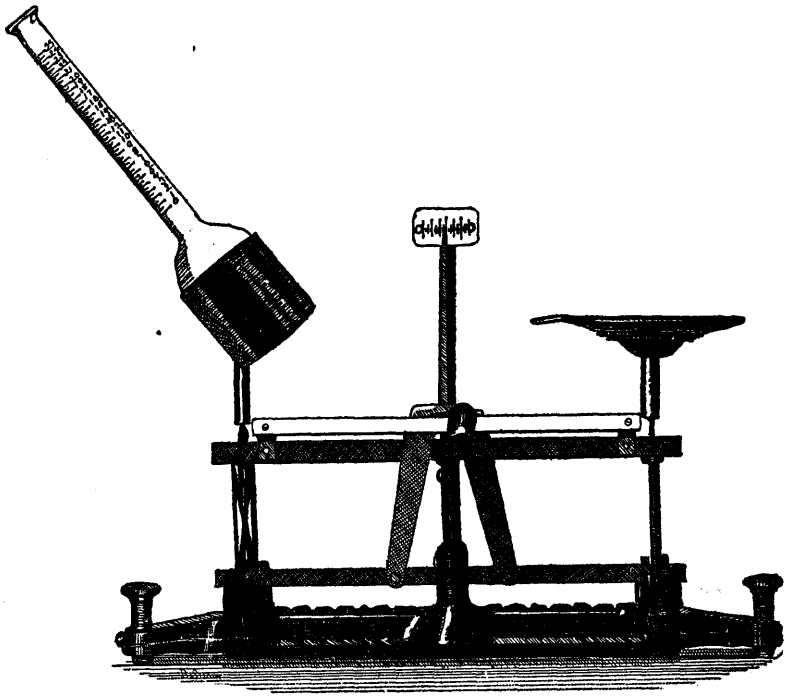


FIG. 7.

Scale for Weighing. As has already been stated, sweet cream that is not frothing and does not contain over 25 per cent of butter fat can be accurately measured with a pipette. If, however, the cream is sour and thick, as will sometimes happen, it cannot be tested without considerable trouble. It can be gotten into condition by means of caustic soda and heat, as recommended on page 66, but if it is simply broken up by shaking, it will contain many air bubbles and cannot be measured correctly. Thick separator cream is seldom in condition to measure with any degree of accuracy, and if it is very rich, an error as great as 10 to 15 per cent of the total fat may be made.

The only accurate method to pursue in such cases is to weigh the cream, and this can be very easily done by any one who has skill enough to make the test. The balance or scale recommended is shown in the above cut, and was designed by the Springer Torsion Balance Company especially for this purpose from suggestions made by the writer. The peculiar feature of the Torsion Balance is, that it has no knife edges, the beam and pan being supported on flat spring steel wires. Knife edges become dulled by wear or corrosion, consequently a knife edge balance, in constant use, loses its sensitiveness quite rapidly.

The manufacturers of the Torsion Balance claim that their balances do not become less delicate by use, but retain their original sensitiveness until worn out. This claim seems to be well supported, not only from the nature of their construction but by practical tests. For this reason a scale of this construction was selected, and the one shown in the cut was used successfully by the dairy students the past winter. It is about 10 inches long and 7 inches high, and although delicate enough to weigh accurately to .05 gram, is quite strong and durable. The left hand pan is provided with a support for the bottle, and the right hand pan is used for a counterpoise and weights. A side beam on which slides a light counterpoise to be used in balancing the bottles greatly facilitates this part of the process. A heavier counterpoise, equal in weight to the lightest bottle one uses, can be kept constantly on the right hand pan. This counterpoise can be made of small shot or a piece of any metal of convenient size. Above the middle of the beam is a graduated scale to which points an indicator that shows very plainly when the balance is in equilibrium. Two brass weights are provided, one weighing 9 grams and one 18 grams. It will be noticed that the bottle sets in an oblique position so that the top of the neck is not directly over the pan, thereby decreasing very much the liability of dropping cream on the pan or bottle when running it in.

The scale if properly used will be very durable. Of course, it is, necessarily, a somewhat delicate piece of apparatus and cannot be handled as roughly as a grocer's scale without injury; but with reasonable care and protection from moisture when not in use, it will last many years. There is a device at the bottom of the scale for locking the pans to prevent them from vibrating when not in use. It is very essential for the good of the balance that these be locked and not allowed to rest on the bearings when set aside.

Method of using the Scale or Balance. First place the scale on a firm, level shelf or table that does not shake or jar, with the beam to the front, and the pan with the support for the bottle on the left. Slide the counterpoise on the beam to the extreme left and put the counterpoise weight, which is about equal to the weight of the lightest bottle used, on the right hand pan and the bottle to be weighed on the left. Unlock the pans by turning up the lever on the left hand end at the bottom to a perpendicular position. Now slide the counterpoise on the beam slowly to the right until the scale balances, as shown by the indicator above vibrating equally each side of the middle division of the lines to which it points. After the bottle is counterpoised, put the 18 gram weight on the right pan, fill the pipette with the cream to be tested a little above the 18 cubic centimeter mark, and hold it so the nozzle just clears the neck of the bottle at the opening, and allow the cream to run in. When the pipette is nearly empty, the flow is checked by pressing the finger over the opening at the top until the cream drops slowly. Now watch the scale closely, and when the last drop makes the indicator vibrate, or shows that the cream balances the weight, the pipette is removed. If by accident too much is run in, a little can be sucked up with the pipette or turned from the bottle, and then enough dropped in to balance the weight.

Another convenient method of putting in the cream is to balance the bottle, then remove it from the scale pan and measure in 18 cubic centimeters of the cream, return the bottle to the pan and add enough more cream, drop by drop, to balance the 18 gram weight.

After a little practice one can do this very skillfully, and nearly as rapidly as he can measure. When cream contains more than 25 per cent of fat, use the 9 gram weight instead of the 18, and multiply the result by 2. When 9 grams are taken, 9 cubic centimeters of water must be added and the usual amount of acid. If, by chance, any cream is dropped on the pan or outside of the bottle, it must be wiped off before the weight is taken. No two bottles weigh the same and each must be counterpoised before cream is put in it.

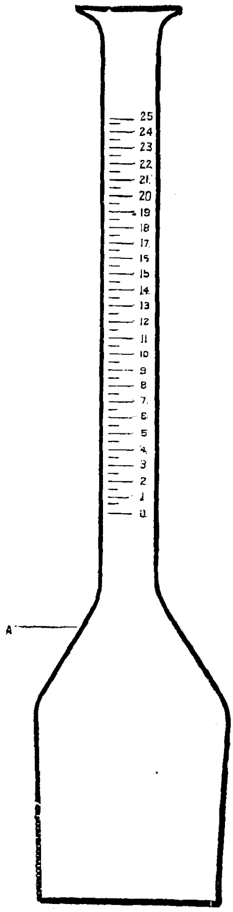


FIG. 8.

The modified method of cream testing. *The test bottle.* (Fig. 8.) This is similar to the regular milk bottle, except that the base portion is made of such size as to avoid using an acid measure. The base is made to hold 38 to 40 cubic centimeters up to the neck and after the cream is measured in, the required amount of acid can be added by filling the bottle nearly to the neck or to the point A shown in the cut. The neck portion is large enough to carry 25 per cent of fat and is graduated to one-half of one per cent and can be easily read to one-quarter of one per cent. Each per cent is numbered. Although one cannot read so closely with this as with the bulb neck bottle shown on page 62, fig. 2, which was designed to test both milk and cream, one can read fine enough for all practical purposes. On account of the neck being larger and shorter, this bottle is more easily cleaned than either of the older forms; it is less liable to breakage, and by using the method given for milk on pages 70-72 a test can be made more rapidly. Twenty-five per cent was fixed upon as the capacity of the neck, for the reason that a much higher percentage necessitates an increase in diameter, which impairs the accuracy in reading and again, nearly all cream shipped to the creameries is raised by the cold deep setting process and seldom contains more than 20 per cent of fat. If one wishes to test separator cream that is very rich, 9 cubic centimeters or 9 grams of the cream can be taken instead of 18, 9 cubic centimeters of water added and the usual amount of acid. The reading obtained in that case, of course, should be multiplied by 2 to give the correct per cent.

Method of using Bottle. Measure 18 cubic centimeters or weigh 18 grams of the thoroughly mixed cream, carrying not more than 25 per cent of fat, into the bottle. Heat it to about 70° F., if not already at that temperature, then fill the bottle up nearly to the base of the neck (point A, fig. 8) with sulfuric acid, specific gravity 1.82. The acid can be handled in a sharp-nosed pitcher or run in from a syphon affixed to a carboy. Mix the acid and cream together thoroughly, which is best done by grasping the neck with the hand, pressing the thumb tightly over the opening and then giving the bottle a rotary motion, holding it upright all the time. The confined air prevents the curd from coming up and sticking to the sides of the neck. The mixing is just as easily done in this as in the old style bottle. The remainder of the process is conducted exactly the same as in testing milk, described on pages 70-72.

If the above directions are followed, a perfectly clear separation will be obtained, with a considerable saving of time over the old method, as only one pouring of the acid and one whirling of the machine are made. The precautions given on page 72 under "Testing Milk" apply also to cream.

APPLICATION OF THE TEST.

The test is applicable to all problems involving a knowledge of the content of butter fat in dairy products. In the pages which follow, the most important uses of the method are pointed out.

THE TEST APPLIED TO THE FARM.

The Babcock test may well be said to be invaluable to the farmer, as it gives him a simple and accurate method of testing his cows with much less labor than was required by the old method, with the churn. By its use he can weed out his poor and unprofitable animals, which are eating up the profits of the good cows. Every farmer keeping five or more cows should have access to a tester.

How to Test a Cow. Milk the cow thoroughly dry at the usual hour. A pail sufficiently large to hold the entire amount of milk given should be used. After the milking is completed, mix the milk thoroughly by turning it two or three times from one pail to another, then immediately take out the sample to be tested. Testing a single milking, however, shows only whether the cow is giving very rich or very poor milk, and does not furnish an accurate knowledge of the quality of her product, for the reason that the percentage of fat is subject to considerable variation from day to day.

To get a reliable result, at least 6 consecutive milkings should be tested. This is most easily done by making a composite sample as follows. After the milk is drawn from the udder, turn it into a deep and narrow can or pail, then lower the sampling tube, described on page 65 and take out one tube full. Have at hand a half pint fruit jar labeled with the cow's name or number, and run the contents of the tube into it, closing the jar tightly to prevent evaporation. Proceed in the same manner each time for 6 consecutive milkings. Care must be used to lower the sampling tube with the lower end open to the bottom of the pail, so as to secure a column of milk that will represent the whole. By this method a proportional part of each milking is taken and a very accurate sample obtained.* A small piece of bichromate of potash, about the size of a pea bean, should be put in the jar and dissolved in the milk, to prevent its souring in warm weather. After the last tube full has been put in the jar and the whole thoroughly mixed, the composite sample is complete and can be tested. The percentage of fat found will be a fair representation of the quality of milk the cow is giving.

If one wishes to learn the true value of a cow as a butter producer, it is necessary to know the quantity of butter fat given. This can be estimated approximately by testing the cow every two or three months and keeping a record of the number of pounds of milk she gives. To get an accurate result, the milk should be tested each month, for as the period of lactation advances, the quantity of milk *decreases,* while the percentage of fat *increases.* With a fat test of the composite sample and a record of the number of pounds of milk given for each month, the total fat yield is very simply calculated by multiplying the per cent of fat found by the number of pounds of milk for that month. The yield for the whole year will be the sum of these monthly products. If several cows are being tested, a sample jar, properly labeled, should be supplied for each one.

A very convenient form of keeping records is shown on page 82, and explains itself. Fools-cap paper can be ruled off to

* In the absence of a sampling tube the sample can be obtained by pouring the freshly drawn milk from one vessel to another three or four times and quickly dipping up a small cup or ladle full, and pouring this into the jar.

answer the purpose at very little expense. One space is allowed for each day's milk, the weight of the morning's milk being put in the upper part of the space and the weight of the night's milk in the lower part.

The Vermont Experiment Station has made a special study of the question at what times in the period of lactation a cow should be tested to give a fairly accurate idea of the whole year's yield, by making one or two tests. The results obtained indicate that the first test for spring cows should be made about 6 weeks after calving, summer cows, 8 weeks after calving, and fall cows 8 to 10 weeks after calving. The second test should be made about 6 to 7 months after calving. Composite samples of 4 days' milk should be used for these tests. To find the quantity given, weigh the milk for 4 days in the middle of each month during the period of lactation. These weights will give a very close average for the months in which they are taken. The average of all the weights obtained multiplied by the number of months the cow is giving milk will give the total yield. This product multiplied by the average per cent of fat found will give the total yield of butter fat.

APPLICATION OF THE TEST TO SEPARATOR BUTTER FACTORIES.

Although it is quite generally admitted that the quality as well as quantity of milk delivered, should be considered in making dividends in factories where milk is pooled, many who recognize the justice of the relative value plan hesitate to adopt it, on account of the labor and expense involved in making daily tests from each patron's milk. The best plan yet proposed for reducing the expense of the necessary tests is that of the composite sample first described by Professor Patrick.*

* Bulletin 9, Iowa Agricultural Experiment Station, 1890.

MILK RECORD

FOR THE MONTH OF ...., 1898.

Day.	Cow's Number. 1	2	3	4	5	6	7	8	9	10
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
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20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
Total										
Fat per cent										
Total fat										

In buying milk on this plan it is necessary that care should be taken to get correct samples. A pint or quart fruit jar should be provided for each patron and labeled with his name or number, if one has been assigned him. Into this put a small quantity, as much as one can hold on one-half inch of a pen knife blade, of the preservative, powered bichromate of potash. A measured portion of every lot of milk furnished by a patron should be taken and put in the jar bearing his number. The milk should first be thoroughly mixed by stirring or pouring from one can to another, and the sample taken immediately The sampling tube described on page 65 is the best instrument for this purpose and should always be used.

Whenever a fresh portion of milk is placed in the jar, it should be mixed with milk previously added by giving the jar a rotary motion. The jars should always be closed tightly to avoid evaporation and kept in a cool place. At the end of two weeks, or as often as one desires, the composite samples are tested. The percentages of butter fat found represent the average composition of each patron's milk for that time, and the product obtained by multiplying these percentages by the respective number of pounds of milk furnished will give the number of pounds of butter fat furnished.

THE TEST APPLIED TO GATHERED CREAM BUTTER FACTORIES.

When the Babcock test was first introduced, the butter factories of this State were nearly all buying cream by the inch and paying a uniform price, regardless of its quality. The defects and injustice of that system were, even then, realized at some factories, and those in charge did not hesitate to say that a change must be made or the business discontinued. For this reason the Station recommended the use of the Babcock test, believing that it offered a practicable and accurate method of determining the actual butter value of cream. Nearly all of the creameries in the State have adopted this system and are paying for cream on the basis of the butter fat it contains.

Causes which affect the quality of cream. Cream for butter making is only valuable in proportion to the amount of butter fat it contains, and there are many factors in raising cream by the gravity process which have a decided influence on its fat content. Much of the dissatisfaction among the patrons of creameries comes from a lack of understanding of the conditions that affect the quality of cream.

The temperature at which the milk is set has a very marked effect on the quality of the cream produced. Cream from the same herd of cows will vary in butter fat as the temperature of the water in which the cans are submerged changes. If the milk is kept at a temperature of about 35° F., instead of 45° F., the cream will often drop 4 or 5 per cent in butter fat. This explains the fact that cream frequently tests lower in very cold weather than in warm weather. The volume increases correspondingly, so there is no loss of butter fat. If the water in the creamer is allowed to become warmer than 45° F. the cream becomes proportionately richer. Keeping the milk at a temperature of 65° F. or 70° F. will cause an increase of 10 or 15 per cent of butter fat in the cream, while the volume of the cream decreases. This latter temperature is objectionable because the separation is not so complete and more fat is left in the skimmed milk than when the lower temperature is used.

To make cream at all uniform in composition it is necessary to use the greatest care in handling and setting the milk. The water must be kept at an even temperature, the milk set immediately after being drawn, and the intervening time between setting and skimming the milk be the same. Cream raised by setting the milk 12 hours is not as rich as cream obtained from milk set 24 hours.

It seems hardly necessary to mention that the amount of skimmed milk drawn off with the cream affects its quality. It should be apparent to every one that increasing its bulk with skimmed milk decreases proportionately its per cent of butter fat. Only the best methods of skimming should be employed. The old method of dipping the cream from the top of the milk is wasteful and should not be practiced. The best method is to draw the skimmed milk off by a faucet at the bottom of the can, and about one inch of skimmed milk should always be left under the cream, as drawing closer than that endangers loss of fat.

The above facts will account for most of the variations in the fat content of cream and show how necessary it is to sample each lot of cream collected in order that the composite sample shall fairly represent the whole. Little dependence can be put on the test of a single lot of cream as representing the percentage of fat contained in the cream furnished for a month or any given time, and patrons have a right to demand that a sample of each lot of cream collected shall be taken and tested by itself or made a part of a composite sample.

When the test was first introduced, an attempt was made to continue the inch system of measuring the cream, but that involved too much work and when the space pail was brought out by an enterprising dealer, it was quite generally adopted. This pail has a scale so made that the product obtained by multiplying the number of spaces of cream by the percentage of fat it contains, gives approximately the number of pounds of butter containing 85 per cent of butter fat. This space pail furnished a method which was a great improvement over the inch system and has served a valuable purpose in the creamery business.

At one time there were at least three systems of buying and paying for cream by the test in use in this State and it was not surprising that there was considerable confusion and distrust among farmers. Recognizing the necessity of uniformity in this work, the Station issued a bulletin in 1894 advocating weighing instead of measuring cream. The method of weighing is believed to be simpler, more accurate and just as convenient as measuring.

Sampling the Cream. If it were practicable, it would be much better to have each patron's cream brought to the factory by itself; then the one who operates the test could see that a correct sample is taken and the butter maker could inspect its quality for butter making. As most of the creameries at the present time are not able to adopt this plan, a method is here given by which the collector takes the sample.

The man who does this work should be reliable and thoroughly instructed in taking the sample before he starts out. Too much care cannot be used in this part of the work. Correct sampling is a matter of dollars and cents to the farmer and success or failure to the creamery, for no enterprise can expect to succeed for any length of time, unless justice is done to all parties concerned. It is for this reason that the employment of cheap labor for collecting, and letting the cream routes to the lowest bidder, regardless of his qualifications, are to be condemned. The law requires the operator of the test to understand his part of the work. It is equally important that the collector should have a thorough knowledge of sampling. If the sample is taken carefully with the tube, as directed on page 87, it will be done correctly; but if the collector is in a hurry and carelessly lets the tube drop down closed or quickly, so that it fills from the bottom, or takes his sample from but one can when there are several, the sample may be far from correct. It may seem that correct sampling takes a good deal of time, but as a matter of fact it takes but little more time than it does to do the work improperly. As success or failure of the business may depend upon the results obtained, it is imperative that the work be properly done. The patrons of a creamery are much given to decrying the test when the results do not suit them, but it is safe to say that in nearly every case the discrepancies are due to other causes than errors in testing, and very often to sampling, which is within the control of the patron. Let every patron who is not satisfied get a tester himself or in combination with his neighbors, and sample and test his own cream. It would take but little time and perhaps be dollars in his pocket.

Collector's Apparatus for Sampling and Weighing Cream. Pail for Weighing. For this purpose a light pail not more than 9 or 10 inches in diameter and 18 to 20 inches deep, having a strong bail, a lip or nose on the top and handle near the bottom to assist in emptying, is recommended. It should be made of light material and strengthened at the top by a hoop, to avoid denting when being emptied. Such a pail holds 50 pounds of cream, which is as much as a collector cares to handle at once.

Scales for Weighing. There are several spring scales on the market that doubtless are good for this purpose, but the best we have seen is a Chatillon dial spring scale with an adjustable tare, that will weigh up to 60 pounds by tenths. These scales are very convenient and are sufficiently accurate with light weights for this work; but are reported by some who have used them, not to be very accurate when loaded to near their full capacity. Of course all spring scales deteriorate quite rapidly in constant use. A more durable, accurate, and nearly as convenient scale is the so-called " market scale," which is provided with an iron crane, a single beam, brass sliding counterpoise and brass weights. This scale can be attached to an upright post on the cream wagon in the same manner that it is attached to the market wagon. The weighing pan with which they are equipped, can be replaced by the collector's pail properly counterpoised. These scales range in capacity from 50 to 125 pounds; one to carry 100 pounds would answer the purpose of most creameries. It is much more convenient, in making calculations, to have the scale weigh to tenths of a pound than to ounces.

Bottle for Carrying the Sample. A two-ounce, wide mouthed bottle, made of strong glass or preferably, white metal, and provided with a cork stopper is used. A case should be provided for these bottles with pockets to prevent them from rattling around, and a closely fitting cover to protect them from cold in winter. Each bottle should be marked with the number of the patron for whom it is to be used.

Preservative. Bichromate of potash is recommended for this purpose. After the sampling bottles are thoroughly cleaned with hot water and washing soda, a small amount, just enough to give the cream a light yellow color, of the finely powdered bichromate of potash should be put in each bottle before starting out to collect cream. If the cream is sweet when sampled and well shaken up after being put in the bottle, so as to dissolve and thoroughly mix the powder, it will keep sweet four weeks if kept in a cool place. Too much bichromate interferes with the test. Formalin is now being quite generally used as a preservative of milk and will possibly be found more convenient than bichromate, but the writer has not yet had sufficient experience with the material to warrant recommending it.

Manipulation. After the cream has been turned into the weighing pail, the sample is taken by letting the open sampling tube, described on page 65, slowly to the bottom of the pail. The opening is then closed, the tube taken out, allowed to drain a moment and the contents run into the bottle marked with the patron's number. In order to obtain a fair sample, the tube must be let down slowly with the end open so it will fill as it goes down. If the tube is let down quickly, or with the end closed, and then allowed to fill from the bottom of the pail, it is possible to get a sample much less rich in fat than the top would yield. If there is more than one pail of cream, a portion should be taken from each lot weighed out. If a tube full from every pailful more than fills the sample bottle, then all the portions drawn should be mixed in a dish large enough to hold them, and the bottle filled from the mixture. In any case, enough should be taken to fill the sample bottle to prevent churning on the road.

Cream that is sour should not be sampled, as it is impossible for a collector to get a fair sample of it in any reasonable length of time. If it has become thick, it cannot be easily mixed by the collector so it will be uniform, and cannot be sampled with the tube. Creamery managers should insist that patrons keep their cream sweet until it is taken by the collector. This is essential not only to correct sampling, but to make a good quality of butter.

Composite Sample. The composite sample is made up from the small samples taken by the collector and is the one from which the portion is taken for the test. Pint fruit jars are good receptacles in which to put these samples, and each one should be numbered with the patron's number, the same as the small bottles used by the collector.

The small samples are taken every time the cream is collected according to the directions previously given, and as soon as they arrive at the factory they are emptied into the fruit jars having corresponding numbers. The jar should be closed tightly to prevent evaporation. These accumulated small samples constitute the composite sample, and the per cent of butter fat found in this sample, will be the average per cent in all the cream furnished by the patron having that number for the period. A test can be made once in four weeks or oftener.

Valuing Cream. When cream is bought by weight, according to the plan previously outlined, valuing it or fixing the price of each patron's product is very easily accomplished. Each lot collected is weighed and sampled. The weight is recorded and the sample goes to make up the composite sample previously described. At the end of the month the sum of the weights found credited to any one patron shows the number of pounds of cream he has furnished, and the per cent of fat found in his composite sample shows the average per cent of fat in his cream for that month. Then the product of the number of pounds of cream furnished multiplied by the per cent of fat it contains will be the number of pounds of butter fat he has supplied. The money value of the cream will be the product of the number of pounds of butter fat multiplied by the price per pound. For example, suppose A furnishes 350 pounds of cream for the month. His composite sample tests 18 per cent fat and the price paid for fat is 23 cents. Then A will receive $350 \times .18 \times .23 = \$14.49$ for his month's cream.

Pay for fat and not butter. From the preceding calculations we see that when a price is fixed for butter fat, finding the value of a patron's cream is a very simple process, easily understood, and for this reason recommends itself to every one. It is much simpler than the common practice of calculating the fat over into butter, for that has to be done for every patron in the creamery, while the price for butter fat is calculated but once for all the patrons for any one month and can be used as a common factor in calculating the value of each man's cream.

How to fix the price of butter fat. In a co-operative creamery this is as simple a matter, when the cream is bought by the test, as it is to fix the price of butter. The manager learns from his books the gross income from sales of butter and cream for the month and deducts therefrom the expense of the factory to find the amount of net profits to divide among the patrons. He also has a record of the number of pounds of butter fat received. To find the price per pound to be paid patrons, he simply divides the number of dollars to be paid by the number of pounds of butter fat furnished. For example, suppose the factory has \$330 to divide among its patrons for one month's dividends for which it has received 1,500 pounds of butter fat, then $\$330.00 \div 1{,}500 = \$0.22$, the price of butter fat for that month.

It sometimes becomes necessary, especially when cream is bought from the patrons and the creamery is non co-operative, to value it on a basis of the market price of commercial butter. Hardly two lots of butter will contain the same amount of fat, so a fair average percentage must be taken. A really good butter to stand up well in all kinds of weather, should contain about 85 per cent of fat, and that is the factor usually made use of. Therefore we assume that a pound of commercial butter contains .85 of a pound of fat, consequently to find the price of butter fat the market price of butter is divided by .85. For example, if butter is 20 cents per pound, then $.20 \div .85 = 23.5$ cents, the price per pound of fat.

The system of apportioning dividends to patrons just described, namely, weighing the cream and fixing a price for butter fat, seems to be the simplest and best yet suggested. It is the method which is in general use in milk gathering factories in the West and in the gathered cream creameries of Massachusetts and Connecticut, and there seems to be no good reason why the creameries of Maine should not universally adopt it. The sooner this is done the sooner will the patrons understand the methods of the creameries and gain confidence in their management, but as long as several methods are in use, nothing but confusion and distrust can be expected. A few creameries in the State have already adopted and are using this method satisfactorily.

TESTING BUTTER.

Butter is the most difficult of all dairy products to test accurately for fat. The writer, however, has had fairly good success by the following method. A bottle with a separable neck, similar to the cream bottle No. 3, described in Bulletin 3 of this Station, is used. The neck is a tube enlarged in the middle like a pipette and having a total length of about 10 inches. Above and below the enlarged portion, the tube is about the size of the neck of the milk bottle and graduated the same, the scale reading on the lower part being 0 to 10 per cent and on the upper 80 to 90 per cent of fat.

Method of Making the Test. Put the base portion of the bottle on the scale and counterpoise it as directed in weighing cream. About a half pound of the butter to be tested is put in a bottle or small fruit jar and placed in water heated to 110° to 120° F. until the butter is all melted. It is then taken and shaken vigorously for a minute and the 18 cubic centimeter pipette filled immediately, before the salt and water have a chance to settle to the bottom of the jar. The contents of the pipette is then run into the bottle, the jar shaken again and more butter taken up and run drop by drop into the bottle until the scale turns. Remove the bottle from the scale and add 9 cubic centimeters of hot water and 10 cubic centimeters of sulfuric acid, (1.82 specific gravity), mix thoroughly, place in the centrifugal machine and whirl a few minutes at usual rate. Then take the bottle from the machine, connect the neck by a piece of rubber tubing and stand the whole in a tank of water heated to 110° to 120° F., sufficiently deep to allow the water to come up to near the 90 per cent mark. Now fill the bottle to near the 87 per cent mark with hot water and let it stand several minutes before reading. The reading is taken the same as on the milk or cream bottles.

TESTING CHEESE.

How to take the Sample. Where the cheese can be cut, a narrow wedge reaching from the edge to the centre of the cheese will more nearly represent the average composition of the cheese than any other sample. This may be chopped quite fine, with care to avoid the evaporation of water, and the portion for analysis taken from the mixed mass.

When the sample is taken with a cheese tryer, a plug taken perpendicular to the surface, one-third of the distance from the edge to the centre of the cheese, should more nearly represent the average composition than any other. The plug should either reach entirely through or only half through the cheese. For inspection purposes the rind may be rejected, but for investigations where the absolute quantity of fat in the cheese is required, the rind should be included in the sample. It is well when admissible, to take two or three plugs on different sides of the cheese, and after splitting them lengthwise with a sharp knife take portions of each for the test.

Making the Test. For the estimation of fat in cheese, 6 grams should be carefully weighed out in a cream test bottle. Twelve cubic centimeters of hot water is then added, and the bottle shaken at intervals, keeping it warm, until the cheese has become softened, and converted into a creamy emulsion. This may be greatly facilitated by the addition of a few drops of strong ammonia to the contents of the bottle. After the contents of the bottle have become cold, the usual amount of acid should be added and the bottles shaken until the lumps of cheese have entirely dissolved. The bottles are then placed in the machine and whirled, the test being completed in the same manner as with milk. To obtain the per cent of fat, the reading should be multiplied by three.

TESTING CONDENSED MILK.

The estimation of fat in condensed milk is accomplished in exactly the same way as with cream. As a rule, condensed milks are so thick that it is impracticable to measure the test sample directly with a pipette. This difficulty may be overcome by carefully diluting the milk with a known volume of water, making the analysis of this and correcting the result for the quantity of water added. The best method is to weigh the sample into a test bottle, taking about 9 grams, and after adding about 9 cubic centimeters of water completing the test in the same manner as with milk, the per cent of fat being obtained by multiplying the reading by two. The results are satisfactory.

THE LACTOMETER AND FAT TEST FOR DETECTION OF ADULTERATED MILK.

The most common adulterations are the removing of cream and the addition of water. By determining the fat and the solids not fat, either or both of these adulterations are easily detected.

In many states legal standards for fat and solids not fat have been established in order to protect the public against fraud. In some states the required standard is 3 per cent fat, in others 3.5 per cent and solids not fat about 9 per cent. Milk from a good sized herd varies but little from day to day. Milk from a single cow may vary quite widely in fat, but from a herd will seldom vary more than 0.2 or 0.3 per cent, and solids not fat even less.

It is rather difficult to fix any standard, so great is the variation in different animals, but it is very rare that the mixed milk from a large herd at any season of the year will fall below

12 per cent total solids, unless it has been diluted. Milk containing less than 9 per cent solids not fat is suspicious, and a sample containing much less than 8.5 is probably watered. When a standard is adopted, the only course to pursue is to consider all milk falling below this standard adulterated. If the milk is not up to the standard, it matters not whether it is from poor cows or is diluted after milking, the results are the same.

It is necessary, therefore, in order to detect adulteration to determine both the fat and the other solids. For the determination of the former, one has recourse to the Babcock test, and the solids not fat can be quite readily and accurately estimated (from the specific gravity and per cent of fat) by means of a formula. The specific gravity of whole milk at 60° F. varies from 1.030 to 1.034. This means that when a certain volume of distilled water at 60° F. weighs just 1,000 pounds the same volume of milk will weigh 1,030 to 1,034 pounds.

The solids not fat, namely, the casein, albumin, milk sugar and mineral matter, are constituents of milk that are heavier than water and therefore cause its greater weight. On the other hand the fat is lighter, consequently the abstraction of fat increases the specific gravity, and the addition of water decreases the specific gravity, so one can readily tell by these two tests whether the milk has been skimmed or diluted with water. For example, suppose a sample of whole milk contains 4.2 per cent fat, and has a specific gravity of 1.032. If this milk were diluted one-half with water, it would contain 2.1 per cent fat and have a specific gravity of about 1.016, while if it were partially skimmed to contain about 2.1 per cent fat its specific gravity would be increased to about 1.0345.

The Lactometer. The lactometer is an instrument for taking specific gravity and is sufficiently accurate for practical purposes. There are several kinds in use at the present time, all of which are made on the same general principle, viz.: A narrow stem attached to an elongated bulb, weighted at the bottom so that it will maintain an upright position when floating in the milk, with the stem, which is graduated, partially submerged. The mark on the stem to which it sinks shows the specific gravity. The instrument for which the formula and table are constructed is the Quevenne lactometer. The scale on the stem expresses in thousandths the weight of the liquid in which it is placed as compared with water. The graduations are usually from 15 to 40. To illustrate, milk having a specific gravity of 1.032 would give a reading of 32 on the lactometer and one having a specific gravity of 1.025 would give a reading of 25.

Method of Making the Test. To take the specific gravity with the lactometer it is necessary (1) that milk be free from air bubbles, and in order to insure this it should stand at least one-half hour after being drawn; (2) that it should be thoroughly mixed by pouring from one vessel to another, avoiding any violent motions that would be likely to collect air bubbles, then brought to the proper temperature, 60° F., placed in a vessel of sufficient depth and diameter to allow the lactometer to float freely, and the mark on the stem to which the instrument sinks read. The lactometer can easily be read to half spaces when it is necessary to be quite accurate. In case it is not convenient to bring the milk to the temperature of 60° F., a correction may be made, where the variation is not more than 10°, by adding to the lactometer reading 0.1 for each degree the temperature exceeds 60, and substracting 0.1 for each degree below 60. For example, a lactometer reading of 32 at 65° F., corrected, would read 32.5; at 55° F., corrected, 31.5.

After finding the per cent of fat, and taking the lactometer reading, the per cent of solids not fat may be found by the table given on page 95. Find the per cent of fat in one of the side vertical columns, and the lactometer reading at the top of the table in the line of figures marked lactometer reading, then look down the column of figures directly under the lactometer reading till on line with the per cent of fat, and the figures found at this point will be the per cent of solids not fat in milk.

For example, suppose the per cent of fat is 4.5 and the lactometer reading is 32, then the per cent of solids not fat will be 8.92. Suppose the lactometer reads 33 instead of 32 in the above example, then the per cent of solids not fat would be 9.17. The per cent of solids not fat added to the per cent of fat gives total solids.

Per cent of fat.	Quevenne Lactometer Readings at 60° F.											Per cent of fat.
	26	27	28	29	30	31	32	33	34	35	36	
1.0	6.70	6.95	7.20	7.45	7.70	7.95	8.20	8.45	8.70	8.95	9.20	1.0
1.1	6.72	6.97	7.22	7.47	7.72	7.97	8.22	8.47	8.72	8.97	9.22	1.1
1.2	6.74	6.99	7.24	7.49	7.74	7.99	8.24	8.49	8.74	8.99	9.24	1.2
1.3	6.76	7.01	7.26	7.51	7.76	8.01	8.26	8.51	8.76	9.01	9.26	1.3
1.4	6.78	7.03	7.28	7.53	7.78	8.03	8.28	8.53	8.78	9.03	9.28	1.4
1.5	6.80	7.05	7.30	7.55	7.80	8.05	8.30	8.55	8.80	9.05	9.30	1.5
1.6	6.82	7.07	7.32	7.57	7.82	8.07	8.32	8.57	8.82	9.07	9.32	1.6
1.7	6.84	7.09	7.34	7.59	7.84	8.09	8.34	8.59	8.84	9.09	9.34	1.7
1.8	6.86	7.11	7.36	7.61	7.86	8.11	8.36	8.61	8.86	9.11	9.37	1.8
1.9	6.88	7.13	7.38	7.63	7.88	8.13	8.38	8.63	8.88	9.13	9.39	1.9
2.0	6.90	7.15	7.40	7.65	7.90	8.15	8.40	8.66	8.91	9.15	9.41	2.0
2.1	6.92	7.17	7.42	7.67	7.92	8.17	8.42	8.68	8.93	9.18	9.43	2.1
2.2	6.94	7.19	7.44	7.69	7.94	8.19	8.44	8.70	8.95	9.20	9.45	2.2
2.3	6.96	7.21	7.46	7.71	7.96	8.21	8.46	8.72	8.97	9.22	9.47	2.3
2.4	6.98	7.23	7.48	7.73	7.98	8.23	8.48	8.74	8.99	9.24	9.49	2.4
2.5	7.00	7.25	7.50	7.75	8.00	8.25	8.50	8.76	9.01	9.26	9.51	2.5
2.6	7.02	7.27	7.52	7.77	8.02	8.27	8.52	8.78	9.03	9.28	9.53	2.6
2.7	7.04	7.29	7.54	7.79	8.04	8.29	8.54	8.80	9.05	9.30	9.55	2.7
2.8	7.06	7.31	7.56	7.81	8.06	8.31	8.57	8.82	9.07	9.32	9.57	2.8
2.9	7.08	7.33	7.58	7.83	8.08	8.33	8 59	8.84	9.09	9.34	9.59	2.9
3.0	7.10	7.35	7.60	7.85	8.10	8.36	8.61	8.86	9.11	9.36	9.61	3.0
3.1	7.12	7.37	7.62	7.87	8.13	8.38	8.63	8.88	9.13	9.38	9.64	3.1
3.2	7.14	7.39	7.64	7.89	8.15	8.40	8.65	8.90	9.15	9.41	9.66	3.2
3.3	7.16	7.41	7.66	7.92	8.17	8.42	8.67	8.92	9.18	9.43	9.68	3.3
3.4	7.18	7.43	7.69	7.94	8.19	8.44	8.69	8.94	9.20	9.45	9.70	3.4
3.5	7.20	7.45	7.71	7.96	8.21	8.46	8.71	8.96	9.22	9.47	9.72	3.5
3.6	7.22	7.48	7.73	7.98	8.23	8.48	8.73	8.98	9.24	9.49	9.74	3.6
3.7	7.24	7.50	7.75	8.00	8.25	8.50	8.75	9.00	9.26	9.51	9.76	3.7
3.8	7.26	7.52	7.77	8.02	8.27	8.52	8.77	9.02	9.28	9.53	9.78	3.8
3.9	7.28	7.54	7.79	8.04	8.29	8.54	8.79	9.04	9.30	9.55	9.80	3.9
4.0	7.30	7.56	7.81	8.06	8.31	8.56	8.81	9.06	9.32	9.57	9.83	4.0
4.1	7.32	7.58	7.83	8.08	8.33	8.58	8.83	9.08	9.34	9.59	9.85	4.1
4.2	7.34	7.60	7.85	8.10	8.35	8.60	8.85	9.11	9.36	9.62	9.87	4.2
4.3	7.36	7.62	7.87	8.12	8.37	8.62	8.88	9.13	9.38	9.64	8.89	4.3
4.4	7.38	7.64	7.89	8.14	8.39	8.64	8.90	9.15	9.40	9.66	9.91	4.4
4.5	7.40	7.66	7.91	8.16	8.41	8.66	8.92	9.17	9.42	9.68	9.93	4.5
4.6	7.43	7.68	7.93	8.18	8.43	8.68	8.94	9.19	9.44	9.70	9.95	4.6
4.7	7.45	7.70	7.95	8.20	8.45	8.70	8.96	9.21	9.46	9.72	9.97	4.7
4.8	7.47	7.72	7.97	8.22	8.47	8.72	8.98	9.23	9.48	9.74	9.99	4.8
4.9	7.49	7.74	7.99	8.24	8.49	8.74	9.00	9.25	9.50	9.76	10.01	4.9
5.0	7.51	7.76	8.01	8.26	8.51	8.76	9.02	9.27	9.52	8.78	10.03	5.0
5.1	7.53	7.78	8.03	8.28	8.53	8.79	9.04	9.29	9.54	9.80	10.05	5.1
5.2	7.55	7.80	8.05	8.30	8.55	8.81	9.06	9.31	9.56	9.82	10.07	5.2
5.3	7.57	7.82	8.07	8.32	8.57	8.83	9.08	9.33	9.58	9.84	10.09	5.3
5.4	7.59	7.84	8.09	8.34	8.60	8.85	9.10	9.36	9.61	9.86	10.11	5.4
5.5	7.61	7.86	8.11	8.36	8.62	8.87	9.12	9.38	9.63	9.88	10.13	5.5
5.6	7.63	7.88	8.13	8.39	8.64	8.89	9.15	9.40	9.65	9.90	10 15	5.6
5.7	7.65	7.90	8.15	8.41	8.66	8.91	9.17	9.42	9.67	9.92	10.17	5.7
5.8	7.67	7.92	8.17	8.43	8.68	8.94	9.19	9.44	9.69	9.94	10.19	5.8
5.9	7.69	7.94	8.20	8.45	8.70	8.96	9.21	9.46	9.71	9.96	10.22	5.9
6.0	7.71	7.96	8.22	8.47	8.72	8.98	9.23	9.48	9.73	9.98	10.24	6.0

By means of the methods given, any person of ordinary intelligence and skill, can, with a little practice, readily determine the value of milk quite accurately.

All lactometer readings must be taken before the milk is sour. Quite a number of formulas have been made for estimating solids not fat from the specific gravity and the per cent of fat. The table here given is made from one published by Dr. Babcock, in the report of the Wisconsin Agricultural Experiment Station for 1895.

The apparatus for these tests can be obtained from most dealers in dairy supplies. The Quevenne lactometer should always be ordered to use with the table given.

THE NEW POULTRY PLANT.

G. M. GOWELL.

The poultry industry of the State has already assumed large proportions. For three or four years the station management has desired to undertake experimental work along these lines, but until the current year (1897) it has not been practicable to make a beginning. The station funds are definitely limited, and it is impossible to undertake a new line of work without reducing the amount of work in other directions. For this reason, only a small amount of money could be devoted to the establishment of a poultry plant. The buildings are plain and practical in every respect, and can be readily duplicated or adapted by any one entering upon the business.

In the planning and construction of these buildings we endeavored to secure such conditions as are necessary for the welfare and productiveness of the birds, and to economize the labor involved in their care as much as possible. This we tried to secure at as small cost as was consistent with quality. They are well constructed and covered, and should last as long as our barns, stables, or other wooden buildings. Not a single part of them was made for show. True, we could have secured buildings at much less cost, but they would not have met the requirements of our climate, or given protection from dampness that prevails in single walled houses.

INCUBATOR ROOM.

A wing of the well lighted cellar of the farm house is partitioned off from the main cellar for an incubator room. It is 18x24 feet and 7 feet high, and has a cement floor. Its windows are on the north and south sides. The south ones are shaded in sunny weather. This room is free from drafts, and is not much affected by outside temperature. The humidity is considerably affected during the wet weather of early spring and the incubators have to be adjusted to the changes as they occur. At present the room contains two 600 egg size "Monarch" incubators, one 132 egg size "Peep O'Day," and one 400 egg size "Excelsior" incubators.

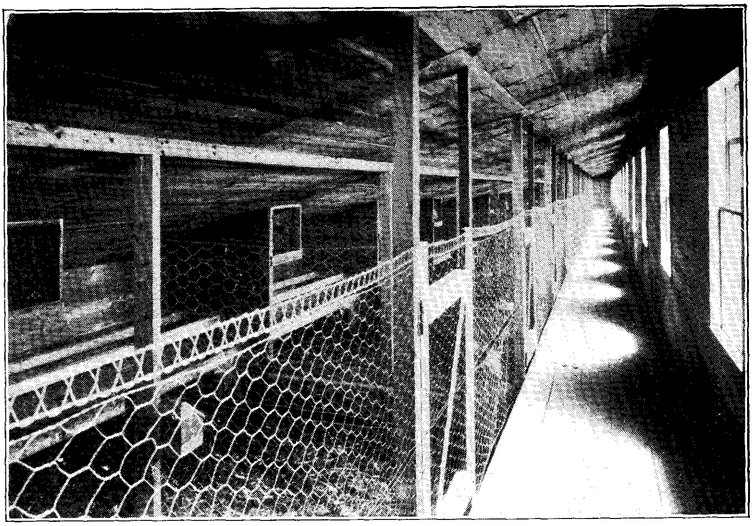
BREEDING HOUSE.

The ground upon which the poultry buildings are located slopes somewhat to the south and east, and gives good surface drainage. The soil is reddish loam, inclining quite strongly to clay, and is rather heavy for yards and walks in wet weather.

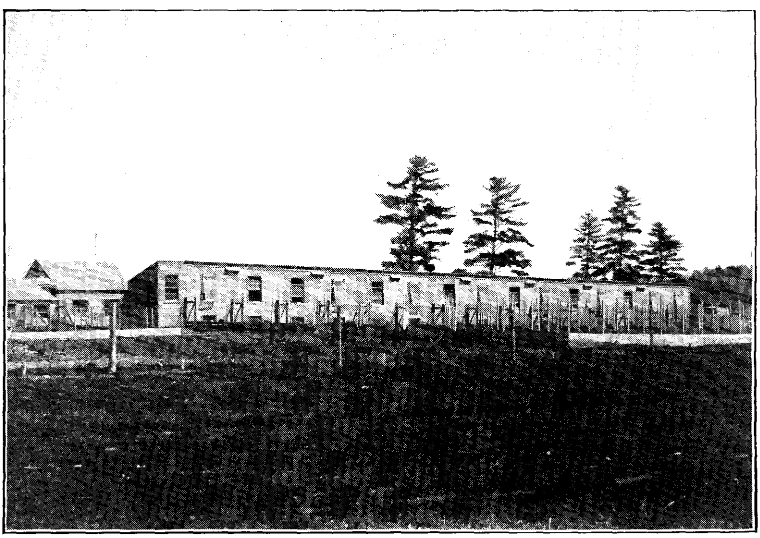
The breeding house is 16 feet wide and 150 feet long. It faces the south and conforms nearly to the land surface, the east end being 5 feet lower than the west end. The sills are of 4x6 inch hemlock, placed flat upon a rough stone wall which rests upon the ground surface, and varies from 1 to 2 feet in height. The earth is graded up to within 6 inches of the sills on the outside.

The floor timbers are 2x8 inch plank, placed 2½ feet apart, and are halved on to the sills. The studs for the back wall are 2x4 stuff, 5 feet 8 inches long, and rest on the sills. The front studs are 10 feet 6 inches long. All studs are set 3 feet apart. The plates and rafters are of 2x4 stuff. The rafters are 3 feet apart. Each 10 feet in length of the front of the building has one 12 light window of 10x12 glass. The top of this window comes within one foot of the plate. Directly underneath these windows, and 6 inches above the floor, are other 3 light windows of 10x12 glass. There is a door in each end 3x6 feet. The building is boarded and papered all over outside, and the ends and back wall are shingled, while the front wall is ceiled with matched boards.

The floor is 2 thicknesses of hemlock boards. The entire inside—walls and roof—is papered on studs and rafters with black Neponset sheathing paper. All edges of the paper lap on studs or rafters, as they are the right distance apart to take the width of the paper. This insures a tight paper wall. The paper is covered with planed pine boards, giving a smooth surface to the inside of the building. This gives a tight dead air space over the whole building, walls and roof. A 4x4 inch plate, supported by studs, run through the centre of the building.



NEW POULTRY HOUSE—INTERIOR.



NEW POULTRY HOUSE—EXTERIOR.

The building is divided into 15 sections. The close partitions between the pens are 2 feet high and made of 2 inch plank. These 2 inch partitions form strong trusses to which the studs supporting the central plate are thoroughly nailed. This saves the floor from sagging from the weight of the roof when it is covered with snow. An elevated plank walk, 4 feet wide, runs along the whole length of the front of the building, and rests on the cross partitions just mentioned. The walk, being 2 feet above the floor, allows the hens to occupy the whole floor space. This part of the floor is lighted from the front by the small windows spoken of above. Above the close partition, the pens are separated from each other and from the walk by wire netting of 2 inch mesh. A light wooden frame door, covered with wire and hung with spring hinges, leads from the walk down 3 steps, each a foot wide, into the pens.

The back ends of the cross partitions, 4 feet out from the back wall, are carried up to the roof, so as to protect the birds from currents of air while on the roosts. The roost platform is along the back wall. It is 3 feet 2 inches wide and is raised 2 feet above the floor. There are 2 roosts made of 2x2½ inch spruce, with cross pieces nailed firmly across each end. This roost frame is hinged to the back wall of the house and is readily turned up out of the way when the platform is to be cleaned off. The roosts are 10 inches above the platform; the back one is 1 foot from the wall and the front one is 1 foot 4 inches farther away.

Two sliding nest boxes are hung under the platform in each pen. These boxes are 1 foot wide, 1 foot deep, and 3 feet long, with a low partition across the middle, and a hinged door in front through which to remove eggs. The hens enter through the back end, which is always open. The darkness in the inner nest box tends to prevent them from learning the habit of egg eating. The nest boxes are readily pulled out and carried out of doors for cleaning.

A coop 2x2½ feet is hung in each pen, in which to confine would-be sitters and extra males.

A feed trough 8 inches wide is hinged to the partition, 8 inches above the floor, and is turned up out of the way and hasped, except when used for the feeding of the morning's mash. Eight inches above the floor, a slot 8 inches wide and 4 inches high is cut through the plank partitions between every other pen. Galvanized iron pans 4 inches deep, 12 inches square at the top and 10 inches square at the bottom, are slipped into the slots, and each one accommodates two pens with water. A cleat on each side of the slot at the bottom is necessary to give sufficient base rest to the pans. Shelf troughs, 10 inches above the floor, contain grit, shell and bone.

A small box, with sloping cover, is hung on the wall in each pen and receives the eggs as they are collected during the day.

Partial ventilation is provided by eight ventilator places in the front wall between the studs. These places between the studs are 3 feet wide by 4 inches deep, and open into the pens, 6 inches above the floor. They open on both sides of every other cross partition and so ventilate from every pen. They have an upright draft of about 10 feet, and open out just under the plate, the openings being protected by sloping board covers to prevent inward currents of air when the wind blows hard against them.

All windows are double. Eight of the large outside ones are hinged at the tops and are kept hasped out one foot at the bottom except in the roughest weather. This furnishes excellent ventilation without drafts as the position of the outside windows prevents strong currents of air from entering.

When the temperature has fallen to 10 degrees below zero, water has frozen quite hard in the breeding house and egg production has been seriously checked. We shall probably provide five or six large oil stoves for use in this building during nights in extreme weather, and try to keep it above the freezing point at all times.

Double doors, 10 inches wide and 12 inches high, are placed under the walk and admit the birds to the front yards which are 10 feet wide and 75 feet long. Similar doors in the back wall of each pen, under the roost platforms, allow the birds to pass to the back yards, which are of the same width but somewhat longer than those in front. These back yards are particularly for use in warm weather.

The frame and outside boarding of the building are of hemlock, costing $8 per M. at the mills, a mile away. The doors are of pine, costing $17 per M. The spruce for studs for partitions cost $12 per M. The inside ceiling is pine, having some knots and streaks of dry rot, but giving a smooth hard surface, and cost $8 per M. The hard pine sheathing on the outside front cost $15 per M. The cedar shingles on the roof cost $2 per M., and the pine shingles on the walls were $1 per M. The cost of the building completed was $705. Of this amount the material cost $515 and the labor, which was partly contract and partly by the day, cost $190.

The front yard fences are 6 feet in height. Two feet at the bottom is of boards and the 4 feet above of 2-inch mesh, No. 19 wire. The yards and gates cost completed, $65. The back yard fences are not yet constructed.

BROODING HOUSES.

In the spring of 1897 six movable brooder houses were made and located on the grass land conveniently near the farm buildings. These houses are each 6 feet by 12 feet and 5 feet high at the front, and 4 feet at the back, with a door and window in the front.

Two Peep O'Day brooders were put in each house and separated from each other by a wire partition. Each house had two separate yards. In these six houses nine hundred Brahma and Plymouth Rock chickens were raised until October, when the pullets were put into winter quarters and the houses drawn together by a pair of horses, so as to be ready for use again early next spring.

In the fall of 1897 a permanent brooding house was constructed and equipped for use. This house is 14 feet wide and 60 feet long. Its front wall is 4 feet 10 inches high from bottom of sill to top of plate and the back is 7 feet high. The ridge is 4 feet in from, and 1 foot and 6 inches higher, than the back plate. This gives the short part of the roof back of the ridge and the long part to the front of it.

This building is constructed in the same manner and of the same material as the breeding house. It has the 4 inch dead air space in walls and roof, and the tight double floor. The front wall is 3 feet 8 inches high inside and the back wall is 5 feet 9 inches from floor to ceiling. There is a 3x6 feet door in each side. There are ten windows in the front wall, equal distances apart. The bottoms of these windows are 8 inches from the floor. There are also five windows in the back wall close up to the plate. These windows all have six lights each of 10 by 12 glass.

All sash are in two parts and slide up or down to admit fresh air and keep the house cool in warm weather. All windows are double. There are ten small doors each 10 by 12 inches, placed close to the floor, along the front wall, through which chicks can pass in and out. All doors are double.

Two galvanized iron ventilators, each 10 inches in diameter and 6 feet 6 inches high, with projecting hoods at the tops, extend from the inside of the room up through the ridge, and furnish sufficient means of ventilation during cold weather. Ventilation is regulated by means of a shut off at the ceiling.

There are ten breeding pens, each 6 feet by 10 feet and 8 inches. The partitions have an 8 inch board at the bottom with 3 feet of 1-inch mesh wire above. A walk 2 feet and 6 inches wide extends along the back of the building. The doors which lead from the walk to the pens swing both ways and are wire covered. A Peep O'Day brooder is placed in each pen with the lamp door opening into the walk. Each of these pens accommodates about 60 chicks in winter or 75 or 80 in spring when they can get out into the yards.

The building being low is kept warm enough in winter by the ten brooder stoves, and the temperature under the hovers is easily kept so that it is found in the morning about as left the night before.

The cost of this building without the brooders was $235. Of this amount $160 was for material and $75 for labor.

FEED HOUSE.

The east end of the brooding house is 25 feet west of the west end of the breeding house. The fronts of both buildings are on the same line, facing the south. The 25 feet space is filled in with a small temporary cook and feed mixing-house, which opens into the breeding and brooding houses. It contains a supply of running water, mixing trough, feed bins, water heater, clover cutter, bone mill, etc.

It is designed to erect in its stead, at some future time, a permanent two-story building, the lower floor to be used for mixing and cooking feed, and the upper floor for storage, feather curing, and a sleeping room for the poultryman.

EXPERIMENTS.

The plant was constructed for the purpose of investigation, and many experiments are being planned. The houses are just completed, and at this date (December, 1897) the chief point being studied is in reference to the number of hens that can be carried in a room of a certain size, and their health and productiveness maintained.

There are 15 pens, all alike in arrangement and size, each being 10x15 feet and 2 inches. November 1st 15 Brahma pullets were put in pen No. 1, 20 pullets in pen No. 2, 25 in pen No. 3 and 30 in pen No. 4. In pens No. 5, 6, 7 and 8 similar assignments of 15, 20, 25 and 30 birds were made. In pens 9, 10, 11 and 12 the same arrangement of numbers of Plymouth Rock pullets was made and pens 13, 14 and 15 were duplicates of pens 9, 10 and 11. This gave four pens with 15 birds in each one, four pens with 20 birds, four pens with 25 birds and three pens with 30 birds each. The birds are treated alike in every pen and fed in proportion to numbers. The eggs are recorded at each collection. This and other experiments to be undertaken will be reported upon from time to time as results of importance are obtained.

ORNAMENTING HOME GROUNDS.*

W. M. MUNSON.

A constantly recurring problem in New England, is, How shall we keep the boys on the farm? The answer is not easy, but more people are driven from the farm by its isolation, loneliness and lack of tasteful surroundings than by any other cause. If the boys and girls go away to the academy for a time and get a taste of village or city life, the contrast when they return to the old farm is often too strong. For this reason any effort towards improving the surroundings of the home is labor well expended.

LOCATION.

In building a new house, consider well its location. Don't build where the old one was simply because the barns are there,—though of course, other things being equal, the barns should be near the house. Healthfulness is of the first importance, so be sure that the location of the residence is such that perfect drainage is secured. Other things being equal, a southern or southeastern aspect is most desirable.

If possible, make use of natural groves or scattering trees and of shelter-belts or windbreaks, and place your buildings near them. Nothing you can plant will be so satisfactory as the native forest trees. If there is not a natural shelter of trees, by all means provide one.

Better results may be obtained and much needless waste of time and expense may be avoided, if a definite plan of the place be made before commencing the work of improvement, though "paper gardening" is often ridiculed by so-called practical men.

The house, both because of its importance and for sanitary reasons, should, if possible, be on a slight elevation and should be so situated as to secure the best views both of your own grounds and of the surrounding landscape.

*This paper in an abridged form was published as Bulletin 42 of this Station.

The relative position of house and barns should also receive attention. It is in bad taste to have the barn in the fore ground, partially shutting off the view of the house as approach is made from either side. It is in much worse taste, indeed it is the *worst* taste, to place the barn on the opposite side of the street from the house and directly in front. The proper location of the barn is at one side and to the rear of the house.

WALKS AND DRIVES.

The best grounds are those which combine the greatest convenience with the greatest pleasure. In general, every object should be easily accessible. Walks and drives are, however, always unsightly, and there should be as few of them as is consistent with convenience. They should approach the buildings with direct curves. Indirect and reversed curves, without an apparent reason, give the idea of an attempt to "show off" the grounds unduly. When walks or drives branch or turn aside abruptly from their general course, there should be an apparent reason for such change of course. This may be accomplished by placing some obstruction, as a group of shrubs at the angle or turn.

In the construction of walks and drives the natural undulations of the surface should be followed, though of course sudden swells or dips should be avoided. A firm bottom should be secured by excavating somewhat as shown in the cut. The

trench thus made is filled to within three inches of the surface with cobble stones, coal ashes, etc., placing the coarser material near the sides to insure drainage. At least three inches of gravel should be placed above the coarser material, and this should be slightly convex at the surface—not so much so, however, as the bottom. Both the gravel and the coarser material in the bottom should be packed very firmly.

THE LAWN.

A good lawn is the most essential element of beauty in any grounds and in these days of cheap lawn mowers there is no excuse for not having a neat lawn in front of the humblest dwelling. It is very little more work to leave the surface of the ground smooth after the final grading about the buildings than it is to leave it rough and uneven. Arrange if possible, to have a few inches of good loam on the surface when the grading is completed, and in any case, make a liberal application of well rotted stable manure. After thorough preparation and raking with a hand rake, seed very thickly, using three to five bushels of seed per acre. After the seed is sown, roll and if late in the season or the soil is very dry, mulch with chaff or fine manure or leaf mould. Keep the grass closely clipped during the summer. In this way only can the weeds be kept down and a thick velvety turf be formed. In the latter part of the season it is well to let the grass become longer, for the double purpose of strengthening the roots and of serving as a mulch during the winter.

The best grasses for a lawn are Kentucky Blue Grass and Red Top, with a slight admixture of White Clover on heavy soils. Rhode Island Bent is also a valuable grass for heavy clay soils. On a sandy loam, Kentucky Blue Grass alone will be found as satisfactory as anything.

As to the care of the lawn but little need be said. In the spring it is well to rake off dead leaves and roll the ground, but the practice of burning over the lawn is not to be recommended. A lawn mower is necessary to insure good results. A very good machine can be procured for $5, and the labor of mowing in this way is very light.

On small surfaces a lawn may be formed more quickly and better by turfing than by seeding. For this operation the surface should be prepared as for seeding. Then from some well established lawn or from an old pasture procure sods about one and one-half inches thick. These should be as nearly as possible of a uniform width and thickness, and should be cut into strips several feet long rather than in squares. The strips may be made into compact rolls for moving to the desired place. In laying the turf be careful to make good joints and when it is in place beat it thoroughly with a heavy wooden mallet.

About two years will usually be required to free a newly seeded lawn from weeds. Close clipping will keep most weeds in check but it may be necessary to dig the roots of some, e. g. mallow, fall dandelion, etc.

The use of stable manure, unless it has been thoroughly heated and rotted to kill all weed seeds, is to be discouraged. Instead of manure, an application of concentrated fertilizer rich in phosphoric acid is to be preferred.

THE FLOWER GARDEN.

While, as a rule, better results may be obtained for the same expenditure of time and labor by using shrubs and perennials, the old fashioned flower garden of our grandmothers is not out of place on the farm. In many cases the taste—or lack of taste—of the occupants of a home are here most vividly portrayed.

Many genuine lovers of flowers fail to realize the difficulty in securing a constant succession of beauty both in blossom and leaf. Indeed there are very few collections which can be considered in any way satisfactory.

The leading faults that are met in all of our flower gardens are the want of proper selection in the plants and a faulty arrangement. A flower garden should be rich and attractive during the whole summer and autumn, hence the importance of avoiding plants which from their coarse straggling habit, or sparseness of bloom give a confused or meagre effect. The best effects will be produced from the use of a few species or varieties which combine beauty of form with the habit of perpetual blooming.

Among shrubs, such as will give a succession of bloom and will present attractive foliage during the remainder of the season, should be chosen. For example, the old fashioned roses which bloom but once during the season, should be discarded for the hybrid perpetuals and Rosa rugosa. Among annuals all short lived species should be rejected and instead, such plants as portulacca, verbena, petunia, Phlox Drummondii, calundula, asters, pansies, etc., should be used.

The good effect from a careful selection of plants may be enhanced by exercising proper care in grouping or massing colors and particular species of plants. Masses of white and crimson, of yellow and purple, and other shades and colors brought boldly into contrast or so placed as to form an agreeable harmony will produce a much more forcible and pleasing impression than is possible when the various shades and colors are thrown together indiscriminately. The bringing together of masses of colors in this way gives a breadth of effect, which is entirely lost by the other mode.

As to the location of the "flower garden" but little need be said. In general it should be at one side and a little to the rear of the house rather than directly in front,and although "fashion" may sanction the practice, do not torture your neighbors by arranging a display of pots and kettles, wash-tubs and churns painted a glaring red, in solemn array before the house—as if to remind passers by of the blood of the martyrs.

WHAT TO PLANT.

The selection of trees and shrubs for planting is always perplexing. A few general principles may aid in solving the problem:

1. Do not attempt too much. Grounds that are crowded, even though the plants of themselves may be choice, have the appearance of an overdressed person.

2. Do not discard native plants because they are "common." The oaks, maples, hickories and elms; the viburnums, dogwoods, roses and sumacs are unsurpassed in their respective classes. We might name further the hawthorns, the wild crab, the wild cherry and plum, the shadbush and tamarack, the white ash and many others of special value and easy to be obtained.

3. Do not invest freely in untried things. If you have enterprising and experienced neighbors, consult with them before ordering nursery stock. Otherwise correspond with some reliable nursery firm or with some person in whose judgment you have confidence for advice in specific cases. It is usually safer to place an order directly with some reliable firm rather than with an agent. As a rule you will pay an agent 50 to 100 per cent more than the same goods would cost if purchased direct, and are less likely to receive them in good condition. It is often practicable for several neighbors to unite in sending an order and thus get wholesale rates.

4. In making a selection of flowering trees and shrubs, aim to secure a succession of bloom, in order that the grounds may

be attractive all summer. Among the earliest flowering hardy shrubs are Daphne mezereum and the Forsythias which bloom before putting forth leaves—usually about the first of May. Following these shrubs are the Magnolias, the Red Bud or Judas Tree, the Hawthorns, the apple and the cherry among small trees. The magnolia will succeed only in the southern counties. Some of the best second early shrubs are the Azalias, Bush Honeysuckle, Japan Quince, Double Flowering Plum, Flowering Almond, Lilacs in variety and the earlier Spiraeas—especially Van Houteii, prunifolia and Thunbergii. A little later come the Weigelas and Mock Orange (Philadelphus) and the Japanese Rosa rugosa. In late summer we have the late Spiraeas—as Bumalda, Billardi, Callosa, etc.,—the "Smoke Bush" (Rhus cotinus) and, best of all for massing, the hardy Hydrangea.

The brightness produced by bulbs and hardy perennials will well repay a small outlay in this direction. In earliest spring we have the Christmas Rose (Helleborus niger), the Snowdrops (*Galanthus*), Crocuses and Pansies. A little later Tulips and Hyacinths appear, and these are followed by Columbines, Lily-of-the-Valley, "Bleeding Heart" (*Dicentra*) and Peony. In summer and early fall, the Japan Anemone, the Golden Columbine (*Aquilegia Chrysantha*), the Foxglove, Hollyhock, Plantain Lily (*Funkia*) and the numerous species and varieties of true lilies are all very effective and are easy of culture.

WHEN TO PLANT.

But for the difficulty of obtaining well matured stock in the fall, I should advocate setting most trees and shrubs in September and October; because of this difficulty, however, spring planting is usually advisable. All planting should be done just as early in the spring as possible that the trees or shrubs may become well established before the leaves are put forth.

Hardy herbaceous perennials such as phlox, digitalis, hollyhock, columbine, etc., should, as a rule, be planted in September. The same is true of most bulbous plants, including the crocus, hyacinths, lilies, tulips, etc. The gladiolus is usually set in spring.

HOW TO PLANT.

In working with trees and shrubs, remember that a plant is a living organism and is as truly sensitive to neglect or ill treatment as is an animal. In handling nursery stock, always be careful to keep the roots moist. When received from the nursery the bundles should at once be opened and the plants carefully "heeled in." In case any of the plants are very dry and withered, they should be completely covered with earth for several days. In this way many plants which if set immediately would die, may be saved.

If a tree could be removed with all of its rootlets and placed in the soil exactly as it stood before, it would suffer no check in transplanting; but as this is impossible, a certain amount of pruning must be done. Even with the best of care the mutilation of the roots must be great, and with careless handling nine-tenths of the root system may be destroyed. All the bruised and broken roots should be cut off with a clean smooth cut from the under side.

Now with the depleted root system the capacity of the plant for absorbing moisture from the soil is reduced to such an extent that unless the leaf surface be also reduced, the loss by evaporation soon causes the plant to wilt. Hence, before setting, the top should be cut back to correspond with the roots.

In cutting back the top, consider the habit of the plant and the desired form. If it is wished to encourage a tendency to spread, cut off the branch in each case just above a bud on the *outer* side. If, on the other hand, a more upright habit is desired, cut just above a strong bud on the *inner* side of the branch.

As a rule, a tree or shrub should not be set deeper than it sat before removal and the hole should be large enough so that none of the roots need be cramped. If the soil is not in good condition, the labor of carting in good loam, in which to set the plants, will be well expended.

If but few trees or shrubs are to be set, it is well to use water, in settling the earth about the roots. In any case, tramp the soil firmly and leave a slight mound above the base of the tree.

If the season is late, or if the soil is very dry, the roots should always be mulched. Any coarse litter that will shade the ground will answer for this purpose—coarse manure, leaves, straw, sawdust or even boards, will answer.

ARRANGEMENT.

The effective arrangement of trees and shrubs is often a most difficult problem. One of the first things to accomplish is the screening of outbuildings and other unsightly objects. The best plants for this purpose are evergreens—especially those which appear best at a distance, as Norway Spruce, Austrian Pine or Arbor vitae (white cedar). It is not necessary that the planting be done in formal belts or hedges. Irregular groups, so arranged that the view is obstructed, are better than formal hedges. A trellis covered with vines may often be made effective and attractive as a screen. Clematis, Bittersweet, or even the common hop, may be used to advantage in such a place.

There may properly be a border of low growing shrubbery next to the house and it is well to plant a vine of some sort by the piazza. Nothing is better for this purpose than the common woodbine or Virginia Creeper. Akebia and Actinidia, two new Japanese climbers, are also good. In general, a better effect is produced by planting in masses and borders, than by dotting the plants here and there over the lawn. By the first method a picture is created with the residence as the central object, and one sees the grounds as a whole. The other method is meaningless and the effect produced is that of an orchard or nursery.

SHELTER BELTS OR WINDBREAKS.

The importance of a windbreak in exposed situations can hardly be overestimated. The saving in fuel as well as the increased comfort will well repay an outlay in this direction when planting is better done.

The best windbreak for general purposes consists of a mixed planting of evergreens and deciduous trees such as Norway Spruce, and sugar maple or elm.

FENCES.

Fences are, as a rule, unsightly and should be avoided as much as possible. High picket fences painted white are specially glaring and objectionable,—they are too suggestive of prison bars. That fence is best which is least conspicuous and best seen through. A picket fence of the ordinary height does not fill either requirement, though it is perhaps the least objectionable form of wooden fence.

In general, avoid all useless fences, but if needed, a neat, inconspicuous wire fence is best. Do not fence the "front yard," in other words do not have a front yard. Road fences are usually unnecessary and should be avoided.

SOME NATIVE TREES AND SHRUBS VALUABLE FOR PLANTING.

The following list of trees and shrubs includes only those which are most common in our forests and which may thus be obtained at slight expense.

EVERGREEN TREES.

Arbor Vitae, or White Cedar (*Thuja occidentalis*, L.).
Hemlock (*Tsuga Canadensis*, Carr.).
Pine, White (*Pinus strobus*, L.)
Pine, Norway (*P. resinosa*, Ait.).
Spruce, White (*Picea alba*, Link.).
Black (*P. niger*, Link.).

EVERGREEN SHRUBS.

Juniper (*Juniperus communis*, L.)
Laurel, Mountain Laurel, (*Kalmia latifolia*, L.).
Laurel, Sheep Laurel, (*Kalmia angustifolia*, L.).

DECIDUOUS TREES.

Ash, White (*Fraxinus Americana*, L.).
Basswood (*Tilia Americana*, L.).
Beech (*Fagus ferruginea*, Ait. .
Birch, Black or Cherry B. (*Betula lenta*, L.).
Birch, Yellow B. (*Betula lutea*, Michx.).
Gray B. (*Betula populifolia*, Ait.).
Bird Cherry (*Prunus Pennsylvanica*, L.).
Black Cherry (*Prunus serotina*, Ehrh.).
Chestnut (*Castanea Americana*, Watson).
Elm, White or American (*Ulmus Americana*, L.).
Hawthorn (*Cratægus coccinea*, L.).
Hackmatack, Tamarack or "Juniper" (*Larix Americana*, Michx.).
Maple, Rock or Sugar M. (*Acer saccharinum*, Wang.).
White or Silver M. (*Acer dasycarpum*, Ehrh.).
Red, Soft or Swamp M. (*Acer rubrum*, L.).
Mountain Ash (*Pyrus Americana*, DC.).
Oak, White (*Quercus alba*, L.).
Scarlet (*Quercus coccinea*, Wang.).
Plum, "Pomegranate" (*Prunus Americana*, Marsh.).

DECIDUOUS SHRUBS.

Black Alder or Winterberry (*Ilex verticillata*, Gray.).
Chokeberry (*Pyrus arbutifolia*, L.).
Choke-cherry (*Prunus Virginiana*, L.).
Dockmackie or Maple-leaved Arrowwood (*Viburnum acerifolium*, L.).
Dogwood, Red Osier (*Cornus stolonifera*, Michx.).
Elder, Common or Black E. (*Sambucus Canadensis*, L.).
Red E. (*Sambucus racemosus*, L.).
High-bush Cranberry (*Viburnum Opulus*, L.).
Hobblebush (*Viburnum lantanoides*, Michx.).
Honeysuckle (*Lonicera ciliata*, Muhl.).
(*Diervilla trifida*, Moench.)
Meadowsweet (*Spiraea salicifolia*, L.).
Mountain Maple (*Acer spicatum*, Lam.).
Mountain Holly (*Nemopanthes fascicularis*, Raf.).
New Jersey Tea (*Ceanothus Americanus*, L.).
Rose (*Rosa blanda* Ait.).
(*Rosa lucida*, Ehrh.).
(*Rosa humilis*, Marsh.).
Sheep Berry (*Viburnum Lentago*, L.)
Staghorn Sumach (*Rhus typhina*, L.).
Thimble Berry (*Rubus odoratus*, L.).
Witch Hazel (*Hamamelis Virginiana*, L.).

CLIMBING VINES.

Bittersweet (*Celastrus scandens*, L.)
Clematis, Virgin's Bower (*Clematis Virginiana*, L.).
Grape (*Vitis Labrusca*, L.)
Virginia Creeper, (*Ampelopsis quinquefolia*, Michx.).

THE ACQUISITION OF ATMOSPHERIC NITROGEN.

W. M. MUNSON.

[Several years ago, the Director of this Station, then assistant to Professor W. O. Atwater of Wesleyan University, had the privilege of sharing in an investigation upon "The acquisition of atmospheric nitrogen by growing plants." The experiments demonstrated that certain plants had this power. The results of the first series of experiments were presented by Professor Atwater at the meeting of the American Association for the Advancement of Science in 1881. These results together with those of another series of experiments were presented by Professor Atwater at the meeting of the British Association for the Advancement of Science in 1884, and were published in detail in the American Chemical Journal for February, 1885. The investigation was interrupted for four years, and in the mean time the results were confirmed by other experimenters. Notable among these is Hellriegel, who showed that in some way the enlargements of the roots (root nodules or tubercles) are concerned in the fixation of the nitrogen of the air. After the establishment of the Storrs (Conn.) Experiment Station these investigations were continued by Professor Atwater and the writer. A number of allied questions were studied, including the losses of nitrogen which occur in germinating seeds and in growing plants. The last important experiment was an investigation in which it was shown that it was the free (uncombined) nitrogen of the air which peas and allied plants have the power of acquiring. The results of this investigation were given in the report of the Storrs Station for 1892.

In 1897, it was deemed advisable to undertake an investigation here with special reference to the practical application of the principles already established. During the past few years a large amount of work, from many different standpoints, has been undertaken by different investigators. In beginning our investigations it was found that no satisfactory summary of the work was available in any language. For this reason a somewhat extended study of the literature of the subject was necessary and the general facts obtained are herewith presented by Professor Munson. The bibliography, although incomplete, is given as an aid to others working on this subject. Chas. D. Woods.]

NITROGEN ACCUMULATING PLANTS.

The most important discovery in vegetable physiology in its relation to agricultural science, which has been made during the present generation, is that of the relation between microörganisms and the acquisition of atmospheric nitrogen by plants.

A review of the question of assimilation of free nitrogen by plants would necessarily be disconnected, since the subject has been approached from so many different points of view. It is not our purpose at this time, however, to make an exhaustive study of the subject, but rather to bring it into view and call attention to its economic importance.

The results of several hundred experiments have shown conclusively that many if not all of the more common species of legumes are capable of using atmospheric nitrogen. Peas, beans, vetches, clover, alfalfa, lupine, soja bean, sainfoin, serradella and many other species have been used in the experiments.

NATURE OF THE TUBERCLE ORGANISMS.

The tubercles were observed as early as 1615,* but their origin and significance have not been well understood. At first the tubercles were supposed by some to be caused by a parasitic fungus; others supposed them due to the attack of insects or worms (*Anguillulidae.*) They were then regarded as rudimentary roots or as buds which might develop in case the plant did not fruit.

In 1866 Woronin† made a careful study of the subject and found in the tubercles numerous bodies resembling bacteria. Because of the regularity of the organisms which were often

*De Lechamp, *Histoire generale des plantes*, cited by Vuillemin, Ann. d. Sci. Agronom. franç. et etrang., 1888, p. 96.

†Mem. Acad. imp. des Sci. de St. Petersburg, t. X, (1866) No. 6.

branched into T or Y shaped bodies, it was impossible to determine whether they were true bacteria. They were therefore called by the discoverer bacteroids. This contribution marks the beginning of serious investigation as to the nature and etiology of the tubercles.

A few years later, Erickson* found that in the early stages of the tubercles, long branching threads, like the mycelium of fungi, were present but he was unable to determine whether there was any connection between these and the bacteroids which appeared later.

Other experimenters a little later concluded, as already indicated, that the tubercles were normal parts of the plant and had no connection with infection from without. The bacteroids were observed but were not considered distinct organisms. They were considered rather as differentiated portions of the proteid contents of the cells which were later absorbed by the plant. This was the view of Brunchorst;† also of Sorauer,‡ Van Tieghem and Duliot¶ and others.

In 1887, Marshall Ward proved conclusively§ that the tubercles are caused by some organism which is abundant in the soil, apparently a parasitic fungus.

In 1888, Beyerinck§§ undertook the cultivation of the organism in artificial media and was confident he could trace the development of the bacteroids from a bacterium which he named *Bacillus radicicola.* The bacteroids were regarded as degenerate forms appearing only after the bacteria had lost their vigor.

In 1890, Prazmowski published the results of extended researches,** the results of which are so concisely summarized by Conn†† in the Experiment Station Record, that I take the liberty of quoting freely in this connection.

According to the investigations of Prazmowski the development and growth of the tubercles are as follows: *Bacterium radicicola* lives normally in the earth and collects in numbers on

*Studier öfver Leguminosernas Rotknöler Lund, 1874; Bot. Zeitung 1874, p. 381.
†Ber.d. Deutsch. Bot. Gesell. III (1885), pp. 241, 257.
‡Bot. Centralb. XXXI, (1887), 308.
¶Bull. d. Soc. Bot. France, XXXV (1888).
§Phil. Trans. Roy. Soc. CLXXVIII (1887), 139-562.
§§Bot. Zeitung. Bd. 46, (1888), p. 725 *et seq.*
**Landw. Versuch. Stationen, 37, p. 161.
††Expt. Sta. Record II, 689, (1891).

the outside of the roots of various legumes. Some of the organisms succeed in forcing their way into the tissues of the young roots, though they are not able to pierce the older roots. For a while they may remain in the root as free bacteria, but the plant plasma seems to exert an injurious influence upon them, for very soon a thin membrane is formed around the bacteria masses, inclosing them like a pouch. Prazmowski thinks that this membrane is a product of the bacteria themselves, formed for the purpose of protecting them from the injurious action of the plant tissue. The bacteria which do not succeed in getting into one of these pouches soon cease to grow and degenerate into irregular forms like the bacteroids which appear later in greater numbers. The bulk of the bacteria, however, become enclosed in the membrane, after which they continue their growth with much vigor. The pouches begin to grow into threadlike masses, and these make their way among the cells of the root. The thread branches more or less as it lengthens and its various filaments grow through and between the cells, soon permeating the root with a fine, branching filament, which looks much like the mycelium of a mold. It was this bacteria pouch which was first seen by Erickson, and which previous observers regarded as the hypha of some low fungus. Instead of being a mycelium growth of a mold the thread is nothing more than a large, branching colony of bacteria inclosed in a thin membrane.

"The growth of this colony of bacteria among the cells of the root stimulates these cells to an unusual growth. They multiply more rapidly than usual, and thus soon produce a swelling on the root which is the beginning of the tubercle. While this rapid multiplication of root cells is going on, the bacteria pouch continues to grow, and swells out into rounded vesicles within the cells which lie at the center of the forming tubercle until most of them become filled with these expanded portions of the bacteria thread. Meantime the root cells of the plant have been rapidly growing, and form around the cells containing the bacteria several layers of smaller cells, which develop into a hard, corky covering forming a coat around the tubercle. This seems to be impervious to the bacteria thread, and confines the bacteria within its limits.

"The bacteria colony now undergoes a change. Although Prazmowski has not been able to follow the details of the process, it is thought that the vesicles in the central cells swell until the membrane covering the bacteria is so thin that it bursts, and the bacteria are themselves extruded into the plasma of the root cells. At all events, the vesicles disappear and there appears in their place what is called the bacteroid tissue. His interpretation of this is that the vesicles burst and the bacteria coming into the cell plasma are immediately checked in their growth by the injurious influence of this plasma and begin to undergo involution changes. Instead of multiplying in the normal manner, they asume various abnormal forms which have no further power of growth. They become, in short, the bacteroids which have been found by so many observers, filling the central cells of the tubercle. The bacteria retain their power of growth only so long as they remain in the protecting covering of the membrane.

"The tubercle by this time is pretty well formed. The outer cells have undergone quite an extended growth and differentiation, so that the tubercle is really a structure of a rather high grade of plant tissue. The tubercle itself is thus really a growth of the root cells of the plant and not a growth of bacteria. But in the centre of this mass of plant tissue are a large number of cells, which are completely filled with the so-called bacteroids. These bacteroids give to the tubercle at this stage a flesh-red color. Some of these central cells are so completely filled with them that nothing else can be seen, while others may show the nucleus. In others, spaces begin to appear in the body of the cell. The appearance of the spaces marks a new stage in the history of the tubercle, and indicates that the bacteroids entirely cease their activities and begin to disappear rapidly. After a little they are completely absorbed by the substance of the plant and the tubercles are left as empty pouches. The tubercles have now changed their appearance again and assume a somewhat grayish green color.

"This practically ends the history of the tubercle. In most cases some of the bacteria seem to remain within their original membrane, and therefore are capable of growing. These may now set up a secondary growth, but it amounts to little, for by this time the plant has usually blossomed, ripened the seeds, and the root is beginning to die. The tubercle is immediately attacked by the putrefactive bacteria in the soil and becomes decomposed."

Frank has also published an extended series of observations upon the same subject.* While he differs from Prazmowski in some important particulars, his later results, on the whole, confirm those of the latter writer. He finds the tubercles produced as the result of infection by some organism in the soil, and he describes the organism as a micrococcus or short rod,—very probably the same as that studied by Prazmowski. His explanation of the hyphae and the bacteroids is different from the one just noticed. The hyphae he finds filled with bacteria, as does Prazmowski, but he regards the membrane that surrounds them as a product of the root cells rather than of the bacteria. He thinks that the root cells produce these peculiar threadlike forms in which the bacteria multiply, and that by means of the threads the bacteria are conducted into the inner cells of the root to produce the infections there. He therefore calls them "infection threads."

The essential point in which Frank's theory differs from that of Prazmowski is, in regarding the filaments as products of the root cells instead of the bacteria. He thinks that in some cases the infection occurs without the development of the filaments. After the infection, the cells of the roots are stimulated into growth to form the tubercle, as already described, and bacteroids appear in the central cells. Frank, however, regards the bacteroids as peculiar formations of the plant tissue and not as distinct organisms or degenerate bacteria. According to him the presence of the bacteria produces abnormal changes in the plasma of the root cells, causing it to become separated into numerous irregular masses which contain the bacteria inside of them. These masses are the bacteroids which fill the central cells. They are subsequently absorbed by the plant in the manner described by Prazmowski.

In a series of experiments performed at the Pasteur Institute, Paris, Laurent† reaches a different conclusion. In his studies of pure cultures of the tubercle organism, he finds that in gelatin the organisms spontaneously assume, by a sort of bud-

*Landw. Jahr., Bd. 17, (1888), pp. 421-552, and 19, (1890), pp. 523-640.

†Ann. d. L'Institute Pasteur, 1891, No. 2.

ding, the irregular forms which have been called bacteroids. The bacteroids are, therefore, not degenerate, but normal forms of the bacteria. He further asserts that the bacteroids found in the tissue of the tubercles arise by a normal process of budding from the hyphae. The hyphae themselves he looks upon as filamentous growths of the organism, and not as pouches filled with bacteria nor as products of the root cells. Now, since bacteria always multiply by division and never by budding, it is plain that if these observations of Laurent are correct, the organisms in question cannot be called bacteria. Laurent, therefore, like Ward and other earlier investigators, affirms that the organism is really a low fungus, related to the yeasts in its method of growth, and regards it as intermediate between the yeasts and the filamentous fungi. He accepts the name formerly suggested by Frank, *Rhizobium leguminosarum*.

The three views thus outlined give in substance our present knowledge of the origin and structure of these tubercles. It may seem strange that there should be such a difference of opinion on mere matters of fact, but as indicated by Conn,* the differences are explained by the difficulties of observation. The tubercles grow naturally under ground, Laurent alone having had much success with water culture. They are opaque, and can therefore only be studied by tearing them to pieces or by cutting sections of them. The only method of observation is by examining a large number of tubercles in different stages of growth, and in this way important points are sure to be missed. Differences in results of observation as wide as above sketched are, therefore, not surprising.

Our present knowledge of the nature of these tubercles is somewhat as follows:† "They are not normal products of the plant, but are in all cases produced by infection from some organisms which exist in the soil and attach themselves to the young roots. Their presence in the tissue stimulates the root cells to active growth and a mass of new tissue is formed around the growing organisms. This tissue forms the tubercle and confines the infectious action within narrow limits. The tubercle is thus a sort of gall. The study of the development of this

*Conn, l. c.
†Conn, l. c.

gall shows three somewhat distinct stages. First there appears a branching filament which grows among the cells of the root and which soon stimulates an active growth of the root cells. A little later, after the tubercle is formed, the central cells become filled with the bodies called bacteroids. Lastly the bacteroids of the central cells are absorbed by the plant and the tubercle becomes empty. These facts are agreed upon by all.

In regard to the significance of these facts there are three distinct opinions. The first is that of Prazmowski, who calls the organism which produces the infection a bacterium, and claims that the branching filaments are simply colonies of bacteria inclosed in a membrane of their own manufacture, for their protection against the injurious action of the plant tissue. The filaments swell with the multiplication of the bacteria until they burst. The bacteria then coming into contact with the plant tissue and no longer being able to grow, owing to an injurious influence of the plant plasma upon them, degenerate into the bacteroids. They are subsequently absorbed by the plant and incorporated into the substance, serving therefore as food.

"The view held by Frank differs from this essentially in its explanation of the filaments and bacteroids. The filaments are said to be a mixture of plant protoplasm and bacteria. They are produced by the plant and serve to conduct the infectious matter into the midst of the root. The bacteroids are also products of the plant plasma and not distinct organisms. Their absorption does not, therefore, especially help the plant.

"The third view, that of Ward and Laurent, regards the infecting organism not as a bacterium, but as a low fungus, somewhat closely related to the yeasts. The filament is really a mycelial growth of the organism, and the bacteroids arise from it by budding. The bacteroids are thus distinct organisms—not degenerate forms, but normal growths.

"None of these views would regard the tubercle organisms as true parasites on the plant, since the plant is not injured by them, but is probably directly benefited. The association is rather to be regarded as an instance of symbiosis, an association of two organisms together in such a way that each receives benefit from the other. The plant is probably benefited in gaining nitrogen, and the infecting organism is benefited in gaining a brood pouch for its development."

HOW IS THE NITROGEN FIXED?

There has been a question whether, under the influence of the symbiosis, the higher plant was enabled to fix the free nitrogen of the air by its leaves. It seems probable, however, that the nodule-bacteria fix the nitrogen within the plant, and that the higher plant then absorbs the nitrogenous compounds produced.

Among the most important recent contributions to the subject are those of Nobbe and Hiltner, who claim* that the assimilation bears a direct relation to the formation of bacteroids. In many cases plants growing in rich soil and well supplied with nodules, when inoculated with pure cultures of *Bacillus radicicola* behaved very differently; some growing considerably in the amount of nitrogen, and others apparently suffering from nitrogen hunger. Examination proved that the nodule producing organisms were unchanged in the weak plants, while in the thrifty ones the bacteria were changed to bacteroids. The conclusions drawn were that "(1) tubercles in which bacteroid formation does not occur are injurious instead of beneficial to the host plant (the unchanged bacteria are then merely parasites;) (2) the unchanged bacteria present in tubercles seem to have no relation to the nitrogen fixation by legumes; (3) the more vigorous the bacteria the less tendency there is toward bacteroid formation; (4) the assimilation of nitrogen begins with the formation of bacteroids."†

Nobbe and Hiltner claim further that the bacteroids are formed by repeated division of the tubercle germ without the separation into isolated individuals. This continued division usually takes place transversely, producing an elongated growth, although lateral protuberances often arise making a branched and irregular appearance. They liken the swollen branched bacteroids to a gill respiration, the nitrogen being absorbed by the water and thus coming to the absorbing surfaces in a dissolved condition.‡

*Landw. Vers. Stat. 42: 459 *et seq.*
†Cited by Russell, Bot. Gaz. 19, 291, (1884).
‡Ibid.

ARE THERE SEVERAL SPECIES OF NODULE-PRODUCING ORGANISMS?

The fact that many different forms of bacteroids have been noted among the different species of legumes, has led to the view that each species of leguminous plant may have its specific nodule-producing bacterium. In nitrogen-free soils, as shown by Nobbe and Hiltner,* *Lupinus luteus, L. augustifolius* and some of the Acacias, produce tubercles when inoculated with bacteria of pea and bean tubercles, but when nitrogen was present in the soil, no infection occurred; an indication that nitrogen hunger is an important factor.

Bolley has observed† that many of the introduced legumes, especially *Trifolium pratense*, often fail to establish themselves in the virgin soil of the prairie, even though native leguminous species may be abundant. On the other hand, when preceded by *Trifolium repens*, the red clover develops tubercles and is thrifty.

Schneider‡ has classified the various forms under the general name of *Rhizobium*, adopting the generic name suggested by Frank.§ This classification is based mainly on form, but cultural characteristics have since been ascribed to several of these forms.

Byerinck made numerous artificial cultures and claims** that different races were obtained which remained true to form through successive cultures.

Nobbe, Schmid, Hiltner and Hotter†† found that "*Lupinus luteus* inoculated with pea tubercle organisms, as well as those from Robinia, Cytisus and Gleditschia, developed no tubercles, but when inoculated with lupine tubercle organisms, developed tubercles. *Phaseolus vulgaris* inoculated with cultures from tubercles of Phaseolus and peas developed tubercles, but if inoculated with cultures from tubercles of Lupinus or Robinia none were developed. In one case *Pisum sativum* inoculated

*Landw. Vers. Stat. 39, 227-359 (1893).
†Ag. Sci. 7: 58, (1893).
‡Bul. Torrey Bot. Club XIX 203, July 1892.
§Ueber die Pilzesymbiose der Leguminosen, Berlin 1890.
**Bot. Zeit. 1888; cited by Atkinson, Bot. Gaz. 18: 262.
††Landw. Versuchs Stat. XXXIX (1891), 227-359.

with lupine tubercle organisms developed tubercles, while in other cases it did not."*

Laurent† found that he could produce tubercles on the roots of the pea, by inoculating from the tubercles of any one of thirty-six different species of leguminous plants. All species, however, would not produce them in equal numbers. From these and other studies he believed that there are many varieties of the organism associated with the different species of legumes. It was found, however, that ordinary soil bacteria have no power to produce tubercles.

Atkinson inoculated young plants of *Dolichos sinensis* with organisms from *Vicia sativa* without effect, while inoculated plants of Vicia from the same culture produced tubercles. Considering the almost universal infection of leguminous plants, however, he doubts whether there are so many species as are represented by the different forms of bacteroids and suggests a possible influence of the various plants on which the different forms are found. "Does not the influence of the macrosymbiont upon the microsymbiont while within the tubercle fix a certain type of racial form and attenuation upon the microsymbiont until it shall have passed through normal conditions in the soil again and been restored to its original form and infecting power?"‡ The question as yet remains open.

FIXATION OF NITROGEN BY NON-LEGUMINOUS PLANTS.

Some non-leguminous plants possess well developed root tubercles, the function of which is, in many cases, uncertain. Among such is *Elaeagnus angustifolius*. This plant, as shown by Nobbe and others§ is without doubt able through its root tubercles, to assimilate the free nitrogen of the air. These tubercles are produced by an organism entirely distinct from *Bacterium radicicola*. In demonstrating this power of assimilation in Elaeagnus, Nobbe planted some Elaeagnus seedlings in pots containing sterilized nitrogen-free sand. The sand in one pot was then inoculated with an extract of soil in which Elaeagnus had grown. No marked result was noticeable the first

*Cited by Atkinson, Bot. Gaz. 18: 263.
†Ann. d. L'Inst. Pasteur, 1891, No. 2.
‡Atkinson, Bot. Gaz. 18: 263. (1893).
§Landw. Vers. Stat. 41, pp. 138-140.

season, but the following year the plant from the inoculated pot made a vigorous growth and branched freely, while uninoculated plants were without branches and in a famished condition.

Experiments by Breal,* Frank,† and others indicate that some other non-leguminous crops—including oats, barley, rape, spurry and cresses—may utilize a certain amount of atmospheric nitrogen. In Breal's experiments, cress seeds were germinated on moist filter paper and then transferred to flower pots containing sand. The pots were moistened with a nutritive solution containing all the essential elements of plant food except nitrogen. The plants developed slowly at first but afterward made normal growth and produced seeds. A determination of the amount of nitrogen in sand at the beginning and the end of the experiment, as also that in the water used and in the plants, was made. It was found that the plants produced, contained much more nitrogen than the seed and the water used.

That the gain above noted was due to micro-organisms was shown by a duplicate lot in which both the sand and the seeds used were sterilized. "The plants in sterilized soil grew normally at first but after reaching a height of about 0.14 meter produced a few imperfect seeds and began to languish."

From the data presented it was concluded:

1. "A soil very poor in nitrogenous matter planted with cresses (Breal) or with various phanerogamous or cryptogamous plants (Frank) is capable of bringing these plants to maturity.

2. "The nitrogen used is not entirely derived from the soil, since it appears that in some cases the soil is enriched instead of impoverished by the gain of the plant, and in cases where loss does occur it is overbalanced by the gain by the plant."‡

In a résumé of his experiments in 1892§ Frank referred to two experiments with non-leguminous phanerogams—mustard and potato. The results were as follows:¶

Sinapis alba (4 plants)—grams of nitrogen in seed 0.0012; in crop, 0.0043.

*Ann. Agronom. 18 (1892), No 8, pp. 269-379.

†Deut. Landw. Presse, 1891, p. 779.

‡Abstract of Breal's paper, Ex. Sta. Record IV, 376.

§Bot. Ztg. 51: 150 *et. seq.*

¶Cited by Russell, Bot. Gaz. XIX, 286.

Solanum tuberosum (4 pcs.)—grams of nitrogen in seed 0.022; in crop, 0.2186.

Another experiment with *Sinapis alba* detailed in the same paper, also indicated a certain amount of nitrogen fixed. These results with mustard were apparently confirmed by Liebscher,* but in both cases the methods of analysis were lacking in accuracy and the factors of growth were not carefully controlled.

Lotsy† in 1893, after a very careful study of the subject, using both sand and water cultures in sterilized and unsterilized conditions, asserts positively that neither *Sinapis alba* nor *S. nigra* are able to live without combined nitrogen. Schloesing and Laurent have also shown‡ that white mustard, oats, cress and spergula were unable to assimilate free nitrogen.

In 1890, Petermann§ announced that barley was as efficient as beans in collecting nitrogen. After repeating his experiments, however, under more careful control, he was obliged to retract.¶

In 1893, Frank,** in summarizing the results of his experiments, repeated his assertion that, "the non-leguminous organisms can assimilate free nitrogen," and cites examples of fungi, algae and mosses, as well as oats, buckwheat, spurry, turnip, white mustard, potato and maple.

Nobbe and Hiltner†† conducted a series of experiments with mustard. The plants were grown in sand to which varying amounts of nitrogen were added from time to time. The total yield of nitrogen kept pace with the varying amounts of soil nitrogen, but there was no increase due to assimilation of free nitrogen.

In another experiment‡‡ with peas, mustard, buckwheat, and oats, it was found that the peas alone were able to acquire the nitrogen of the air, while the others showed a decline in spite of the increased amount of nitrogen in the soil.

Frank's discovery that certain algae are able to utilize uncombined nitrogen has been repeatedly confirmed by Schloesing

*Jour. f Landw. 41: 180 (1893).
†Bul. 18, O. E. S., U. S. Dept. of Agr.
‡Ann. Inst. Past. 6: 114 (1892).
§Mem. Acad. Roy. de Belg. 44: 1889.
¶Bul. Acad. Roy. de Belg. 25: 267-276, 1893.
**Bot. Ztg. 51: 139 (1893).
††Landw. Vers. Stat. 45 (1894), 155-159.
‡‡*Ibid.*

and Laurent* as well as by Koch and Kossowitsch† and others. This fact of assimilation of algae, long overlooked, is of the greatest importance in harmonizing the results of various investigators in studying non-leguminous plants where the amount of nitrogen claimed to be assimilated is always small.

SOIL INOCULATION.

Some of the most valuable work in the inoculation of soils with tubercle bacilli is that of Nobbe‡ and others at Tharand, Saxony. In these experiments peas, lupines, beans, common locust (*Robinia pseudacacia*), honey locust (*Gleditschia triacanthos*) and Laburnum (*Cytisus Laburnum,*) were used. Both pure cultures of bacteria, prepared from the tubercles of each species, and extracts of soil in which each of the above mentioned plants had previously grown were employed.

It was found that the extracts of different soils are quite different in their action on different plants. Nearly all the plants inoculated produced tubercles, but in varying numbers, and the tubercles were confined almost exclusively to those roots near the surface.

One very interesting fact in this connection is that where the inoculation of Robinia was successful the amount of dry matter produced and the percentage of nitrogen in the same, were larger than when the plants received a dressing of nitrogenous fertilizers instead. The results obtained from these experiments will be referred to more in detail hereafter.

Lawes and Gilbert, in 1888, carried on extensive experiments with peas, beans, vetches, lupines, white and red clover, sainfoin and lucern. Plants were grown in sterilized soil; also in rich garden soil to which a watery extract from soils which had previously grown each of the various crops under study, was applied. Favorable results were obtained and the next year the work was repeated. It was found that without the "microbe-seeding," nodules were not formed and there was no gain of nitrogen; but when the microbes were added, there was nodule formation and, co-incidently, considerable gain of nitrogen.

*Compt. rend. 115; 732 (1892).
†Bot. Ztg. 51; 342 (1893).
‡Landw. Vers. Stat. 39, pp. 327-359.

In the sand, the infection was comparatively limited, though some of the nodules developed to great size. In the rich soil the infection was more general and the nodules, though more numerous were much smaller.

Some of the most careful work done in this direction is that of Hellriegel and Wilfarth* at Bernburg, Germany. In the pot experiments made, it was found that when the soil was not sterilized the leguminous plants had tubercles on the roots and there was a noticeable acquisition of nitrogen. When the soil was kept sterile, the plants grew only in proportion to the nitrogen in the soil; the roots had no tubercles and there was no evidence of acquisition of atmospheric nitrogen.

In the field experiments at Bernburg, the fact that different species of leguminous plants require different kinds of tubercle-bacteria was well shown.

Nobbe, Schmid, Hiltner and Hotter, having observed† that when soils were inoculated at the surface, only the upper part of the root system produced tubercles, undertook to determine the reason for this.‡ Some pea plants were set in sterilized sand and supplied only with mineral manures. After forty-one days there were marked evidences of a lack of nitrogen and the soil was inoculated to a depth of 200 mm. with an emulsion of pure cultivated pea-tubercle bacteria. The effect of the inoculation was soon apparent. Within three weeks the plants took on a dark green color and developed rapidly. On harvesting it was observed that only those roots in close proximity to the point of inoculation had produced tubercles, showing the inability of the bacteria to spread to any considerable extent in the soil. The experiment was repeated with like results. "It appears that the distribution of tubercles on the roots is determined by the presence of active bacteria in the soil at the proper place and time."

Schmitter, in Germany, found marked results from the inoculation of clay soils with bacteria from the root tubercles of lupines. On cultivated soils results were negative, but on soils previously uncultivated the increase in the weight of the lupine plants was from 11 to 32 per cent.§

*Résumé by Wilfarth, Ex. Sta. Record III, 334 (1891).

†Landw. Vers. Stat. 39, pp. 327–359.

‡Landw. Vers. Stat. 41, pp. 137, 138.

§Bot. Centbl. 57 (1894), No. 1, pp. 25, 26.

Jaspers* cites a statement by Von Landsberg, that the lupine thrives without inoculation on land which has grown broom (*Sarothamas scoparius.*) He thinks that the organism causing root tubercles may sink deep into the soil and retain its vitality for a long time. In proof of this theory he cites the observation that lupines flourished even at the bottom of deep cuts along the railroad.

This position is directly contrary to that before expressed, viz.: That the bacteria are diffused but slightly through the soil.

PRACTICAL APPLICATIONS.

Soil inoculation may be accomplished either by distributing some material containing the specific germs over the soil or by bringing the seeds in contact with the germs before planting; thus assuring the presence of bacteria when the roots first start. The material used may be either soil in which leguminous plants of the same or a closely related kind have previously been grown; or tubercles from such plants; or it may be a pure culture in gelatin of the specific bacteria required.

The prepared culture, sold as Nitragin or Germ Fertilizer is made in Germany and may be obtained of Victor Koechl & Co., 79 Murray Street, New York. Cultures for pea, clover, vetch and various other legumes are made.

Our experience at the Experiment Station in the inoculation of soils with specific bacteria has been limited, but in the case of the soja bean decided results were obtained.

Until the present season soja beans were never grown in the station garden, therefore it was safe to assume that none of the bacteria peculiar to the plant were present in the soil.

June 14, a quantity of soja beans was planted in drills and with the seed a number of tubercles from the previous year's crop at the Storrs Experiment Station, were scattered. In contiguous rows, the same variety of bean was planted without tubercles. The crop was cut by frost before maturity so no weights were obtained, but on October 14, the following results were noted:

1. The plants from the inoculated soil were more stocky and of a darker color than those from the adjacent rows.

*Deut. landw. Presse. 22 (1895), No. 28, p. 266.

2. The plants from the inoculated soil bore an abundant supply of tubercles while the others bore *none*.

3. The average height of plants from inoculated soil was 2 feet 2 inches; from the other plot, 1 foot 11 inches.

4. The average number of pods per plant from inoculated soil was 81, from the other plot 74.

Our results are confirmed and emphasized by the experience of Professor J. F. Duggar of the Alabama Experiment Station. In his work with the hairy vetch (*Vicia villosa*), Duggar found that plants from seed dipped in water into which there had been stirred earth in which the common vetch had formerly grown, were vastly superior to those from seed not treated. "With inoculation the yield was over ten times as great as without inoculation, the increase in hay being 995 per cent.*

A Trial of Nitragin—In April, the W. H. Bowker Fertilizer Company sent a bottle of nitragin for the common pea for trial. The material was used in accordance with the directions sent, i. e., the nitragin was warmed and diluted with water after which it was poured over the seed and allowed to stand for an hour. The peas were then planted in the field and in adjacent rows seeds not treated were planted.

There was no appreciable effect from the inoculation. Tubercles developed abundantly on both lots, a result which is not strange, since peas have been grown freely in the vicinity for many years and the necessary germs have been carried by the wind in all directions.

A series of green-house experiments conducted by Duggar† at the Alabama Experiment Station yielded very different results from our own and indicate that on some soils nitragin may give a very marked increase in the yields of leguminous plants.

Duggar's work included experiments with hairy vetch, Canada field peas, and crimson clover, and it was found that in each case the yield was greatly increased as a result of the inoculation.

"The increase in weight of inoculated plants after thoroughly drying was as follows:

*Bul. 87 Alabama Expt. Sta. 466.

†l. c.

"Hairy vetch increased by 89 per cent.

"Canada field peas increased by 138 per cent.

"Crimson clover (young plants) increased by 146 per cent.

"Germ fertilizer prepared for vetch was effective on Canada field peas."

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DIGESTION EXPERIMENTS.

J. M. Bartlett.

The digestibility of the following materials has been determined during the past year:

Silage—Made of mature flint corn, sunflower heads and horse beans.

Silage—Made of mature flint corn, sunflowers (whole plant) and horse beans.

Silage—Made of Sanford corn, a large white flint variety.

Hay, mostly timothy.

Corn meal.

Skimmed milk.

The animals used were sheep (wethers), from five to seven years old, of medium size and in good condition. No. 1 was slightly larger and more vigorous than the other two and he also had a better appetite, with perhaps stronger digestive powers, which may account for his giving higher digestive coefficients when heavily fed. No. 2, when fed a ration of hay alone, refused to eat but a small quantity and it would seem that his dislike for the food affected his digestion, as he gave a very low coefficient for protein. They all stood the confinement well and as a rule ate their rations up clean.

The experiments were conducted on the plan which has been followed in the past by the Station. The feeding periods were twelve days each; the first seven days being used as preliminary feeding, and the last five days for the experiment, during which time the feces were collected and weighed. The rations were uniform for each animal and weighed throughout the whole feeding period.

In connection with these digestion experiments the heats of combustion of the feeding stuffs and the feces were determined by the use of the bomb calorimeter. The method followed in the calculations is that of Atwater and Woods given on pages 123 and following in the report of the Storrs (Conn.) Experiment Station, for 1894.

The composition of the feeding stuffs used in these experiments is given in the table which follows:

COMPOSITION OF FODDERS AND FEEDING STUFFS USED IN DIGESTION EXPERIMENTS IN 1896-7.

	Station number.	Water.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%	%
Silage (mature corn, sunflower heads, and horse beans)	4045	79.85	1.70	2.72	5.00	9.99	0.74
Silage (mature corn, sunflower, whole plant, and horse beans)	4046	80.90	1.67	2.31	4.83	9.62	0.67
Silage (Sanford corn, partially mature	4048	81.50	1.27	1.80	4.90	9.97	0.56
Hay, mostly timothy	4061	16.50	4.92	7.91	26.57	42.33	1.77
Corn meal	4062	14.84	1.71	10.31	1.67	68.43	3.04
Skimmed milk	4075	90.50	0.75	3.56	....	5.07	0.12

COMPOSITION OF FODDERS AND FEEDING STUFFS USED IN DIGESTION EXPERIMENTS IN 1896-7 CALCULATED TO WATER-FREE SUBSTANCE.

	Station number.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%
Silage (mature corn, sunflower heads, horse beans)	4045	8.44	13.50	24.81	49.60	3.65
Silage (mature corn, sunflowers, whole plant, and horse beans)	4046	8.73	12.09	25.27	50.40	3.51
Silage (Sanford corn, partially matured)	4048	6.90	9.72	26.45	53.90	3.03
Hay, mostly timothy	4061	5.89	9.47	31.82	50.70	2.12
Corn meal	4062	2.00	12.10	1.96	80.37	3.57
Skimmed milk	4075	7.85	37.50	....	53.37	1 28

DIGESTION EXPERIMENT 56—(MIXED SILAGE.)

Material used: Silage made of mature flint corn, horse beans and sunflower heads, cut and put in the silo in the proportion of one acre of corn, one-fourth acre of sunflower heads and one-half acre of horse beans. This mixture was first recommended by Professor Robertson of Canada, and so far as the writer is aware, this is the first digestion experiment that has ever been made with it. The material was perfectly preserved in the silo and readily eaten by the sheep. The results of the experiment are given in the following tables:

RATIONS.

Fed daily, Sheep I, 3,000 grams.
Fed daily, Sheep II, 2,500 grams.

COMPOSITION OF FODDER AND FECES.

	Lab. number.	Dry matter.	Water-free.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDERS.		%	%	%	%	%	%	%	
Silage (corn, sunflower heads, horse beans)..	4045	20.15	91.56	8.44	13.50	24.81	49.60	3.65	4370
FECES.									
Sheep I................	4049	....	84.69	15.31	14.60	27.73	39.84	2.52	4415
Sheep II...............	4050	....	86.34	13.66	14.62	29.49	39.70	2.53	4425

FUEL VALUE OF FOOD FOR 5 DAYS AS DETERMINED BY THE BOMB CALORIMETER.

	Fuel value of food eaten.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea, etc.	Total available fuel value.	Per cent available fuel value.
	Calories.	Calories.	Calories.	Calories.	Calories.	%
Sheep I............	13208.	4328	8880	231	8649	65.5
Sheep II...........	11007	4073	6934	179	6755	61.4
Average........						63.5

TOTAL NUTRIENTS IN THE FODDER EATEN AND FECES EXCRETED IN FIVE DAYS.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
Sheep I:	Grams.	Grams.	Grams	Grams	Grams	Grams.	Grams
Silage	3022.5	2767.3	255.1	408.1	749.6	1499.2	110.4
Feces	980.2	830.1	150.1	143.1	271.8	390.5	24.7
Digested	2042.3	1937.2	105.0	265.0	477.8	1108.7	85.7
Per cent digested	67.6	70.0	41.2	64.9	63.7	74.0	77.6
Sheep II:							
Silage	2518.8	2306.2	212.6	340.0	624.7	1249.4	92.1
Feces	920.5	794.8	125.7	134.6	271.5	365.4	23.3
Digested	1598.3	1511.4	86.9	205.4	353.2	884.0	68.8
Per cent digested	63.5	65.6	40.9	60.4	56.5	70.8	74.7
Average per cent digested	65.6	67.8	41.1	62.7	60.1	72.4	76.7

DIGESTION EXPERIMENT 57—(MIXED SILAGE.)

Material used: Silage made of mature flint corn, horse beans and sunflowers (whole plant), cut and put in the silo in the proportion of one acre of corn, one-fourth acre sunflowers and one-half acre horse beans. This mixture was well preserved and notwithstanding the coarse nature of the sunflower stalks was readily eaten by the sheep, not enough being left to affect the results.

RATIONS.

Fed daily, Sheep I, 3,000 grams; Sheep II, 2,500 grams.

COMPOSITION OF FODDER AND FECES.

	Laboratory number.	Dry matter.	Water-Free.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDERS.		%	%	%	%	%	%	%	
Silage (corn, sunflowers, horse beans)	4046	19.10	91.27	8.73	12.09	25.27	5.04	3.51	4334
FECES.									
Sheep I	4051	......	80.91	19.09	14.44	25.82	38.33	2.32	4215
Sheep II	4052	......	81.46	18.54	15.03	24.90	38.55	2.98	4205

TOTAL NUTRIENTS IN THE FODDER EATEN AND FECES EXCRETED IN FIVE DAYS.

MATERIALS.	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
Sheep I.	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Silage	2864.0	2614.0	250.0	346.3	723.7	1443.5	100 5
Feces	1041.3	842.5	198.8	150.4	268.9	399.1	24.1
Digested	1822.7	1771.5	51.2	195.9	454.8	1044.4	76.4
Per cent digested	63.6	67.8	20.5	56.6	62.8	72.4	76.0
Sheep II.							
Silage	2378.5	2170.9	207.6	287.5	601.1	1198.8	83.5
Feces	776.9	632.9	144.0	116.8	193.4	299.5	23.2
Digested	1601.6	1538.0	63.6	170.7	407.7	899.3	60.3
Per cent digested	67.3	70.8	30.6	59.3	67.8	75.0	72.2
Average	65.5	69.3	25.6	58.0	65.3	73.7	74.1

FUEL VALUE OF FOOD FOR 5 DAYS AS DETERMINED BY THE BOMB CALORIMETER.

EXPERIMENT II.	Fuel value of food eaten.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea, etc.	Total available fuel value.	Per cent available fuel value.
	Calories.	Calories.	Calories.	Calories.	Calories.	%
Sheep I	12,413	4389	8024	170	7854	63.3
Sheep II	10,308	3267	7041	149	6892	66.9
Average	....	....	....	....	....	65.1

DIGESTION EXPERIMENT 58—(CORN SILAGE.)

Material used: Silage made from Sanford corn, a large white flint variety but recently grown in this section. An enormous crop was produced in 1896 which was only partially matured, only a part of the ears being glazed. Although this silage was well preserved and in good condition, Sheep No. II refused to eat it, consequently two trials were made with Sheep I.

The results are given in the following tables:

RATIONS.

Fed daily, Sheep I, 3,000 grams.

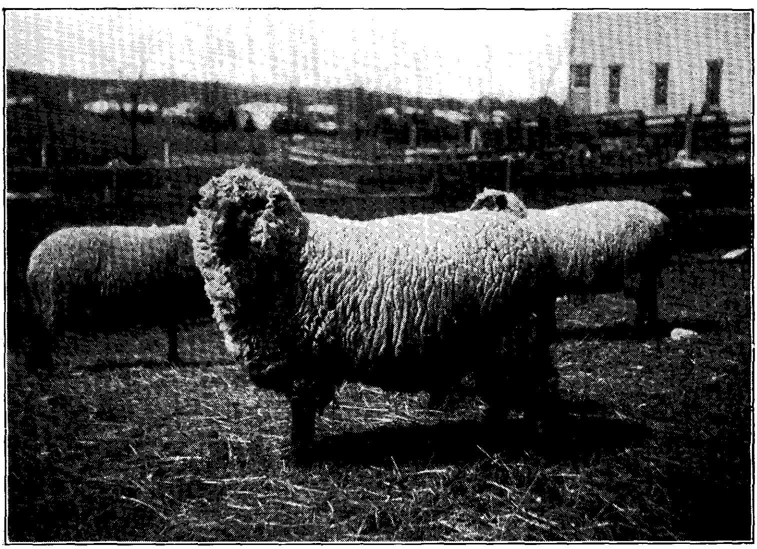
COMPOSITION OF FODDERS AND FECES.

	Lab. number.	Dry matter.	Water-free. Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDERS.		%	%	%	%	%	%	%	
Silage, Sanford corn.	4048	18.57	9.31	6.9	9.72	26.45	53.9	3.03	42.34
FECES.									
Sheep I	4053	-	84.52	15.48	13.84	27.34	43.74	2.60	43.81
Sheep II	4054	-	85.44	14.56	14.36	24.78	43.44	2.86	44.26

TOTAL NUTRIENTS IN THE FODDER EATEN AND FECES EXCRETED IN FIVE DAYS AND PER CENTS DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
SHEEP I.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Silage	2775.0	2583.5	191.5	269.7	734.0	1495.7	84.1
Feces	846.7	715.6	131.1	117.2	206.1	370.3	22.0
Digested	1928.3	1867.9	60.4	152.5	527.9	1125.4	62.1
Per cent digested......	69.5	72.3	31.5	56.5	71.9	75.2	73.8
SHEEP I.							
Silage	2775.0	2583.5	191.5	269.7	734.0	1495.7	84.1
Feces	824.9	704.8	120.1	118.4	204.4	358.4	23.6
Digested	1950.1	1878.7	71.4	151.3	529.6	1137.3	60.5
Per cent digested......	70.3	72.7	37.3	56.1	72.2	76.0	71.9
Average	69.9	72.5	34.4	56.3	72.1	75.6	72.9

DORSET HORN BUCK.



SHROPSHIRE BUCK.

FUEL VALUE OF FOOD FOR FIVE DAYS AS DETERMINED BY THE BOMB CALORIMETER.

EXPERIMENT III.	Fuel value of food eaten.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea, etc.	Total available fuel value.	Per cent available fuel value.
	Calories.	Calories.	Calories.	Calories.	Calories.	%
Sheep I	10769	3366	7403	133	7270	67.5
Sheep I	10769	3306	7463	132	7331	68.1
Average	-	-	-	-	-	67.8

DIGESTION EXPERIMENT 59—(HAY.)

Material used: Hay, mostly timothy.

The object of this experiment was to determine the digestibility of hay which was to be fed with corn meal and skimmed milk in the next three experiments.

The results are presented below:

RATIONS.

Fed daily, Sheep I, 600 grams.
Fed daily, Sheep II, 400 grams.
Fed daily, Sheep III, 600 grams.

COMPOSITION OF FODDERS AND FECES.

	Laboratory number.	Dry matter.	Water-free.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDERS.		%	%	%	%	%	%	%	
Hay	4061	83.5	94.11	5.89	9.47	31.82	50.70	2.12	4867
FECES.									
Sheep I	4055	-	89.81	10.19	11.51	33.47	41.81	3.02	4694
Sheep II	4056	-	90.36	9.64	12.61	32.35	42.43	2.98	4711
Sheep III	4057	-	91.39	8.61	10.98	34.73	43.12	2.56	4694

TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
SHEEP I.							
Hay	2505	2357.5	147.5	237.3	797.1	1270.0	53.1
Feces	1070	961.0	109.0	123.2	358.1	447.4	32.3
Digested	1435	1396.5	38.5	114.1	439	822.6	20.8
Per cent digested	57.3	59.2	26.1	48.1	55.1	64.8	39.2
SHEEP II.							
Hay	167.0	1571.6	98.4	158.1	531.4	846.7	35.4
Feces	766.9	693.0	73.9	96.7	248.1	325.3	22.9
Digested	903.1	878.6	24.5	61.4	283.3	521.4	12.5
Per cent digested	54.1	56.9	24.9	38.8	53.3	61.6	35.3
SHEEP III.							
Hay	2505	2357.5	147.5	237.3	791.1	1270.0	53.1
Feces	1160.6	1060.7	99.9	127.4	403.1	500.5	29.7
Digested	1344.4	1296.8	47.6	109.9	388.0	769.5	23.4
Per cent digested	53.7	55.0	32.3	46.3	49.0	60.6	44.1
Average	55.0	57.0	27.8	44.4	52.5	62.3	38.9

FUEL VALUE OF FOOD FOR FIVE DAYS AS DETERMINED BY THE BOMB CALORIMETER.

Experiment IV.	Fuel value of food eaten.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea, etc.	Total available fuel value.	Per cent available fuel value.
	Calories.	Calories.	Calories.	Calories.	Calories.	%
Sheep I	12191	5023	7168	99	7069	57.9
Sheep II	7821	3613	4268	53	4155	53.1
Sheep III	12191	5448	6743	96	6647	54.5
Average	-	-	-	-	-	55.2

DIGESTION EXPERIMENT 60—(CORN MEAL.)

Material fed: Hay and corn meal.

The object of this experiment was to determine the digestibility of the protein of corn meal. The American coefficient for protein is much less than the German and about 25% less than that of gluten meal, which is a residue of corn left in the manufacture of glucose and starch. One would expect, therefore, protein of corn and gluten meals to have about the same digestibility, unless the carbohydrates which are removed in the manufacture of gluten meals protect the protein from the action of digestion fluids, which supposition is hardly probable. It is most likely that the large difference noted is due to metabolic nitrogen of the feces, which would introduce a much greater error in the case of a feed low in protein, like corn meal, than in the case of a feed higher in protein, like gluten meal. It is necessary to feed a coarse fodder like hay with a fine feed like corn meal in order to keep the animal in normal condition. The digestibility of the hay used was determined in the preceeding experiment and in calculating the digestibility of the corn meal, the individual coefficients of each sheep obtained for the hay was used instead of an average of them.

The detailed results are given in the following tables:

RATIONS.

Fed daily each sheep, hay, 400 grams; corn meal, 300 grams.

COMPOSITION OF FOOD AND FECES.

	Laboratory number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
		%	%	%	%	%	%	%	
FODDERS.									
Hay	4061	83.5	94.11	5.89	9.47	31.82	50 7	2.12	4867
Corn meal	-	85.6	98.00	2.00	12.10	1.96	80.37	3.57	-
FECES.									
Sheep I	4058	-	88.81	11.19	15.51	28.36	41.70	3.24	4694
Sheep II	4059	-	90.64	9.36	15.33	28.85	43.44	3.02	4699
Sheep III	4060	-	91.33	8.67	13.02	33.48	42.14	2.69	4820

TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED FOR FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
SHEEP I.							
Fed in hay	1670	1571.6	98.4	158.1	531.4	846.7	35.4
Fed in corn meal	1277.4	1251.9	25.5	154.6	25.0	1026.7	45.6
Total fed	2947.4	2823.5	123.9	312.7	556.4	1873.4	81.0
Total feces	749.8	665.9	83.9	116.3	212.7	312.6	24.3
Total digested	2197.6	2157.6	40.0	196.4	343.7	1560.8	56.7
Digested from hay	956.6	930.9	25.7	76.0	-	548.4	13.9
Digested from corn meal	1241.0	1226.7	14.3	120.4	-	1012.4	42.8
Per cent digested from corn meal	97.1	98.0	56.1	77.8	-	98.6	93.8
SHEEP II.							
Fed in hay	1670.0	1571.6	98.4	158.1	531.4	846.7	35.4
Fed in corn meal	1277.4	1251.9	25.5	154.6	25.0	1026.7	45.6
Total fed	2947.4	2823.5	123.9	312.7	556.4	1873.4	81.0
Total feces	847.7	768.4	79.3	129.9	244.6	368.3	26.6
Total digested	2099.7	2055.1	44.6	182.8	311.8	1505.1	55.4
Digested from hay	903.1	878.6	24.5	61.4	-	521.4	12.5
Digested from corn meal	1196.6	1176.5	20.1	121.4	-	983.7	42.9
Per cent digested from corn meal	93.7	93.9	78.8	78.5	-	95.8	94.1
SHEEP III.							
Fed in hay	1670.0	1571.6	98.4	158 1	531.4	846.7	35.4
Fed in corn meal	1277.4	1251.9	25.5	154.6	25.0	1026.7	45.6
Total fed	2947.6	2823.5	123.9	312.7	556.4	1873.4	81.0
Total feces	911.8	832.7	79.1	118.7	305.3	384.2	24.5
Total digested	2035.8	1990.8	44.8	194.0	251.1	1489.2	56.5
Digested from hay	896.3	864.5	31.8	73.2	-	513.0	15.6
Digested from corn meal	1139.5	1126.5	13.0	120.8	-	976.2	40.9
Per cent digested from corn meal	89.2	89.9	50.9	79.7	-	95.1	89.7
Corn meal average	93.3	93.6	61.9	78.7	-	98.5	92.5

DIGESTION EXPERIMENT 61—(SKIMMED MILK.)

Material used: Hay and skimmed milk.

This experiment was made to determine the digestibility of skimmed milk which was to be used as a source of digestible protein in further experiments with corn meal. In nearly all digestion experiments with human subjects the protein of milk has been assumed to be wholly or at least 98 per cent digestible, and it was expected that figures agreeing quite closely with those would be obtained with sheep. It will be seen by the tables that the results of the experiment give figures considerably below the assumed digestibility and probably much lower than they should be, due to the error introduced by the presence of metabolic nitrogen in the feces. The corrected results given in tables on page 155 are probably more nearly correct.

It will be observed also that the organic matter is about one hundred per cent digestible, which makes the figures for protein appear more inconsistant.

RATIONS.

Fed daily each sheep, hay, 400 grams; milk, 3,500 grams.

NOTE—Sheep No. II took but 200 grams of hay per day.

COMPOSITION OF FOOD AND FECES.

	Laboratory number.	Dry matter.	Water-free.					
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%	%	%
FODDERS.								
Hay	4061	83.50	94.11	5.89	9.47	31.82	50.70	2.12
Skimmed milk	4075	9.50	92.15	7.85	37.50	-	53.37	1.28
FECES.								
Sheep I	4068	-	81.78	18.22	15.88	24.07	39.26	2.57
Sheep II	4069	-	77.80	22.2	20.15	19.78	35.99	1.88
Sheep III	4070	-	86.43	13.57	14.70	27.22	42.10	2.41

TOTAL NUTRIENTS IN HAY EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
SHEEP I.							
Fed in hay	1670.0	1571.6	98.4	158.1	531.4	846.7	35.4
Fed in skimmed milk	1649.0	1518.8	130.2	617.9	-	880.1	20.8
Total fed	3319.0	3090.4	228.6	776.0	531.4	1726.8	56.2
Total feces	783.7	640.9	142.8	124.5	188.6	307.7	20.1
Total digested	2535.3	2449.5	85.8	651.5	342.8	1419.1	36.1
Digested from hay	956.6	930.9	25.7	76.0	292.6	548.4	13.9
Digested from skimmed milk	1578.7	1518.6	60.1	575.5	-	870.7	22.2
Per cent digested from skimmed milk	95.7	99.9	46.1	93.1	-	98.9	106.7
SHEEP II.							
Fed in hay	835.0	785.8	49.2	79.0	265.7	423.4	17.7
Fed in skimmed milk	1653.8	1523.2	130.6	619.7	-	882.6	20.9
Total fed	2488.8	2309.0	179.8	698.7	265.7	1306.0	38.6
Total from feces	450.5	350.5	100.0	90.8	89.1	162.1	8.5
Total digested	2038.3	1958.5	79.8	607.9	176.6	1143.9	30.1
Digested from hay	451.6	439.3	12.3	30.7	141.6	260.7	6.3
Digested from skimmed milk	1586.7	1519.2	67.5	577.2	-	883.2	23.8
Per cent digested from skimmed milk	95.9	99.8	51.7	93.1	-	100.4	113.9
SHEEP III.							
Fed in hay	1670	1571.6	98.4	158.1	531.4	846.7	35.4
Fed in skimmed milk	1655.4	1524.6	130.8	620.7	-	884.0	20.9
Total fed	3325.4	3096.2	229.2	778.8	531.4	1730.7	56.3
Total from feces	740.7	640.2	100.5	108.9	201.6	311.8	17.9
Total digested	2584.7	2456.0	128.7	669.9	329.8	1418.9	38.4
Digested from hay	896.8	864.4	31.8	73.2	262.7	513.0	15.6
Digested from skimmed milk	1687.9	1591.6	96.9	596.7	-	905.9	22.8
Per cent digested from skimmed milk	101.9	104.4	74.1	96.13	-	102.5	109.1

DIGESTION EXPERIMENT 62—(CORN MEAL.)

Materials used: Hay, skimmed milk, corn meal.

This experiment was undertaken to determine the effect of feeding a large amount of digestible protein, on the digestibility of corn meal.

The results with the different animals are not as close as is desirable, but the average coefficient for protein agrees very well with the average obtained in Experiment VI. It is possible that the ration fed was a little too heavy, especially for sheep 3, hence the low digestion coefficient obtained. The coefficients obtained in experiments VI and VII were used in calculating the digestibility of the hay and milk.

RATIONS.

Fed daily each sheep, hay, 300 grams; milk, 3,500 grams; corn meal, 300 grams.

COMPOSITION OF FODDERS AND FECES.

	Lab. number.	Dry matter.	Water-free.					
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
Fodders:		%	%	%	%	%	%	%
Hay	4061	83.50	94.11	5.89	9.47	31.82	50.70	2.12
Skimmed milk	4075	9.50	92.15	7.85	37.50	....	53.37	1.28
Corn meal	4062	85.16	98.00	2.00	12.10	1.96	80.37	3.57
Feces:								
Sheep I	4071	....	81.39	18.61	18.45	21.84	38.66	2.44
Sheep II	4072	....	80.85	19.15	20.22	20.90	37.36	2.37
Sheep III	4073	....	85.00	15.00	17.13	26.30	39.65	1.92

TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED FOR FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
SHEEP I.	Grams	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Fed in hay	1252.5	1178.7	73.8	118.5	398.6	635.0	26.6
Fed in skimmed milk	1662.5	1531.3	131.2	623.0	-	887.3	21.0
Fed in corn meal	1277.4	1251.9	25.5	154.6	25.0	1026.7	45.6
Total fed	4192.4	3961.9	230.5	896.1	423.6	2549.0	93.2
Total in feces	704.9	573.7	131.2	130.0	154.0	272.5	17.2
Total digested	3487.5	3388.2	99.3	766.1	269.6	2276.5	76.0
Digested from hay and skimmed milk	2308.7	2231.1	79.8	637.0	-	1289.0	31.4
Digested from corn meal	1178.8	1157.1	19.5	129.0	-	987.5	44.6
Per cent digested from corn meal	92.3	92.4	76.4	83.4	-	96.2	97.8
SHEEP II.							
Fed in hay	1134.8	1068.0	66.8	107.5	361.1	575.3	24.1
Fed in skimmed milk	1662.5	1531.3	131.2	623.0	-	887.3	21.0
Fed in corn meal	1277.4	1251.9	25.5	154.6	25.0	1026.7	45.6
Total fed	4074.7	3851.2	223.5	885.1	386.1	2489.3	90.7
Total feces	699.0	565.1	133.9	141.3	146.1	261.1	16.6
Total digested	3375.7	3286.1	89.6	742.8	240.0	2228.2	74.1
Digested from hay and skimmed milk	2208.2	2140.1	84.5	620.8	-	1241.7	29.6
Digested from corn meal	1167.5	1146.1	5.1	122.0	-	986.5	44.5
Per cent digested from corn meal	91.4	91.6	20.0	78.9	-	96.1	97.6
SHEEP III.							
Fed in hay	1252.5	1178.7	73.8	118.5	398.6	635.0	26.6
Fed in skimmed milk	1662.5	1531.3	131.2	623.0	-	887.3	21.0
Fed in corn meal	1277.4	1251.9	25.5	154.6	25.0	1026.7	45.6
Total fed	4192.4	3961.9	230.5	896.1	423.6	2549.0	93.2
Total in feces	800.2	680.2	120.0	137.1	210.4	317.3	15.4
Total digested	3392.2	3281.7	110.5	759.0	213.2	2231.7	77.8
Digested from hay and skimmed milk	2325.1	2179.6	97.2	653.5	-	1272.1	32.7
Digested from corn meal	1067.1	1102.1	13.2	105.5	-	959.6	45.1
Per cent digested from corn meal	85.1	88.0	52.1	68.3	-	93.5	98.9
Average	98.6	90.7	49.5	76.9	-	95.3	98.1

SUMMARY OF DIGESTION COEFFICIENTS OBTAINED IN THE EXPERIMENTS HERE REPORTED.

	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
	%	%	%	%	%	%	%
Silage, mature flint corn, sunflower heads and horse beans	65.6	67.8	41.1	62.7	60.1	72.4	76.7
Silage, mature flint corn, sunflowers, whole plant, and horse beans	65.5	69.5	25.6	58.0	65.3	73.7	74.1
Silage, Sanford corn, partially mature	69.9	72.5	34.4	56.3	72.1	75.6	72.9
Hay, mostly timothy	55.0	57.0	27.8	44.4	52.5	62.3	38.9
Skimmed milk							
Corn meal (fed with hay)	93.3	93.6	61.9	78.7	......	98.5	92.5
Corn meal (fed with hay and skimmed milk)	89.6	90.7	49.5	76.9	......	95.3	98.1

DIGESTION COEFFICIENTS OBTAINED FOR PROTEIN AFTER CORRECTION FOR METABOLIC NITROGEN.

	Sheep.	Total protein in feces.	Protein Left After Treatment with: Pepsin, H Cl solution.	Protein Left After Treatment with: Alcohol, ether, water and lime water.	Coefficents After Treatment with: Pepsin, H Cl solution.	Coefficents After Treatment with: Alcohol, ether, water and lime water.
		grams.	grams.	grams.	%	%
Hay (mostly timothy)	I	123.2	80.4	84.1	66.1	64.6
	II	96.7	67.0	71.7	57.7	54.6
	III	127.4	84.6	77.4	64.4	67.5
Average					62.7	62.2
Corn meal (fed with hay)	I	116.3	77.7	70.9	84.4	90.4
	II	124.9	82.9	84.0	89.4	92.1
	III	118.7	77.2	68.3	86.5	89.1
Average					86.8	90.5
Skimmed milk (fed with hay)	I	124.5	81.0	73.9	95.6	97.1
	II	90.8	55.1	53.8	96.5	97.1
	III	108.9	74.2	61.2	97.1	98.4
Average					96.4	97.5
Corn meal (fed with hay, and skimmed milk)	I	130.0	80.8	71.4	91.6	92.6
	II	141.3	89.3	76.6	85.8	93.7
	III	137.1	91.6	74.7	79.7	83.1
Average					85.7	93.5

A SUMMARY OF ALL DIGESTION COEFFICIENTS OBTAINED WITH SHEEP AT THE MAINE EXPERIMENT STATION.

	Number of animals.	Total dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%	%	%
Blue joint (cut late in July)	2	39.9	41.8	10.	56.5	36.5	43.2	37.0
Buttercup (in full bloom)	2	56.1	56.6	48.1	56.3	41.1	66.9	69.7
Barley hay	1	59.1	62.3	44.8	65.2	61.7	63.3	40.5
Clover hay (alsike mixed with a little timothy)	2	54.9	56.2	......	55.5	46.2	64.1	53.2
Clover, alsike	2	62.7	63.6	51.4	68.2	55.9	67.3	61.2
Clover, alsike in full bloom	2	61.9	62.7	53.0	64.0	51.0	74.1	35.1
Average 2 experiments, 4 animals	....	62.3	63.2	52.2	66.1	53.5	70.7	48.2
Clover, white in late bloom	2	66.0	66.6	58.5	73.2	60.6	99.5	50.6
Corn fodder, southern (immature, no ears)	2	64.8	67.2	34.9	58.1	74.6	64.5	68.8
Corn fodder, southern (immature, no ears)	2	69.4	70.6	57.4	65.4	74.2	69.5	70.9
Corn fodder, southern (immature, no ears)	2	63.3	62.8	43.1	63.4	65.7	61.0	59.0
Average 3 experiments, 6 animals	....	65.8	66.9	45.1	62.3	71.5	65.0	66.2
Corn, sweet, partially matured, slightly frosted	2	60.9	63.1	23.4	59.0	70.2	59.4	67.5
Corn, sweet, whole plant mature	2	69.7	73.5	39.4	61.8	76.7	72.1	76.9
Corn, sweet, whole plant, ears mature	2	70.9	72.7	44.0	71.5	74.6	73.1	77.
Average 3 experiments, 6 animals	....	67.2	69.8	35.6	64.1	73.8	68.2	73.8
Corn, flint, partially mature, slightly frosted	2	70.2	72.4	44.2	63.6	79.8	70.3	71.6
Corn, flint, whole plant, ears glazed,	2	70.6	72.4	52.9	61.8	75.6	72.6	70.2
Corn, flint, whole plant, ears glazed,	2	72.7	74.2	50.7	67.6	78.6	73.8	64.7
Corn, flint, whole plant, ears just forming	3	69.8	71.4	54.7	70.4	72.3	71.3	67.3
Corn, flint, whole plant, ears partially glazed	3	69.7	73.6	20.0	68.6	70.7	76.7	73.7
Average 5 experiments, 12 animals	....	70.6	72.8	44.5	66.4	75.4	72.9	69.5
Hungarian grass, green	2	63.4	65.6	35.5	62.4	67.8	65.8	52.3
Hungarian hay, (grass dried)	2	65.0	66.3	47.4	60.0	67.6	67.1	63.8
Hay (mixed, timothy mostly)	3	55.0	57.0	27.8	44.4	52.5	62.3	38.9
Orchard grass past bloom	2	54.4	55.8	35.0	58.5	57.5	54.4	57.2
Oat straw	2	50.3	52.0	......	......	57.6	53.2	38.3

A SUMMARY OF DIGESTION COEFFICIENTS—CONTINUED.

	Number of animals.	Total dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%	%	%
Red top, full bloom	2	57.6	59.3	24.3	60.4	61.2	59.1	44.2
Red top, full bloom	2	61.8	63.0	33.4	62.2	61.3	64.6	56.8
Average 2 experiments, 4 animals	....	59.7	61.2	28.9	61.3	61.3	61.9	50.5
Silage, southern corn, immature	2	63.2	66.3	14.9	46.6	73.9	65.6	65.3
Silage, southern corn, immature	1	64.4	65.8	48.2	64.8	66.7	65.4	67.8
Silage, southern corn, immature	3	63.6	64.8	49.6	59.9	67.5	64.1	67.9
Average 3 experiments, 6 animals	....	63.7	65.6	37.6	57.1	69.4	65.0	67.0
Silage, flint corn, partially mature	2	69.1	72.1	12.3	52.9	75.2	73.4	82.6
Silage, flint corn, whole plant, ears partially glazed	1	78.0	80.2	41.3	68.0	77.9	83.1	80.9
Silage, flint corn, whole plant, ears partially glazed	1	76.0	77.9	36.6	73.3	77.8	78.5	80.9
Silage, flint corn, whole plant, mature	3	75.7	77.9	39.8	67.4	78.5	78.9	87.1
Average 4 experiments, 7 animals	....	74.7	77.00	32.5	65.4	77.4	78.5	82.9
Silage (mature flint corn, sunflower heads, horse beans)	2	65.6	67.8	41.1	62.7	60.1	72.4	76.7
Silage (mature flint corn, sunflowers, whole plant, horse beans)	2	65.5	69.5	25.6	58.0	65.3	73.7	74.1
Silage (Sanford corn)	2	69.9	72.5	34.4	56.3	72.1	75.6	72.9
Timothy hay (fed with corn meal)	1	......	57.7	......	43.0	50.5	65.6	42.8
Timothy hay (fed with cottonseed meal)	1	......	61.2	.....	41.1	......	65.6	54.6
Timothy hay (fed with corn meal)	1	.....	59.1	......	42.1	53.6	66.1	45.5
Timothy, two weeks past bloom	2	51.6	52.4	......	45.2	42.8	58.9	55.0
Timothy, in full bloom	2	65.7	66.8	41.8	60.4	62.1	71.8	51.5
Timothy, past bloom	2	54.1	55.5	28.0	44.5	51.0	61.0	34.6
Timothy, early, cut July 9	2	60.4	61.1	48.2	58.9	58.7	63.7	56.9
Timothy, late, cut July 24	2	58.3	59.4	32.2	50.0	53.3	63.9	58.3
Timothy hay	2	58.5	60.1	29.6	44.1	56.4	63.6	74.3
Timothy hay	2	59.1	60.2	39.7	47.5	54.8	64.7	69.8
Timothy hay	3	53.7	55.0	29.4	45.2	48.7	60.7	50.6
Average 11 experiments, 20 animals	....	57.7	59.0	35.6	47.5	53.2	64.1	54.0
Wild oat grass in bloom	2	68.3	69.1	52.2	68.0	70.6	68.8	62.8
Wild oat grass in bloom	2	59.6	61.2	17.1	48.6	65.1	62.1	38.2
Average 2 experiments, 4 animals	....	64.0	65.2	34.7	58.3	67.9	65.5	50.5
Witch grass	2	59.9	61.0	40.3	64.2	67.6	62.1	60.0

A SUMMARY OF DIGESTION COEFFICIENTS—CONCLUDED.

	Number of animals.	Total dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%	%	%
Witch grass	2	62.4	63.6	41.5	52.9	57.9	69.0	54.5
Average 2 experiments, 4 animals	....	61.2	62.3	40.9	58.6	62.8	65.6	57.3
ROOTS.								
Beets, mangolds	2	78.5	84.8	16.4	74.7	42.3	91.3	
Beets, sugar	2	94.5	98.7	31.9	91.3	100.7	99.9	49.9
Potatoes	2	77.0	78.4	.....	44.2	......	90.9	13.0
Turnips, English flat	2	92.8	96.1	58.6	89.7	103.0	96.5	97.5
Turnips, rutabagas	2	87.2	91.1	31.2	80.3	74.2	94.7	84.2
MILL PRODUCTS.								
Corn meal (fed with hay)	3	93.3	93.6	61.9	78.7	.....	98.5	92.5
Corn meal (fed with hay and skimmed milk)	3	89.6	90.7	49.5	76.9	......	95.3	98.1
Average 2 experiments, 6 animals	....	91.5	92.2	55.7	77.8	......	96.9	95.3
Gluten meal	2	87.4	89.1	......	86.6	......	90.8	87.8
Pea meal	2	86.8	87.9	43.7	83.2	25.7	93.6	54.6
Wheat bran	2	58.8	62.8	......	73.7	......	67.5	82.6
Wheat bran	2	59.8	64.0	......	82.1	36.2	64.1	64.0
Average 2 experiments, 4 animals, wheat bran	...	59.3	63.4	......	77.9	36.2	65.8	73.3
Wheat middlings	2	74.9	77.2	......	78.9	......	82.6	85.1

EFFECTS OF TUBERCULIN ON TUBERCULOUS COWS.*

F. L. RUSSELL.

A herd of ten cows and heifers that reacted to the tuberculin test during the fall of 1895 and the following winter were placed in quarantine in a stable built for them at considerable distance from other buildings. The stable was light and well ventilated and the cattle were well fed and cared for. In summer they had the run of a small pasture with dry feed in the barn when it was needed; in winter they were not confined in the barn, but were turned out in a sunny yard during the middle of the day when the weather was such that they could be comfortable out of doors. Without using any elaborate or extraordinary means, we endeavored to keep the animals under as healthful conditions as possible. When placed in quarantine none of the animals showed marked symptoms of being diseased, but on the contrary, were about as thrifty and vigorous looking animals as could be found anywhere. They were considered diseased simply because they reacted to the tuberculin test. A thorough physical examination failed to reveal any symptoms of disease aside from a slight cough in the case of two or three of them, and these did not cough any more than many other cows that were free from tuberculosis. In October, 1897, the last of these animals was killed and we now make our final report upon them, having made a partial report in the Annual Report of this Station for 1896. Besides the ten animals with which we started, we fed calves and pigs on the milk of these cows and some of these became diseased.

The table gives the result of all tests applied to the ten cows and heifers composing the quarantined herd.

*See Annual Report of this Station, 1896, pp. 56-63.

TABLE GIVING THE RESULTS OF TESTS WITH TUBERCULIN MADE AT THE STATION DURING THE YEARS 1892 TO 1897 INCLUSIVE.

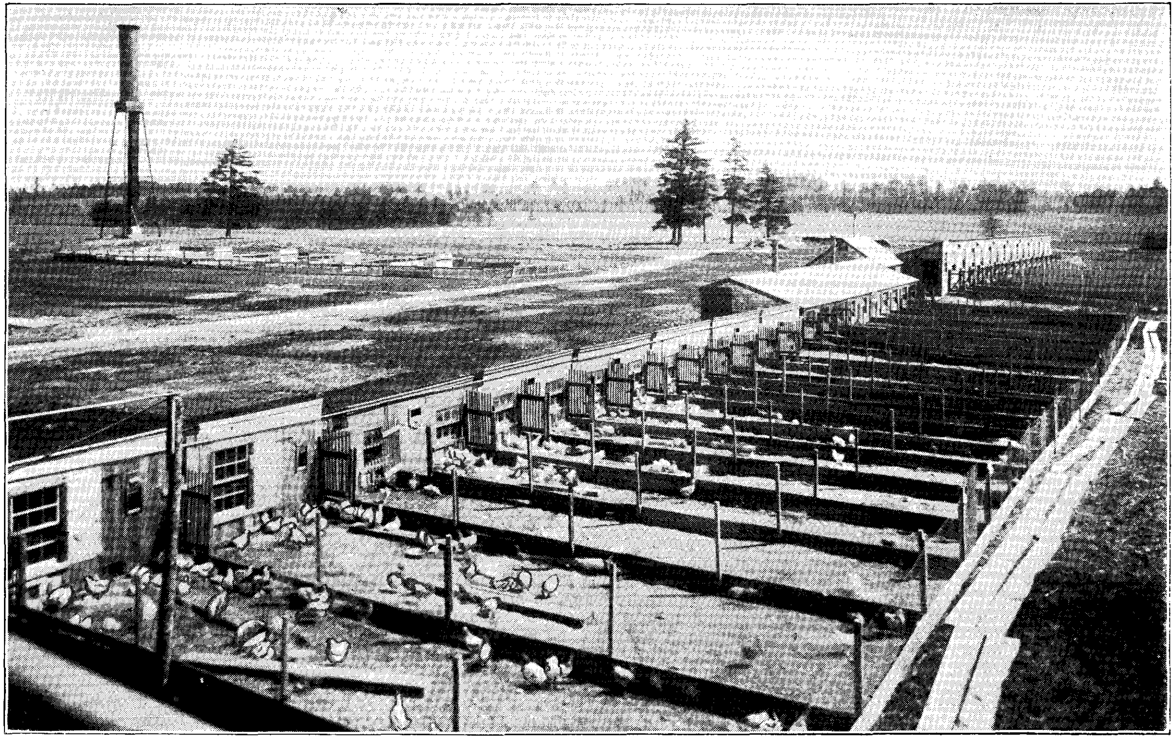
Date of Test.	Number of days since the last test was made.	Temperature at the time the tuberculin was injected—deg.	Maximum temperature on the day after the injection—deg.	Rise or decline (—) of temperature —degrees.	Remarks.
Topaz.					
February 14, 1896.....	First test.	102.1	**105.3**	**3.2**	**Reaction.**
March 8, 1896	23	101.8	102.2	.4	No reaction.
March 13, 1896	5	102.2	102.8	.6	No reaction.
March 21, 1896	8	102.3	101.8	—.5	No reaction.
May 1, 1896............	41	102.	101.9	—.1	No reaction.
July 2, 1896............	62	102.6	101.9	—.7	No reaction.
August 18, 1896	47	102.4	102.	—.4	No reaction.
September 15, 1896 ..	28	102.2	Temperature not taken.		
November 3, 1896. ..	49	101.8	101.8	....	No reaction.
December 9, 1896.....	36	101.8	102.2	.4	No reaction.
January 13, 1897......	35	102.	**105.2**	**3.2**	**Reaction.**
January 27, 1897......	14	101.6	102.9	1.3	No reaction.
February 17, 1897.....	21	100.9	101.6	.7	No reaction.
April 29, 1897	71	102.9	103.8	1.1	No reaction.
May 20, 1897...........	21	102.3	102.6	.3	No reaction.
June 2, 1897...........	13	101.6	102.	.4	No reaction.
June 15, 1897..........	13	102.2	102.	—2	No reaction.
June 25, 1897..........	10	102.5	103.	.5	No reaction.
July 7, 1897............	12	103.2	102.4	—.6	No reaction.
July 10, 1897	3	103.	101.	—.2	No reaction.
August 19, 1897	40	102.1	102.2	.1	No reaction.
September 28, 1897...	40	101.8	102.4	.6	No reaction.
October 11, 1897.......	13	101.2	102.	.8	No reaction.
Dunkard Girl.					
August 13, 1895........	116	101.	**107.4**	**6.4**	**Reaction.**
August 29, 1895........	16	101.6	**107.4**	**5.8**	**Reaction.**
September 4, 1895....	6	101.4	102.5	1.1	No reaction.
September 14, 1895 ...	10	102.6	101.4	—1.2	No reaction.
October 8, 1895........	424	102.7	**105.**	**2.3**	**Reaction.**
October 19, 1895.......	10	101.6	Temperature not taken.		
October 31, 1895.......	12	101.7	102.4	.7	No reaction.
November 20, 1895....	20	101.8	**104.8**	**3.**	**Reaction.**
December 7, 1895.....	17	101.	101.9	.9	No reaction.
January 3, 1896	27	102.	**106.2**	**4.2**	**Reaction.**
January 10, 1896.......	7	101.6	101.2	—.4	No reaction.
February 24, 1896....	14	101.3	101.2	—.1	No reaction.
February 19, 1896.....	26	101.5	100.9	—.6	No reaction.
July 2, 1896............	134	102.	103.	1.	No reaction.
August 18, 1896	47	101.7	101.6	—.1	No reaction.
September 16, 1896...	29	101.7	Temperature not taken.		
November 3, 1896.....	49	103.	101.4	—1.6	No reaction.
January 13, 1897......	72	101.5	102.4	.9	No reaction.
Kate.					
February 14, 1896.....	185	100.3	**105.3**	**5.**	**Reaction.**
March 8, 1896..........	23	101.4	102.8	1.4	No reaction.
March 13, 1896	5	100.4	102.6	2.2	No reaction.
March 21, 1896	8	101.6	102.	.4	No reaction.
May 1, 1896............	41	101.1	101.8	.7	No reaction.
July 2, 1896	62	102.8	102.5	— 3	No reaction.
August 18, 1896........	47	101.7	102.3	.6	No reaction.
September 15, 1896 ...	28	101.3	Temperature not taken.		
November 3, 1896.....	49	103.	103.	....	No reaction.
September 28, 1897 ...	329	100.8	102.3	1.5	No reaction.
October 11, 1897.......	13	101.7	102.3	.6	No reaction.

RESULTS OF TESTS WITH TUBERCULIN—CONTINUED.

Date of Test.	Number of days since the last test was made.	Temperature at the time the tuberculin was injected—deg.	Maximum temperature on the day after the injection—deg.	Rise or decline (—) of temperature —degrees.	Remarks.
Mina D.					
April 30, 1896	72	101.2	**105.9**	**4.7**	**Reaction.**
July 2, 1896	63	101.7	**105.8**	**4.1**	**Reaction.**
July 7, 1896	5	101.3	102.7	1.4	No reaction.
August 18, 1896	42	101.8	**104.8**	**3.**	**Reaction.**
August 20, 1896	2	102.7	102.7	....	No reaction.
August 29, 1896	9	102.3	102.7	.4	No reaction.
September 15, 1896	17	101.8	Temperature not taken.		
November 3, 1896	49	101.1	102.3	1.2	No reaction.
September 28, 1897	329	101.2	105.8	4.6	**Reaction.**
October 11, 1897	13	100.4	102.	1.6	No reaction.
Ruth C.					
February 14, 1896	100	101.2	**106.**	**4.8**	**Reaction.**
March 8, 1896	23	100.8	**103.6**	**2.8**	**Reaction.**
March 13, 1896	5	101.7	100.8	—.9	No reaction.
March 21, 1896	8	101.6	101.7	.1	No reaction.
April 30, 1896	40	103.	101.6	—1.4	No reaction.
July 2, 1896	63	102.2	**105.2**	**2.9**	**Reaction.**
July 7, 1896	5	101.5	101.3	—.2	No reaction.
August 18, 1896	42	102.7	**104.3**	**1.6**	**Reaction.**
August 20, 1896	2	103.4	101.8	—1.6	No reaction.
August 29, 1896	9	103.	102.2	—.8	No reaction.
September 15, 1896	17	102.	Temperature not taken.		
November 3, 1896	49	102.1	102.5	.4	No reaction.
December 9, 1896	36	101.3	101.2	—.1	No reaction.
January 13, 1897	35	101.6	102.	.4	No reaction.
January 27, 1897	14	100.6	103.	2.4	No reaction.
February 17, 1897	21	100.8	101.3	.5	No reaction.
Agnes 2.					
February 14, 1896	100	101.8	**106.**	**4.2**	**Reaction.**
March 8, 1896	23	102.6	**104.**	**1.4**	**Reaction.**
March 13, 1896	5	101.	**103.2**	**2.2**	**Doubtful.**
March 21, 1896	8	101.4	Temperature not taken.		
April 30, 1896	40	101.2	100.	—1.2	No reaction.
July 2, 1896	63	102.7	**103.7**	**1**	**Doubtful.**
August 18, 1896	46	102.1	102.3	.2	No reaction.
September 15, 1896	28	101.8	Temperature not taken.		
November 3, 1896	49	102.2	102.2	....	No reaction.
Hallie.					
February 14, 1896	100	101.7	**106.6**	**4.9**	**Reaction.**
March 8, 1896	13	102.	**105.6**	**3.6**	**Reaction.**
March 13, 1896	5	102.2	**103.5**	**1.3**	**Doubtful.**
March 21, 1896	8	100.2	102.2	2.	No reaction.
April 30, 1896	40	103.1	**104.3**	**1.2**	**Doubtful.**
July 2, 1896	63	101.8	**103.4**	**1.6**	**Doubtful.**
July 7, 1896	5	101.3	101.7	4	No reaction.
August 18, 1896	42	102.	**105.2**	**3.2**	**Reaction.**
August 20, 1896	2	101.8	**105.1**	**3.3**	**Reaction.**
August 29, 1896	9	101.2	102.	.8	No reaction.
September 15, 1896	17	101.7	Temperature not taken.		
November 2, 1896	48	101.7	101.6	.1	No reaction.
February 17, 1897	97	101.6	**105.3**	**3.7**	**Reaction.**
September 28, 1897	223	100.8	101.7	.9	No reaction.
October 11, 1897	13	100.8	101.8	1.0	No reaction.

RESULTS OF TESTS WITH TUBERCULIN—CONTINUED.

Date of Test.	Number of days since the last test was made.	Temperature at the time the tuberculin was injected—deg.	Maximum temperature on the day after the injection—deg.	Rise or decline (—) of temperature. —degrees.	Remarks.
Grace 2.					
February 14, 1896.....	100	99.6	**106.5**	**6.9**	**Reaction.**
March 8, 1896	23	102.	**105.5**	**3.5**	**Reaction.**
March 13, 1896.........	5	102.	102.8	.8	No reaction.
April 30, 1896..........	48	100.	100.2	.2	No reaction.
July 2, 1896............	63	102.3	**104.7**	**2.4**	**Reaction.**
July 7, 1896	5	101.7	101.8	.1	No reaction.
August 18, 1896........	42	102.	102.	....	No reaction.
September 15, 1896 ...	28	101.4	Temperature not taken.		
November 3, 1896... .	49	101.5	102.2	.7	No reaction.
December 9, 1896.....	37	101.4	102.5	1.1	No reaction.
January 13, 1897......	35	102.1	102.	.1	No reaction.
January 27, 1897	14	100.8	102.4	1.6	No reaction.
February 17, 1897.....	21	101.5	**104.1**	**2 1**	**Reaction.**
Melinda 2.					
February 14, 1896.	100	101.5	**106.**	**4.5**	**Reaction.**
March 8, 1896	23	101.2	**104.**	**2.8**	**Reaction.**
March 13, 1896	5	99.8	100.9	1.1	No reaction.
March 21, 1896	8	101.7	101.4	—.3	No reaction.
May 1, 1896............	41	100.3	101.4	1.4	No reaction.
July 2, 1896............	62	102.	102.7	.7	No reaction.
August 18, 1896	47	101.9	102.	.1	No reaction.
September 15, 1896 ...	28	101.3	Temperature not taken.		
November 3, 1896.....	49	102.	102.1	.1	No reaction.
December 9, 1896 ...	36	99.	101.4	2.4	No reaction.
January 13, 1897......	35	102.	102.8	.8	No reaction.
January 27, 1897	14	100.5	102.5	2.	No reaction.
February 17, 1897.....	21	102.4	102.2	.2	No reaction.
April 29, 1897..........	71	101.4	102.8	1.4	No reaction.
May 14, 1897...........	15	103.4	103.	—.4	No reaction.
May 20, 1897............	6	103.2	103.6	.4	No reaction.
June 15, 1897	26	104.4	**105.2**	**.8**	**Reaction**
June 25, 1897..........	10	104.0	104.	.0	No reaction.
Trilby.					
February 14, 1896.....	First test.	102.	**106.3**	**4.3**	**Reaction.**
March 8, 1896..........	23	101.	**105.3**	**4.3**	**Reaction.**
March 13,1896.........	5	101.7	103.2	1.5	No reaction.
March 21, 1896.........	8	101.8	102.1	.3	No reaction.
May 1, 1896	41	102.1	101.6	—.5	No reaction.
July 2, 1896............	62	102.7	**105.5**	**2.8**	**Reaction.**
July 7, 1896............	5	102.	101.7	—.3	No reaction.
August 18, 1896........	42	102.5	103.2	.7	No reaction.
September 15, 1896 ...	28	101.9	Temperature not taken.		
November 3, 1896.....	49	102.	102.	....	No reaction.
December 9, 1896. ...	36	102.	102.2	.2	No reaction.
January 13, 1897.......	35	101.8	102.	.2	No reaction.
January 27, 1897......	14	100.8	102.7	1.9	No reaction.
February 17, 1897.....	21	100.4	102.	1.6	No reaction.
April 29, 1897	71	102.	103.	.1	No reaction.
May 20, 1897.	21	100.1	101.	—.1	No reaction.
June 2, 1897...........	13	100.8	101.	.2	No reaction.
June 15, 1897	13	101.7	101.6	—.1	No reaction.
June 25, 1897	10	103.	102.2	—.8	No reaction.
July 7, 1897............	12	102.6	101.8	—.8	No reaction.
July 10, 1897...........	3	101.8	101.1	—.7	No reaction.
August 19, 1897........	40	102.	102.	.0	No reaction.
September 28, 1897...	40	101.1	102.	.9	No reaction.
October 11, 1897.......	13	101.	101.4	.4	No reaction.



POULTRY HOUSES.

As noticed in the report for 1896, we see that the animals slightly affected with tuberculosis when tested with tuberculin failed to react oftener than they reacted, and the reactions seem to bear no relation to the length of time intervening between tests. The first of the animals killed was Dunkard Girl. When she was killed January 15, 1897, she had been diseased nearly a year and a half, yet the disease had made little advance. She had never exhibited any physical signs of disease. At the time she was killed she was decidedly fat. Two guinea pigs inoculated from her died with tuberculosis.

February 27, 1897, Ruth C. was killed. It had been over six months since she had reacted. But she had been coughing to a noticeable degree for more than a year, and had not been as thrifty as the rest of the herd. How much of this lack of thrift was due to her diseased condition is uncertain as she apparently belonged to rather a frail type before she gave evidence of disease. The autopsy revealed only a small area of diseased lung and two enlarged lymphatic glands.

June 17, 1897, Grace was killed in an advanced stage of tuberculosis. When she calved April 24, 1897, she was in good flesh and apparently perfectly well, and she did well at the time of calving, but very soon afterwards it was noticed that she was rapidly losing flesh and she manifested other marked symptoms of tuberculosis, including a severe cough, rough coat, irregular appetite, and considerable fever. Her temperature was taken frequently and was rarely found below 104° and was often above 105°. An examination of the lungs ten days before she was killed revealed the fact that they were considerably diseased. She had some appetite and considerable strength at the time she was killed. At the autopsy a very large number of tubercles, varying in size from a pin head to three inches in diameter, were found scattered through both lungs, and attached to both the parietal and visceral pleura. The bronchi contained much frothy mucus. The mediastinal lymphatic glands were enlarged and much congested. The tubercles presented no evidence of degenerative changes. She had not been tested since she calved. Her temperature had been constantly high.

July 1, 1897, Melinda was killed. She was very much reduced in flesh and weak. Had eaten but little for ten days previously. Melinda calved May 11, 1897, and was at that time in good flesh and apparently perfectly well. Soon after calving she commenced to fail. Developed a severe cough, had a rough dull coat, her appetite was irregular and she began to fail in her milk. About the 20th of May she went out to pasture in good feed. Was put into the barn at night and fed grain. Three weeks before she was killed we were able to discover lung lesions by a physical examination. At the autopsy we found in the abdominal cavity innumerable small tubercles over the surface of the mesentary and diaphragm. In the walls of the uterus were a considerable number of small abcesses one-half inch in diameter. Scattered quite evenly through both lungs were tubercles from the size of a pin head to one-half inch in diameter and so thick that they seemed to fill nearly the entire volume of the lungs. The parietal and visceral pleura in the inferior anterior region, and on the right side the parietal pleura were nearly covered with small tubercles. The mediastinal glands were tuberculous and much enlarged. One of them was ten inches long and five inches in diameter. Except in the walls of the uterus, there was no breaking down of the tuberculous tissue but it was all apparently of recent growth.

The other six animals of this herd were killed October 12 and 14, 1897, and the following conditions noticed:

Agnes, 2d, had apparently always been well except that she reacted to the tuberculin test. The only lesions found were in two lymphatic glands and they showed very slight evidence of disease. A guinea pig inoculated from one of these glands killed after nine weeks showed no evidence of disease, so that what evidence we have goes to show that this cow had recovered from tuberculosis.

Hallie. This cow had always seemed well except for an increasing difficulty in breathing which had been noticeable for six months before she was killed, and a cough which had been troubling her for three months and constantly growing worse. We found tuberculous lesion in the inguinal, mediastinal and post pharyngeal lymphatics, and a few small tubercles scattered through both lungs. One of the mediastinal glands measured

12x3x2 inches. One of the pharyngeal glands was fully seven inches in diameter and consisted of a very thin walled abcess filled with thin, watery pus. This would account for the difficult breathing. The lung tubercles had cheesy centers.

Mina D. She had never shown symptoms of disease except slight unthriftiness. Tubercular lesions were found in one inguinal and in many of the mesenteric and mediastinal lymphatic glands and both lungs. Tubercles in lungs were scattered and not large, except one which measured 5x4x4 inches. All the diseased tissue was somewhat cheesy.

Kate. Had always been well. The only lesion found was one cheesy, mediastinal gland, one inch in diameter.

Trilby. Has show no symptoms of disease. The only lesion found was one mediastinal gland with cheesy center.

Topaz. Had always appeared to be well. Two mediastinal glands were enlarged and cheesy. One measured 4x3x2 inches and the other 2x1x1 inches.

A study of these cases shows us, that, kept under exceptionally good conditions as these cattle were, five of them kept the disease in check, so that it made practically no advancement. In the case of three others, but little advance was made, while in two cases the disease had nearly reached a fatal termination when the animals were killed. On the whole, we cannot see that the exceptionally good care that these animals received had any effect on the progress of the disease. It may have retarded the progress of the disease, but if so the fact is not sufficiently clear to lend much weight to the argument that tuberculosis can be successfully controlled by simply maintaining animals under good hygienic conditions. Twenty per cent of deaths is probably as high a percentage as one could reasonably expect among ordinary tuberculous herds kept under poor or only fair hygienic conditions, if to begin with all cases that presented any physical symptoms of disease were removed.

The most of these animals were giving milk during quite a part of the time, and their milk was fed to calves and pigs. The pigs were fed some meal, and the calves had a little hay, but their principal food was milk from the cows. Four pigs and fifteen calves in all were fed with milk from these animals. The pigs were killed when they weighed about 175 pounds and the calves at from six to eight weeks old, and when killed were carefully examined. One of the pigs and two of the calves were found to be tuberculous.

The first of the calves to be found diseased was a black calf purchased when it was three days old, out of an apparently healthy cow. It was killed June 3, 1897, when three months old. It was kept to this age because of difficulty in getting a calf to take its place to use the milk. It grew rapidly and was very large and fat when killed. Had never shown symptoms of disease. Had been tested with tuberculin three times, the last time May 6, 1897, but did not react. The autopsy revealed many small tubercles in the liver, one tubercle one-half inch in diameter in the lungs, and three lymphatic glands slightly diseased. A guinea pig was inoculated from a piece of the lung tubercle and died July 17, 1897, from general tuberculosis.

The second calf that was found tubercular was dropped by Kate, April 21, 1897, and was never outside of the barn where it was dropped. It will be noticed from the autopsy of Kate that she was found very slightly diseased. May 14 this calf was tested with tuberculin and reacted with a maximum temperature of 105.°4. May 19 it was tested again and reacted with a temperature of 104°.2. June 25 it was tested again and failed to react. June 29, 1897, this calf was killed. It had always seemed well and was very fat when killed. The autopsy revealed four mediastinal lymphatic glands which contained a large number of small yellow foci each about the size of a pin head and calcareous. The glands were perceptibly enlarged. A guinea pig inoculated with a piece of one of these glands died September 1, and was found to have general tuberculosis.

The hog that developed tuberculosis while being fed on milk from the tuberculous cows was one of two that were kept for nearly a year in the basement of the stable where the cows were. They had access to the manure from the cows. When killed December 3, 1897, this hog was about fifteen months old. Had always appeared well. The autopsy revealed tuberculous lesions in the liver and lymphatic glands. No tuberculin test had been applied.

A COMPARISON OF THE TEMPERATURES OF HEALTHY AND TUBERCULOUS COWS.

F. L. Russell.

Beginning the second of March, 1897, the temperature of six of our tuberculous cows and of six other cows that were considered sound were taken three times a day for about forty days. The temperatures were taken at 9 A. M., 12.30 and 4.30 P. M.

We must regard the results as negative, as far as showing any difference in temperature between well animals and those slightly tuberculous, is concerned. In the following table the summary of the observations is given. The succeeding tables contain the record of the observations as made.

THE AVERAGE HIGHEST AND LOWEST TEMPERATURE, THE GREATEST VARIATION AND THE GREATEST DAILY VARIATION IN TEMPERATURE OBSERVED IN SIX WELL AND SIX SLIGHTLY TUBERCULOUS COWS DURING SIX WEEKS' TIME.

Cow Numbers.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Average of.
Average Temperature.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
Well cows	100.9	101.4	101.4	100.9	101.1	101.8	101.3
Tuberculous cows	100.8	101.2	101.5	100.9	101.4	101.4	101.2
							Extreme of.
Highest Temperature.							
Well cows	101.8	101.4	102	102	102.1	103	103.0
Tuberculous cows	102	103	103	102.4	104.4	103	104.4
Lowest Temperature.							
Well cows	98.6	100	100.4	99.7	98.9	100.1	98.6
Tuberculous cows	99.2	99	99	99	99.8	99.8	99.6
Greatest Variation.							
Well cows	3.2	2.4	1.6	2.3	3.2	2.9	4.4
Tuberculous cows	1.8	4	4	2.4	3.8	3.2	4.0
Greatest Daily Variation.							
Well cows	2.9	2.0	1.3	2	2.6	2	2.9
Tuberculous cows	1.8	2.3	3.4	2.1	3.2	2.2	3.2

THE TEMPERATURES OF SIX WELL COWS TAKEN AT 9 A. M., 12.30, AND 4.30 P. M., FOR SIX WEEKS.

Date.	Number of Cows.					
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	°F.	°F.	°F.	°F.	°F.	°F.
	101	100.7	100.9	100.1	100.9	100.9
March 2	100.9	100.7	100.8	100	100.8	100.1
	100.7	101	100.6	100.6	101	101.9
	100.9	102	101.9	102	102	102.1
March 3	101	101.7	101.8	100.7	100.8	101.7
	100.9	102.1	101.7	100.9	101.8	102.3
	101	101.8	102	100.7	101.6	101.9
March 4	100.5	101.8	100.8	101.1	101.6	102.3
	101.7	101.8	102	101.7	101.6	101.7
	100.8	102.2	101.8	101.6	101.9	101.4
March 5	101.3	101.5	101.4	101.4	100.8	101.9
	101.2	101.6	101.4	101.1	101.2	101.9
	101.4	102	101.9	101.5	102.1	101.9
March 6	100.9	101.4	100.6	101.3	101.3	102.2
	101.4	102.1	101.8	101.8	102.1	102.8
	101.3	101.6	101.8	101.8	101.7	101.9
March 7	101.8	100.7	101.3	100.1	101	102.4
	101.4	101.8	101.4	101.1	102	102.4
	100.4	101.6	100.1	100.2	101.4	101.2
March 8	100.7	101.6	100.9	101	100.6	102.1
	101.4	102.4	101.8	101.2	101.4	102.8
	101	101.7	101.4	101	101.7	101.9
March 9	99.7	99.5	100.9	100	100	102
	101.4	101.5	101.6	101.5	101.6	102.8
	101.5	101.2	101.5	100.4	101.6	101.6
March 10	101	101.1	101.4	101.4	101.3	102
	101.3	101.7	101.4	100.9	101.8	101.8
	100.9	101.6	101.4	100.6	101.6	101.9
March 11	100.7	101.1	101.1	100.1	101	102
	100.9	101.9	101.6	101.1	101.2	102
	100	101.9	102	101	101.4	101.8
March 12	100.2	100.9	101.1	100.8	100.8	102
	101.2	101	101.8	100.6	101.6	102.6
	101.3	101.2	101.8	100.7	100.9	101.4
March 13	101.1	101.4	101.4	100.4	100.3	103
	101.4	101.7	101.4	100.8	101.2	102.8
	100.5	102	101.7	99.7	101.9	102.1
March 14	100.6	100.9	101.6	100.6	102	102.3
	100.9	102.1	101.7	101.4	102.1	103
	99.2	101.2	100.4	100.8	101.2	102.1
March 15	98.6	100.4	101.3	100	98.9	102.4
	101.5	101.6	101.6	100.2	101.5	102.7
	101	101.7	101.7	100.6	101.2	102.2
March 16	101.2	101.4	101	100.6	100.4	102
	101.4	101.6	101.2	100.9	101.4	102.7
	99.8	101	101.5	101.1	101	102
March 17	101.1	101.6	101.1	100.7	101.1	102.3
	101.6	101.4	101.2	101	101.9	102.6
	101.2	101	101	100.6	101.2	102.5

TEMPERATURES OF SIX WELL COWS—CONTINUED.

Date.	Number of Cows.					
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	°F.	°F.	°F.	°F.	°F.	°F.
March 18	101.8	100.7	100.7	100.8	101	102.3
	100.4	101.4	101	101	102	102.3
	101.7	101.6	101.8	100.8	101.2	102
March 19	100.6	101	101	100.8	100	102.2
	101.4	101.6	101	100.5	101.3	102.3
	101.4	101.7	101.7	100.5	101.9	101.4
March 20	101.4	101.7	101.5	101.3	101.4	101.6
	101	101.8	101.4	101.6	101.6	101.9
	100.8	101.9	101.6	100.2	101.6	101.9
March 21	101	101.8	101.4	100.6	101.4	
	101.7	102	101.9	101.3	101.3	102.6
	101	102.2	101.6	100.2	100.5	102
March 22	....	....	....	....	....	....
	....	....	....	....	....	....
	....	....	....	....	....	....
March 23	....	....	....	....	....	....
	....	....	....	....	....	....
	100.8	101.2	101.4	101.4	101.6	101.4
March 24	100.4	100.5	101.2	101.2	101.4	101.5
	100.9	102	101.9	101.3	101.8	101.4
	100.9	101.3	101.7	100.4	102	101.5
March 25	100.6	101	100.9	100.8	101.2	101.6
	101	101.4	101.2	101.2	102	102
	101.5	101.4	101.8	100.6	101	101.5
March 26	101.6	101	100.8	101.4	101	101.4
	101.4	101.7	101.1	101	101.2	101.7
	101.2	101.4	101.4	100.4	100.6	101.3
March 27	100.4	100.6	101.2	100.1	100.6	101.4
	101.6	102.1	101.6	101.6	101.4	101.6
	100.8	101	101.4	100.9	101.6	101.6
March 28	101.4	101.6	101.5	101	101.5	101.7
	101.7	101.8	101.7	101.1	101.4	101.9
	100.8	101.7	101.4	100.7	101.1	101.2
March 29	101.2	101.4	101.1	100.8	101.3	101
	101	100.6	101.2	101	101.6	101.6
	100.6	101	101.2	100.6	101.9	101.6
March 30	100	100.8	101.2	101.1	100	101.2
	101	101.8	101.3	100	101.4	101.8
	101	101.3	101.3	100.6	101.4	102.1
March 31	100.7	100.8	101.2	101.1	100.4	101.8
	100.7	101.7	101	100.9	101.4	101.9
	101	101.7	102	101.2	101.9	101.9
April 1	100.8	101.2	100.6	101	101.6	100.8
	101	102	101.6	101.3	101.6	101.6
	100.4	101.9	101.9	100.8	101.6	101.9
April 2	100.6	101	101.4	101.1	100.8	101.3
	101.4	101.4	101.2	101	101.5	101.5
	100	101.3	101.9	100.9	101.2	101.5
April 3	100.9	101.4	100.8	100.2	101	100.6
	101.6	101.7	101.3	101.1	101.5	101.5
	100.8	101.4	101.3	101.5	102	102

TEMPERATURES OF SIX WELL COWS—CONCLUDED.

Date.	Number of Cows.					
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	°F.	°F.	°F.	°F.	°F.	°F.
April 4	101	101.2	101.5	101.3	101.9	101.8
	101.2	101.9	101.8	101	102	101.6
	100.6	101.1	100.8	100.5	101.8	101.5
April 5	100.8	101.1	101.1	100.8	101.3	101.2
	101	101.5	100.9	100.8	101.1	100.9
	100.6	101.2	101.2	100.6	101.5	101.8
April 6	101.2	101.3	101	100.8	101.1	101.5
	101.4	101.6	101.5	101.1	101.7	102.1
	100	101.9	102	101.9	101.9	101.4
April 7	101.1	101.1	100.7	101.4	100.9	101.1
	101	102	101.6	101.4	101.8	101.8
	99.7	101.9	101.9	101.4	102	101.8
April 8	100.8	101	101.2	100.3	101.6	101.2
	101	101.8	101.9	100.7	101.9	101.9
	100	102	102	100.7	100.7	100.5
April 9	100.6	101.5	101.6	100.8	101	100.9
	99.3	100	101.4	100.9	101.6	101.6

THE TEMPERATURES OF SIX SLIGHTLY TUBERCULOUS COWS TAKEN AT 9 A. M., 12.30 AND 4.30 P. M. FOR SIX WEEKS.

Date.	Number of Cows.					
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	°F.	°F.	°F.	°F.	°F.	°F.
March 2	99.4	100.3	101.6	100.4	101.3	100.4
March 3	100.8	101	101.8	100.9	101.2	101.4
	100.5	100.9	101.2	100.4	101	100.4
	101	101.2	101.4	101.6	102.4	102
March 4	100.8	100.4	101.2	101	101	100.6
	100.7	101.8	100.8	101.3	100.2	100.2
	99.2	100.4	101.7	100.1	102	100.5
March 5	100.1	101.1	101	100	101.7	100.2
	100	101	101.6	100	100.5	99.8
	99.4	100	101.2	99	101	100.2
March 6	100	100.4	101.3	100.1	101.3	100.8
	101	102	100.6	102.1	100.9	104.1
	101	101.4	102.6	101.4	101	103
March 7	100.6	101	101.7	101.9	101.2	101.4
	101.3	101.2	102	100	102	100.6
March 8	100	99	100.6	100.2	99.8	101.4
	100.8	101	100.2	100.1	100	102.1
	101	101.2	101.8	101.2	102.6	101

TEMPERATURES OF SIX SLIGHTLY TUBERCULOUS COWS—CONTINUED.

Date.	Number of Cows.					
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	°F.	°F.	°F.	°F.	°F.	°F.
March 9	101	100.6	100.8	100.6	100.2	101.2
	100.4	100.1	100.2	99	100.8	102
	100	99.8	100	100.1	101	102.2
March 10	100.6	101	101.2	101	101	100.8
	101.1	99.8	100.2	101.8	100.2	....
	101	100.8	102	101.4	102.2	101.6
March 11	99.6	100.4	101.6	100.6	101.8	101.4
	101	100	99.4	100.8	102	100.8
	101	102	102.8	101.4	103.2	101.4
March 12	101	101.2	101.6	100.8	101.4	102
	100.8	102	99.9	100.2	102	102
	101	101.4	100.8	99.8	102.6	100.8
March 13	101.2	101	101.6	101	101.2	100.8
	100.8	100.4	101.9	100.1	102	100
	100.4	102	101.3	101	102.8	102
March 14	100.4	100	101	100.3	101.2	100.4
	101	102.4	101.2	101.4	101.2	101.4
March 15	100	100.4	101.6	100.2	100.8	100.6
	101.2	99.5	102	100.3	100.1	100.6
	100.3	101.8	101.2	101	102	100.8
March 16	100	101.2	101.6	101	100.2	101.6
	101	101.3	100.4	101	101.1	101.5
	100.8	101.1	101.4	102.2	103.4	101.4
March 17	100.6	102	101.6	100	101	101.1
	100.5	102	102.1	100.8	101.4	101.3
	100.4	102.4	102	100.1	101	101.4
March 18	100.8	101.4	101	100	100.4	101
	101	100.5	101	101.3	100.9	101.2
	101.5	101.8	102	101.4	104.4	101
March 19	100.4	100.6	101.8	100.8	101.2	101
	100.2	101	101.6	100.9	101.4	101.1
	101	101.6	102	100.8	102	100.7
March 20	101	101	101.6	100.6	100	100.8
	101.4	100.8	99	100	100.8	101.2
	101	102	100	99.6	101.4	101.3
March 21	100.4	100.6	101.8	100.8	101.2	101
	....	....	....	....	....	....
	101	101.5	102	101.3	102.2	101.6
March 22	101	101.6	101.4	100.8	101	101.4
	101.4	100.6	101.2	100.1	101	101.3
	100.3	101.8	102	100.2	100.1	100.8
March 23	100	100.4	101.8	100.6	101	101.4
	101	101.4	103	101	103.4	103
March 24	101	100.2	102	101.3	101.8	101.4
	101.3	101.5	101.9	101.7	101	102
	101	101.2	101.7	101	100.8	101.6
March 25	100	101.4	101.6	100.4	101.4	100
	99.8	101.9	101.2	100.4	101	100.2
	101.8	103	101.4	101	103.6	101.2

TEMPERATURES OF SIX SLIGHTLY TUBERCULOUS COWS—CONCLUDED.

Date.	Number of Cows.					
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	°F.	°F.	°F.	°F.	°F.	°F.
March 26	101.6 100.2 102	102 100.1 102.6	102 101 101.8	101 100.8 101.6	101.4 101.3 102.5	101.2 101.1 102
March 27	100.4 101.9	100.8 102	101.2 101.6	101 100.9	101.1 101.3	101 101.4
March 28	100.8 101 101.2	100.6 100.4 101	101.2 101.2 101.4	101 101.3 101.6	Calved	100.8 101.1 102
March 29	101.2 101.1 102	101.1 100.9 101.9	101 101.2 103	101.4 101.6 101	....	101.3 101.4 101.4
March 30	101 100.9 100	101.1 101.6 101	101 101.3 101.1	100.6 101 100.6	....	101.4 101.5 101.4
March 31	99.6 101.2 99.8	101 101 100.8	101.6 101.1 101	100.8 100 100.6	....	101.8 101.6 101.7
April 1	101.2 101.2	100.6 101.4	101.4 101.6	101 102.4	100 101.2	101.3 101.8
April 2	99.8 100 101.2	101 100.9 101.8	102.2 102 102.4	101.2 101.6 101	102 101.3 102	102 101 102.2
April 3	100.2 101 102	100.8 100.4 102.2	102 101.4 103	101.4 101.5 101.4	102 101.8 102.8	101 100.9 101.6
April 4	100 101.2 101.8	101.6 101 102	102.8 102 102.8	101 102.1 101	101.4 101.8 102	101.8 101.4 102.4
April 5	99 101.6	102.6 102.4	102 102.6	101.4 101.6	101.8 102.5	102 102.2
April 6	101.4 102 101	101.2 101.8 101.6	102 101.4 102.8	101.4 101 101	101.6 101.4 102.4	102.6 102 102.6
April 7	100.6 101 101.8	101.2 100.8 102	102.6 102 102.8	100.8 101.2 101	100 100 102	102 101.4 102.2
April 8	101 101.3 101.6	100.8 100 101.2	103 102 102.1	101 101.6 101	100.6 101 102	101.8 101.7 102.4
April 9	100 101.4	101 103	102 102.6	101.4 100.6	101.6 103	102 102

NOTES ON INSECTS OF THE YEAR.

F. L. HARVEY.

STONE FLIES or the nymphs of these interesting insects are often received for determination. The nymphs are found in streams under stones, and the flies in damp or shaded places. Some of the smaller species known as SNOW FLIES come out early in the spring and are found on the surface of the snow and often fly into buildings. They may be known by the square thorax and broad, plaited hind wings, which lie flat on the abdomen when folded. The antennae are long and the veins of the wings prominent. They are not injurious. The nymphs are the favorite food of brook trout. See figs. 1 and 2.

THE COCKS-COMB GALL of the elm was received this season and may be added to the pests attacking that favorite shade tree in Maine. These galls are the work of a species of plant louse.

THE ZEBRA CATERPILLAR (*Mamestra picta*) is a common insect in Maine, doing considerable damage to various crops. They are particularly bad in gardens. They were reported the past season as damaging the silks to sweet corn and feeding on turnips. They were quite bad on peas in gardens. These are handsome caterpillars of a pale yellow color, with three broad black stripes running length wise of the body, crossed by numerous narrow, pure white lines. They curl up like cut-worms when disturbed. The moths have dark chestnut fore wings and pale yellow hind wings and expand one and three-fourths inches. See fig. 3.

THE POTATO-STALK BORER (*Gortyna nitela*) was reported as doing considerable damage to potatoes in Western Maine the past season. This insect is on the increase in Maine. The larva bores into the pith of potato stalks, causing them to wilt. The wilting plants should be pulled and burned so as to kill the worms within them.

THE APPLE-TREE TENT-CATERPILLAR and the FOREST TENT-CATERPILLAR were very abundant the past season in the western and southwestern parts of the State. As it was an off bearing year the orchards of Maine were shamefully neglected. Tent-caterpillars were allowed their own way, and it was common to see nice orchards badly eaten, and from one to several tents in a tree.

The abundant crop two years ago, and consequent low prices, the small crop of last season, with small returns, combined to discourage fruit growers and cause the neglect of orchards. We believe in periods of ten years, that the orchard is the best paying part of the farm. To turn the orchard over to the ravages of insects and fungi in off bearing years is a short sighted policy.

In a shy bearing year, trees have the opportunity to regain vigor from overbearing and lay up material for full bloom the following year. Nourishment is elaborated by the leaves and therefore foliage-eating insects sap the vitality of trees. The best time to strike insects that attack the fruit a hard blow, is in shy bearing years, when the food supply is limited.

By the neglect of orchards last year, tent and forest-caterpillars will be abundant this season.

We are glad to know that orchardists are becoming impressed by the fact that the best way to cope with tent-caterpillars, especially in young orchards, is to gather the egg clusters during the winter, or when the leaves are off.

The indiscriminate destruction of all kinds of eggs found attached to the limbs of apple trees would be bad policy, as beneficial and injurious insects would suffer alike. It would be but little trouble to send specimens of egg clusters found to the Station and learn which kinds should be protected. Several parties have availed themselves of this privilege the past season, and in all cases among the lots of eggs sent were several cocoons of beneficial Ichneumons.

Beech-bud Insect. We received from Mrs. Florence W. Jaques, Farmington, Maine, a lot of beech buds that were killed by an insect. They were the terminal buds, and had turned brown. An examination showed that the young leaves had been eaten and that the insect had made his exit by boring a small round hole through the scales near the base of the bud. This insect must do its work early in the spring, as the speci-

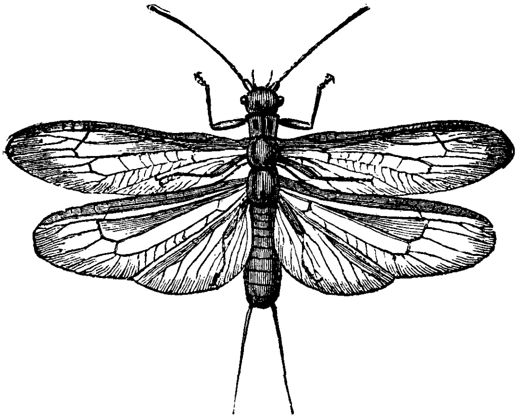


FIG. 1.

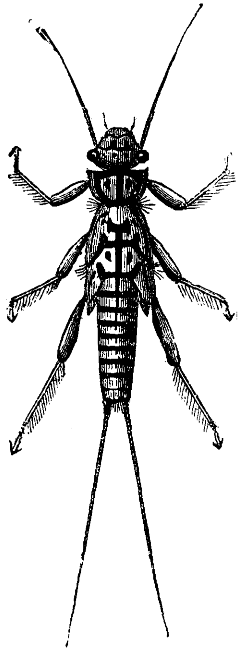


FIG. 2.

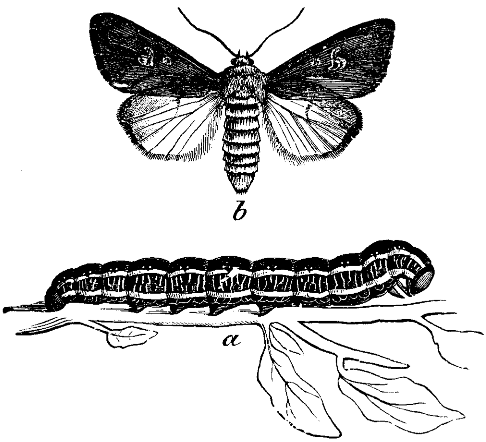


FIG. 3.

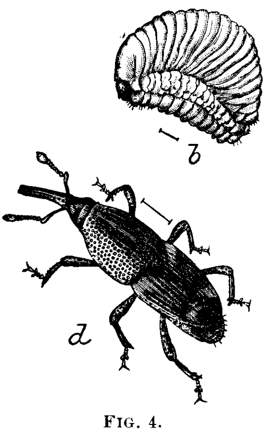


FIG. 4.

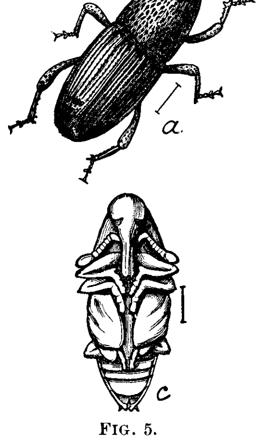


FIG. 5.

Figs. 1 and 2 are from Smith's Economic Eutomology.
Figs. 3, 4 and 5 are from publications of the U. S. Department of Agriculture.

mens were received the last of May, and the buds were dead and the insects gone. The trees were in grounds in Farmington, and the effect on them was quite noticeable. We have never seen the work of such an insect in the forests of Maine. This was probably the work of a small moth. We call attention to it as we do not know the insect and will be pleased to receive specimens of the buds with the worms in them. They should be looked for early in May. Mrs. Jaques informs us that she saw small worms emerging from the holes earlier in the season than the date of sending the buds.

THE BROWN-TAIL MOTH, an insect from Europe that has secured a foothold in Massachusetts and is claiming the attention of the Gipsey Moth Commission as a bad insect, is said to have been found in Maine, as indicated by the following letter from Mr. Sessions, the secretary.

"We are now making an inspection of the territory infested with our new imported pest, the brown-tail moth (*Euproctis chryssorrhoea*). Our inspector in discharge of his duty called on Dr. Geo. E. Osgood of 283 Highland Avenue, Somerville. The doctor is one of the reliable physicians of Somerville. His place is infested with the moth. He said that he saw the brown-tail moth in South Berwick, Maine, while on his last summer's vacation, and was sure that it was identical with the Somerville pest. He also said that while he was in South Berwick he professionally treated two cases of poisoning by contract with the moth and that the symptoms of the patients were identical with those of his Somerville patients who had been poisoned by the brown-tail moth. The premises in South Berwick are owned by the doctor's father-in-law, Andrew Whitehouse, 10 Goodwin St., South Berwick. I send you notice, that you may take such measures as you think proper in the case. I cannot of course vouch for the doctor's judgment in the matter. The caterpillars he saw in South Berwick may be something else, but I give it to you as I had it from our inspector."

We wrote Mr. Whitehouse for specimens, but he was not able to send any. We will investigate the matter next season.

THE FICKLE MIDGE (*Sciara inconstans*, Fitch) was reported by Mrs. R. S. Warren, of South Deer Isle, as eating roots and penetrating the bulbs of *Gloxinia* plants. So far as we know this is a new habit for this species. Specimens of the bulbs received were channeled by the larvae. This insect will be considered in our next report.

Various species of ANTHOMYIIDS are common in Maine, attacking beets, working between and under the epidermis of the leaves, making light colored trails. Radishes, bean-seedlings and onions are often badly attacked. The Onion Maggot (*P. ceparum*) was reported as bad in Maine. We planted a bed of onion seed in our garden in Orono, and nearly every onion was attacked by this species.

Care should be taken to burn infested plants while the maggots are still in them.

THE RAIL-ROAD WORM (*Trypeta pomonella*) will probably not be so abundant, as the short apple crop gave them much less chance to multiply than usual. This insect could have been about destroyed if pains had been taken to gather the much fewer wind-falls.

THE CURRANT FLY (*Epochra Canadensis*) was more abundant than usual about Orono.

THE RICE WEEVIL (*Calandra oryzae*, L.) was reported as quite abundant in the store houses for grain of the Swan and Sibley Company, Belfast, Maine. We recommended the carbon bisulphide treatment. See fig. 4, *b* and *d*; fig. 5, *a* and *c*.

THE SPOTTED PARIA continues its novel habit of attacking the young buds of blackberries and raspberries. The past season this pest nearly ruined an acre of the above plants on the farm of Greenvill M. Foss and Son of Standish, Maine, as reported by Mr. C. S. Phinney. Experience with this insect indicates that it will not continue its depredations from year to year. See fig. 6, Expt. Sta. Rept. 1895.

FOREST INSECTS. We received a letter from Mr. Austin Cary, who has spent considerable time the past season exploring the forests of Maine, calling our attention to the depredations of a timber beetle (*Dendroctonus rufipennis*) that is doing damage to spruce timber in Maine. The study of timber insects is not only a great undertaking, but one of much importance. As it is impossible for the Station Entomologist to find time to enter upon the work, we hope that timber owners and the Forestry Commission may become interested in the matter and that the legislature will provide the funds to make the necessary investigations.

INSECTS EXAMINED IN 1897.

No.	Common Name.	Technical Name.	From Whom Received.	Remarks.
1	Centipede Species.		Several parties	Found in fruit shipped from the South.
2	Stone Fly	*Perla bicaudata*	Mrs. Sarah F. Lee, Oakland.	Larvæ under stones in streams.
3	Helgramite-Fly	*Corydalis cornuta*	A. L. Douglass, East Dixfield	The perfect insect. The larva is used for fish bait.
4	Cock's-Comb Gall	*Colapha ulmicola*	J. F. Bailey, Bradford	Galls on elm leaves.
5	Yellow-Necked Apple-Tree Caterpillar	*Datana ministra*	Wm. S. Robertson, Weld W. W. Perkins, Andover	Feeding on foliage of apple trees.
6	Currant Span Worm	*Diastictis ribearia*	Mrs. Wealthy Page, Hartland	
7	Zebra Caterpillar	*Mamestra picta*	Minot Packing Co., Mec. Falls. C. O. Brown, Etna	Eating corn silks and turnips.
8	Potato-Stalk Borer	*Gortyna nitela*	W. A. Noyes, Auburn E. C. Brown, Riverside	Boring in the pith of potato stalks.
9	White-Marked Tussock-Moth	*Notolophus leucostigma*	D. P. Boynton, Monmouth	Clusters of eggs on apple tree twigs.
10	Luna Moth	*Tropœa luna*	C. F. Kemp, White Rock	Sent for determination.
11	Io Emperor Moth	*Automeris io*	B. McAllister, Lowell	Had eaten all the leaves from the top of a pear tree.
12	Cecropia Emperor Moth	*Samia cecropia*	A. W. Farrer, Ripley	Cocoon on apple twig. See Experiment Station Report, 1894, page 111.
13	Velleda Lappet-Moth	*Tolype Velleda*	W. E. Blanchard, Cumb. Center	On apple tree.
14	Apple-Tree Tent-Caterpillar.	*Clisiocampa Americana*	C. N. Wells, Auburn C. H. Page, Winthrop	Clusters of eggs on apple tree twigs.
15	Forest Tent-Caterpillar	*Clisiocampa disstria*	C. N. Wells, Auburn W. W. Perkins, Andover	Egg clusters on apple trees.
16	Mourning Cloak Butterfly	*Euvanessa antiopa*	G. F. Rowell, Monmouth	Foliage of willows.

INSECTS EXAMINED IN 1897—CONCLUDED.

No.	Common Name.	Technical Name.	From Whom Received.	Remarks.
17	Gloxinia Fly, Fickle Midge...	*Sciara inconstans*, Fitch	Mrs. R. S. Warren, S. Deer Isle..	Larvæ attacking the roots and bulbs of Gloxinia plants.
18	Anthomyiid	....	Mrs. A. M. Huston, Winn.	Larva attacking bean seedlings.
19	The Onion Maggot	*Phorbia ceparum*	G. T. Allen, Haven	Larva attacking onions.
20	Bean Weevil	*Bruchus obtectus*, Say	L. H. Richards	Attacking stored beans.
21	Rice Weevil	*Calandra oryzæ*, L	Swan & Sibley Co., Belfast (per Mr. Bickford)...................	In grain bins in store.
22	Meal Beetle......................	*Tenebrio molitor*..................	Swan & Sibley Company	In grain bins.
23	Round-Headed Apple-Tree Borer.	*Saperda candida*....................	W. E. Ingersol, Epping	Attacking trunk of apple trees.
24	Spotted Paria....................	*Typophrus canellus gilvipes*, Dej ...	C. S. Phinney, Standish.	Attacking raspberries and blackberries. See Expt. Sta. Report, 1895, page 106.
25	....	*Obesia bimaculata*..................	F. L. Harvey, Orono...............	Attacking blackberry leaves.
26	Shot Borer.........................	*Xyleborus pyri*, Peck.............	W. B. Selwood, Perry	Attacking the trunks of young apple-trees.
27	Buffalo Beetle..................	*Anthrenus Scrophulariæ*...........	P. H. Vose, Bangor—Auburn	Attacking carpets and woolen goods.
28	Maple-Tree Borer	*Plaginotus speciosus*	F. J. Libbey, Richmond	Attacking maple trees.
29	Horntail Pigeon Tremex	*Tremex Columba*.....................	W. Stanwood, Bethel.............	Attacking and destroying maple trees.
30	Pear Tree Slug	*Eriocampa cerasi*...................	F. O. Tarbox, W. Kennebunk.....	Attacking foliage of pear trees.

NOTES ON PLANTS OF THE SEASON.

F. L. Harvey.

More plants have been received at the Station for examination the past season than ever before. They have been largely weeds, forage plants and injurious fungi. Lectures upon weeds and fungi delivered before farmers meetings, newspaper articles, station bulletins on these subjects and the enactment of a seed inspection law, have awakened an interest in these pests of the farm. The following table includes those species received that are of economic importance.

Wild Peppergrass (*Lepidium apetalum*, Wild.) still continues to be reported. Many samples of seed examined this season contained the seeds of this weed. Reported from Aroostook as putting up shoots after haying and maturing abundant seed by September.

Shepherd's Purse is being widely introduced with seed. It is not a very bad weed in fields, but a nuisance about gardens and lawns in Maine.

The Red Milkwort, though not a bad weed in Maine, has been reported as abundant in some localities in low sandy soil. It is not likely to give much trouble.

Tufted Vetch or Blue Vetch (*Vicia Cracca*, L.) continues to spread. Farmers are not agreed concerning it. Some regard it as a good forage plant, while others condemn it as a bad weed. It grows rank and gives a good yield per acre. The patches die in the centre and enlarge from the outside.

The Rabbit-foot and Hop Clovers are gaining ground along highways and in waste places. If we must harbor weeds along roadsides, I know of no more attractive ones.

The Orange Hawkweed continues to be reported from new localities.

The Bristly Buttercup and Golden Ragweed have been mistaken for the King-Devil Weed, a plant that is well established about Gardiner and vicinity and is spreading.

THE MAY-WEED (*Anthemis cotula*, L.), which follows man, has made its appearance in northern Aroostook County.

In the seeds examined this season we have frequently found the seeds of SOW THISTLES, and these weeds are widely distributed in the State. *Sonchus arvensis* is reported from Aroostook County as overrunning potato fields and choking out grass in newly seeded fields. Sow Thistles will not persist in grass lands, but they become a nuisance in gardens and fields.

THE COMMON MILKWEED (*Asclepias cornuti*, Des.) is regarded as a bad weed in low mowing fields in southwestern Maine.

THE ARISTATE PLANTAIN is widely distributed in newly sowed land. It does not seem to persist much after the first season. The seeds of its relative, the *English Plantain*, are quite abundant in clover seed from the West.

THE THREE-SEEDED MERCURY (*Acalypha Virginica*) has been reported as a bad weed in gardens and also as spreading to fields. It ought to yield readily to clean culture.

THORNY AMARANTHUS or PIGWEED is a bad weed in gardens and cultivated land. It has the disagreeable habit of growing rapidly after hoed crops are laid by and makes large growth, seeding profusely before frost. The seeds are very common in grass seed sold in Maine.

SQUIRREL-TAIL GRASS (*Hordeum jubatum*) is becoming common in western Maine. It is a bad weed. It springs up in car yards where western grain is unloaded and will spread to farms.

THE POTATO BLIGHT (*P. infestans*) was very prevalent throughout the State. Potatoes rotted badly. Never before has the value of spraying been so emphasized. Fields where spraying was done yielded a good crop of sound tubers, while adjoining fields that were not sprayed were almost a failure.

THE STRAWBERRY LEAF BLIGHT continues to do damage. This has been quite successfully treated by spraying on the Experiment Station grounds.

THE QUINCE RUST continues to give trouble in southwestern Maine, attacking pear trees. A row of *Amalanchier* bushes in the Experiment Station grounds was badly attacked, nearly every fruit being infected. It is very difficult to explain the infection of a whole patch upon any other theory than that the disease is perennial.

BLIGHTING OF MAPLE LEAVES.

Last spring we received specimens of maple leaves from several sources that were turned brown, as though injured by insects or fungi or by frost. We noticed that maple trees about Orono were similiarly affected. A careful examination of the leaves eliminated insects and fungi as the cause of the trouble, and as the temperature did not reach the freezing point at the time the leaves turned brown, this cause was also discarded.

The effect was produced in a day. The leaves were rapidly unfolding and were nearly expanded. Following warm, moist weather there came a dry hot wind, which evaporated the moisture from the tender young foliage faster than it could be restored, causing the leaves to turn brown.

STINKHORN FUNGI.

We frequently receive specimens or inquiries regarding these offensive fungi and presume a short account of them will be interesting. We have found three species growing in Maine, belonging to the genera *Phallus* and *Mutinus*.

These fungi at first are nearly spherical and look like puff balls. They finally burst open irregularly and the hollow stem is pushed through, bearing at its top a conical cap. The stem is sometimes naked, or it may be surrounded by a porous membrane called the veil. The cap is conical and may be loosely attached at the apex of the stem or grown to it the whole length. It may be wrinkled on the outside or smooth. There is usually a hole at the top of the cap, though it is not always present. There is borne on the outside of the cap a greenish jelly-like mass containing the greenish spores. It is this greenish matter that is so offensive. The presence of these fungi gives the impression that an animal has died and is undergoing decomposition and the true cause is usually overlooked. The accompanying figures will enable anyone to determine these plants when seen. They should be burned or buried.

Phallus daemomum, Rumple. This species grows in rich soil about gardens and in the woods. Seems to prefer decaying wood. We have found it about the mill yards where bark and sawdust were decomposing; also in pastures about decaying stumps. The specimen figured was one of a cluster of about a dozen found by Artemus Rigby, Stillwater, Maine, growing in rich soil in his garden. This species has a veil around the stem, the surface of the cap is wrinkled and pitted and there is a hole at the top of the cap, surrounded by a whitish smooth ring. See fig. 1.

Phallus impudicus, Linn. This is not so common. We have specimens from central Maine found growing about the exit of a sink spout.

This species is fully as large as the other, six or eight inches high. It may be distinguished by not having a veil, by the cap being smoother on the outside, with no rim around the hole at the apex. See fig. 2.

Mutinus brevis, B. & C. This is much smaller. Not over three or four inches high, slender, pink and with the cap grown to the stem the whole length. This is the most common species. We have found it every season for the last twelve years on the ground in a clump of low lilac bushes growing near a barn. All three of the above species are very offensive. There are probably other species of the family in the State and we will be pleased to receive specimens. They can be put in fifty per cent alcohol and forwarded by express.

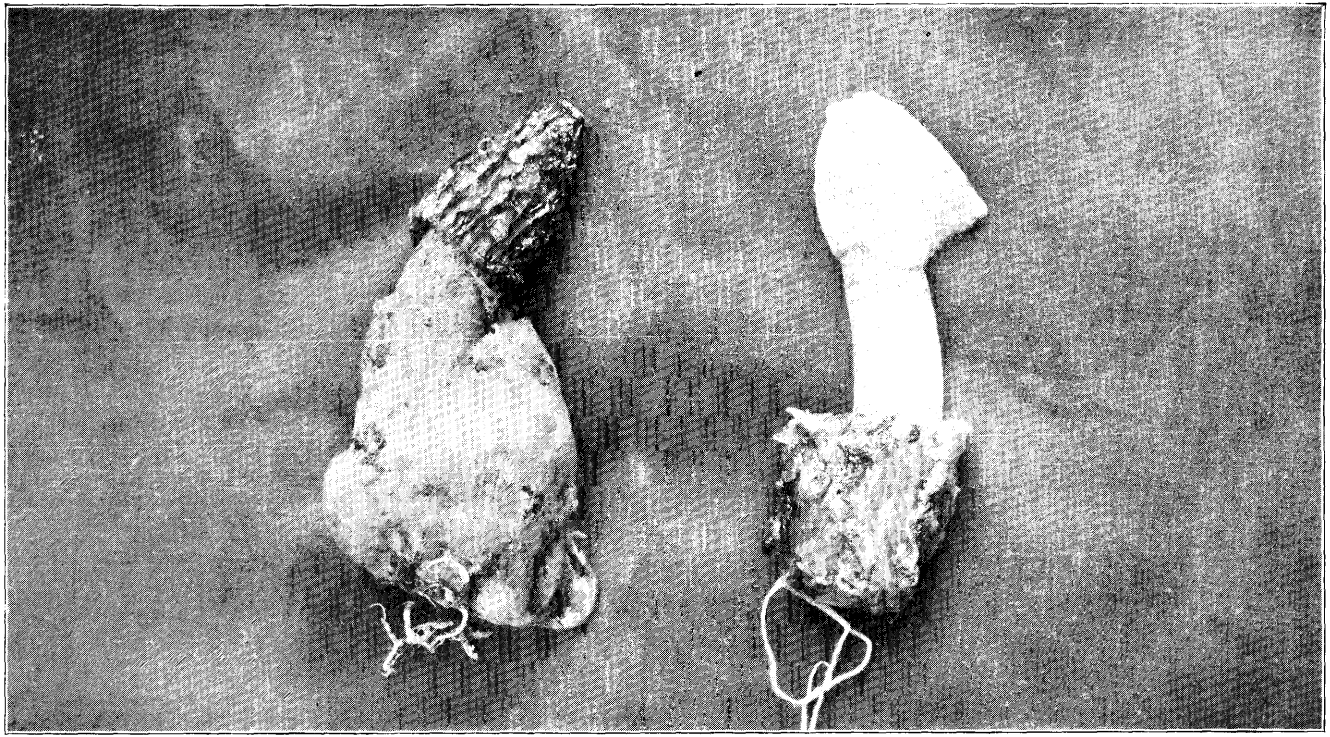


Fig 1. Fig. 2.

STINKHORN FUNGI.

PLANTS EXAMINED IN 1897.

No.	Common Name.	Technical Name.	From Whom Received.	Remarks.
1	Bristly Buttercup	*Ranunculus Pennsylvanicus*, L. f.		Mistaken for King-Devil Weed.
2	Apetalous Peppergrass	*Lepidium apetalum*, Willd.	V. T. Lundvall, New Sweden. S. W. Tabor, Washburn. E. T. Perkins, Saco. J. H. Hammond, Sanford. A. J. Abbott, North Paris.	Introduced with seed. Found in newly seeded land. Increasing rapidly in Maine.
3	Shepherd's Purse	*Bursa Bursa-pastoris*, (L) Brit.	D. F. Hodges, Phillips	Troublesome in gardens and grain. Introduced in western seed.
4	Night Flowering Catchfly	*Silene noctiflora*, L.	Samuel Libbey, Orono	Weed in gardens. Quite common.
5	Cheeses. Dwarf or Running Mallow	*Malva rotundifolia*, L	C. O. Brown, Etna	Weed in rich soil. Gardens and wastes.
6	Red Milkwort	*Polygala sanguinea*	W. R. Plummer, Bradford B. B. Taylor, North Fairfield.	Weed in low fields.
7	Tufted or Cow Vetch. Blue Vetch	*Vicia Cracca*, L.	G. S. Paine, Winslow C. O. Brown, Etna. Wm. Haskell, Hodgden.	Weed in grass lands. Increasing. This is a native plant.
8	Yellow or Hop Clover	*Trifolium agrarium*, L	S. Milliken, West Scarboro. J. H. Hammond, Sanford.	Growing with white clover in field.
9	Rabbit-foot Clover	*Trifolium arvense*, L	C. O. Brown, Etna	Fields and waste places.
10	Low Cudweed	*Gnaphalium uliginosum*, L.		Grain and grass fields.
11	Yellow Daisy. Coneflower	*Rudbeckia hirta*, L.	D. F. Hughes, Phillips	Newly seeded fields.
12	Daisy Fleabane	*Erigeron strigosus*, Muhl	D. F. Hodges, Phillips	Abundant in grass fields and on the increase.
13	Giant Sunflower	*Helianthus giganteus*, L	E. C. Carll, Buxton	Growing in field in bunches.
14	Mayweed	*Anthemis cotula*, L	V. T. Lundvall, New Sweden	Recently introduced.
15	Golden Ragweed	*Senecio aureus*, L.	W. M. Chandler, West Sumner	Mistaken for King-Devil Weed.
16	Star Thistle. Knapweed	*Centaurea nigra*, L.	S. Milliken, West Scarboro	Introduced in western seed.
17	Chicory	*Cichorium Intybus*, L	L. E. Moore, Sebec	Weed in newly seeded fields.
18	Orange Hawkweed	*Hieracium aurantiacum*, L	J. M. Drury, Livermore Center	Recently introduced in mowing field.

PLANTS EXAMINED IN 1897—CONCLUDED.

NO.	COMMON NAME.	TECHNICAL NAME.	FROM WHOM RECEIVED.	REMARKS.
19	King-Devil Weed	*Hieracium prœaltum*, Vill	G. S. Paine, Winslow	Growing in mowing fields and spreading rapidly.
20	Field Sow Thistle	*Sonchus arvensis*	V. T. Lundvall, New Sweden	Mistaken for Orange Hawkweed. Bad weed in potato fi'lds & newly seeded l'd
21	Common Sow Thistle	*Sonchus oleraceus*, L	J. H. Sanborn, South Dover	Weed in fields. Has spread steadily for past ten years.
22	Spring-leaved Sow Thistle	*Sonchus asper*, Vill	V. T. Lundvall, New Sweden	Weed in field.
23	Common Milkweed. Silkweed	*Asclepias Cornuti*, Decaisne	J. H. Hammond, Sanford	Bad weed in low meadows.
24	Purple Gerardia	*Gerardia purpurea*, L	J. D. Bragg, North Sidney	Weed in pasture lands.
25	Yellow Rattle	*Rhinanthus Crista-galli*, L	B. W. McKeen, Roque Bluff	A bad weed in pastures and fields along the coast.
26	Aristate Plantain	*Plantago Patagonica aristata*, Gray	Miss L. O. Eaton, S. Chesterville.	Weed in new mowing fields.
27	Thorny Amaranthus. Pigweed	*Amaranthus spinosus*, L	G. S. Paine, Winslow	Garden and fields.
28	Three-seeded Mercury	*Acalypha Virginica*	Wm. Downs, South Sebec	In garden. Spreading to grass land.
29	Crab-grass. Five finger	*Panicum sanguinale*, L.	G. M. Twitchell, Augusta	Gardens and cultivated land.
30	Meadow Foxtail	*Alopecurus pratensis*, L	B. W. McKeen, Sedgwick and Machias	Growing in low meadows. Good for pastures.
31	Forked Beard-grass	*Andropogon furcatus*, Muhl	G. S. Paine, Winslow	In old fields and pastures with sandy soil.
32	Beard-grass	*Andropogon scoparius*, Alex.	G. S. Paine, Winslow	
33	Squirrel-tail Grass	*Hordeum jubatum*, L	E. C. Carll, Buxton	Where western grain was unloaded.
34	Black or Hair Mold	*Phycomyces nitens*	T. S. Bowden, Washington.	Growing on oily substances.
35	Potato Blight	*Phytophthora infestans*, DeBary	Various parties	Prevalent the past season, doing much damage.
36	Strawberry Leaf Blight	*Sphœrella fragariœ*.	E. L. Miller, East Hampden	Attacking leaves of the strawberry. Detected by the dark spots on the leaves.
37	Quince Rust	*Rœstelia aurantiaca*	A. C. Fernald, North Deering	Attacking Champion quince bushes.
38	Gooseberry Rust	*Æcidium grosulariœ*	A. C. Fernald, North Deering	Cluster cups on leaves of gooseberries.
39	Stinkhorn Fungus	*Phallus dœmomum*, Rumph	Artemus Rigby, Stillwater; W. F. Brown, Week's Mills.	Growing in rich soil. Emitting offensive odors.

THE KING-DEVIL WEED.

F. L. Harvey.

Hieracium praealtum, Villars.

Order Compositae; Sunflower Family.

HISTORY AND DISTRIBUTION.

This interesting plant is a native of Europe. It was first described by Dominique Villars in 1808.

When and where it was introduced into this country, or the circumstances of its introduction are entirely unknown. Mr. Lester F. Ward suggests that it may have been originally a ballast plant of some Canadian port, as Toronto, it having been collected at that place in 1894.

It was first detected in this country in 1879 by Mr. Lester F. Ward, who found it well established at Carthage and Evan's Mills, Jefferson county, New York. Since that date it has spread over a large area in northern New York, becoming a pernicious weed. On account of its bad reputation in that region, it acquired its regal-satanic name.

When it made its first appearance in Maine is not known. It was first brought to notice by Mr. H. K. Morrell, Gardiner, Maine, who found a few specimens growing in fields in West Gardiner in 1895 and reported them to the Josselyn Botanical Society of Maine. Since that date it has spread rapidly and is now found in many fields in West Gardiner, Gardiner, Farmingdale and Litchfield, adjoining towns on the west side of the Kennebec, and also at Winslow on the east side of the Kennebec, over twenty miles from the other infested area.

In June, 1897, we received the following letter from Mr. Dewey, assistant botanist at the United States Department of Agriculture: "I received yesterday from Mr. H. K. Morrell, Gardiner, Maine, specimens of devil weed, *Hieracium praealtum.*

Mr. Morrell states that some fields in the vicinity of Farmingdale are full of this weed. The farmers of that vicinity should be warned of its dangerous character and an effort should be made to eradicate the plant if possible before it becomes more widely distributed. This weed proved very troublesome in northern New York where it is regarded as even worse than the orange hawkweed, (*Hieracium aurantiacum*)."

Although we were aware that this pest had been reported from Gardiner, it was thought advisable to visit the region and learn from personal observation the distribution and habits of the plant.

On June 27, 1897, in company with Mr. Morrell, we examined a part of the infested district and found the pest surprisingly abundant, growing in large patches and as scattering plants in many fields. We informed all the farmers we met of the pernicious nature of the weed and the importance of destroying it. We were surprised at the apathy of farmers regarding the introduction and spread of this bad weed. There are always individuals who are alive to the importance of keeping fields clean and who make desperate efforts to do so, but are hampered and discouraged by their indolent neighbors, whose farms are centres for the growth and distribution of all the bad weeds in the region. So far as we know, no concerted action has been taken to eradicate this pest. We see more and more the necessity of State action in such cases. Unless some definite action is soon taken, we may expect that this weed will overrun the State like its detestable relative, the Orange Hawkweed.

Below we give a record of the known North American localities of the King-Devil Weed.

RECORD.

Carthage, Jefferson county, New York, L. F. Ward, 1879.

Evans' Mills, Jefferson county, New York, L. F. Ward, 1879.

Pierpont Manor, Jefferson county, New York, C. H. Peck, 1893.

Jayville, St. Lawrence county, New York, C. H. Peck, 1893.

Ogdensburg, St. Lawrence county, New York, J. E. DuBois, 1894.

Denmark, Lewis county, New York, specimen in Nat. Herb., 1894.

Toronto, Canada, specimen in Nat. Herb., 1894.

Locust Grove, Lewis county, New York, Helen M. Bagg, 1896.

Maine Localities.

Farmingdale, Maine, Bowman St., Farm of C. R. Glidden, H. K. Morrell, 1895.

West Gardiner, Kennebec county, H. K. Morrell, 1895.

Gardiner, Kennebec county, H. K. Morrell, 1896.

Litchfield, Kennebec county, H. K. Morrell, 1896.

Winslow, Kennebec county, G. S. Paine, 1897.

DESCRIPTION.

Root perennial, multiple,—fibrous.

Stems 2 feet or more high, 1 to 4 or 5 from the same root. The central one erect, the others smaller and more or less declined, purplish below, clothed with whitish, bristly hairs, that are dark colored at the base. The hairs are more numerous toward the base of the plant, mixed in the upper part of the stem with glandular hairs, dark colored, shorter, which become abundant on the flower pedicels and involucre. Mr. Ward and also Dr. Gray describe the upper part of the plant as free from hairs, but our specimens show scattered hairs the whole length of the stem and they are also mixed with the glandular hairs on the flower pedicels and on the scales of the involucre. Spreading by means of stolons as shown in the plate and also by rootstocks which connect different plants below ground.

Leaves lanceolate with a winged petiole, margin more or less wavy with scattered small, dark-colored teeth. Pale green both sides and armed above and below with scattering long, white hairs, which show a dark base on the mid ribs, and sometimes on the other parts. Radical leaves many, making a dense mat on the ground in the patches. Stem leaves smaller, narrower, 2 to 4, located on the radical half.

Infloresence paniculate or cymose. On the larger plants with many heads; those on the lower pedicels open first, and when the pedicels branch, the lower heads on the branches are the first to bloom, making the infloresence indeterminate and paniculate. On the smaller flower shoots of the larger plants, on the smaller flower clusters that come out lower, on plants that branch, and on small plants with few heads; the terminal head opens first making the infloresence determinate and cymose. Dr. Gray says the infloresence is open cymose, probably determined from a small plant with few heads.

Mr. Ward says paniculate, probably from the examination of larger plants with many heads. Flower clusters terminal, and if branched, terminal on the branches, composed of from 4 to 25 heads, each about one-half inch long. Flowers 50 or more in each head. Yellow corollas strap-shaped and extending beyond the involucre about its length. Involucre green, one-fourth inch long, composed of many narrow, pointed, hairy scales in a single row. Achenes 2 mm. long, dark reddish-brown, about ten-ribbed, oblong, truncate above and gradually narrowing to the obtuse base. Slightly flattened below. Pappus 4 mm. long, composed of a single series of delicate, whitish bristles, which under high powers are plumose with short hairs.

HABITS.

The plants grow in grass lands, cultivated fields and along roadsides. The seeds germinate in the fall and the young seedlings live over winter and continue to live from year to year. The plants increase by stolons and rootstocks. Flowering stems are put up early in the summer and the plants are in full bloom and many of the heads fully ripe the last of June in Maine.

Mr. Dewey in Farmer's Bulletin No. 28, U. S. Department of Agriculture, p. 25, gives the time of flowering in New York as from June to September, and the time of seeding from August to October. The plant is fully a month earlier in Maine and becomes a nuisance, as its seeds are ripe before the grass is ready to cut. Plants that were shedding seed from some of the heads the last of June, bore small buds just forming, making the period of seed maturation quite long.

Many plants are tardy in putting up flower stems, so that flowering continues all summer. Plants cut off by mowing the grass put out full flowering stems that mature seed before frost.

The plants make patches and the root leaves mat the ground so thoroughly that nothing else will grow. The seeds (achenes) are provided with numerous bristles (pappus), making them light, and slight winds scatter them far and wide.

This pest seems to flourish in Maine soil and is rapidly spreading. We saw many plants that were considerably over two feet high and some of them put up several stems from the same root. Since 1893 it has spread more than the Orange Hawkweed has in the same region for twenty years. It will take root in mowing fields that have not been plowed for ten years. It blooms about the same time as the Tall Buttercup (R. acris) and the flowers being of nearly the same shade of yellow it is difficult to detect it when they are growing in grass lands together.

It can be distinguished from the Orange Hawkweed by having yellow instead of reddish-orange blossoms, and by the smaller and usually more numerous heads. From our native hawkweeds by the flowers being closely clustered at the top of the few leaved stem. From another introduced hawkweed that is found about Sangerville, Maine, and sparingly at Orono, by its larger size and the fact that this species has only one or two larger heads at the top of the stem. From the Fall Dandelion by the form of the leaves and earlier flowering.

REMEDIES.

We have had no experience with this weed. Its nature and habits are similar to those of the Orange Hawkweed and it would no doubt yield to the same treatment.

Five methods of treating Orange Hawkweed have been suggested:

I. Watch the fields carefully each season and pull or carefully dig the scattering plants that make their appearance, not allowing them to seed or spread.

II. Turn the infested field and cultivate carefully some hoed crop until the weed is eradicated.

III. Crop the turned field heavily with some strong growing plant to choke out the weed.

IV. Convert the infested field into a sheep pasture until the weed is destroyed.

V. Apply salt to single plants, to patches, or to whole fields when badly infested. It should be applied dry, sown broadcast, so as to reach all the leaves, at the rate of 18 pounds to the square rod, a ton and a half to the acre.

Remedy I is preventive and we regard it the best, not only for this weed but as a settled policy for coping with all kinds of weeds. When the plants are few they can be destroyed without much loss of time, or expense. It is poor policy to wait until fields are overrun and then be compelled to turn or salt them at great expense. The safest way to fight a weed is not to allow it to get a foothold. Our farmers should be on the alert and when a strange plant appears in the fields it should claim immediate attention, its name and habits should be determined, and remedial measures at once adopted.

In digging scattering plants of hawkweed it should be remembered that they put out underground stems, and care should be taken not to leave these in the ground to start new plants. The fields should be examined later for any plants that may have been overlooked, or start from stolons.

The Orange Hawkweed in Maine grows along roadsides, in orchards and in rocky pastures where it is undesirable, or impossible to plow, and the only remedy available is to carefully examine such places every year for scattering plants and thus control the spread. If established, apply salt as suggested in remedy V.

Whether the King-Devil Weed will spread to pastures, we do not know. In New York it grew along roadsides, and in Maine the plant established itself in a mowing field that had not been plowed for ten years.

Method II recommends itself when there is no reason why the field may not be turned and cultivated in a hoed crop. It is a worthless method without clean culture and the exercise of care that scattering plants on other parts of the farm are destroyed and not allowed to mature and reseed the field. This method was tried the past season on the University of Maine farm for the Orange Hawkweed and was apparently successful.

Professor L. R. Jones of the Vermont Experiment Station has experimented largely with salt for the Orange Hawkweed and claims that it will destroy it and prove beneficial to the

KING-DEVIL WEED.

grass, nearly doubling the yield. Professor Jones says salt suitable for this purpose can be obtained for from $3 to $5.50 per ton. The expense seems large, but if the application will double the hay crop, as Professor Jones says, the increased yield would balance the outlay.

This method has never been applied for the Orange Hawkweed or King-Devil Weed in Maine, but Mr. Ward records the use of salt to destroy the latter in northern New York and does not speak flatteringly of the results.

Those who are interested in the details of Professor Jones' experiments can consult Bulletin of the Vermont Experiment Station No. 56, 1897.

The plate, prepared from a photograph, shows a specimen that was two and a half feet high, reduced in reproduction. The habit of increase by stolons is shown.

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HERD RECORDS.

G. M. Gowell.

These statements are published to show the individuality of cows as milk and butter producers, and to add to the limited data, so far accumulated, bearing upon: the ratio of the decrease of milk flow, from the time the cow is fresh until she is dry; the changes of the per cent of fat from month to month; and the milk and fat yields during the months following the act of breeding.

On January 1, 1897, there were fourteen cows in the station herd. Several others were purchased later in the season, but their records are not included here, as they were in the herd but part of the year.

The animals have been fed as nearly in accordance with their individual requirements as we have been able to determine. All have received about the same quantities of succulent foods—silage, turnips, and pasturage. The hay and grain have been varied in quantity and kind, as different animals seemed to require at different times. In the main, the grain mixture has consisted of about equal parts by weight of wheat bran, corn meal, and gluten meal, fed at all seasons of the year, while the cows were in milk. Small quantities of linseed meal, cotton seed meal and feed flour have been used. When dry, wheat bran has been the only grain feed. The hay was mixed timothy, redtop and Alaska clover, grown upon the farm. The silage was of Sanford corn—eighty tons having been cut into the silo from three acres of land, when it was in the early dough condition. It would have been allowed to mature further, but for the fear of frost. The turnips were rutabagas, fed until the last of December, to cows in milk just after milking in the morning, and to the dry cows at noon. During July, August, and September, pasture was supplemented by green hay, green oats, and peas or sweet corn fed in the barn, night and morning as needed.

While confined in the barn, from October first to June first, they were watered twice each day. The milking was commenced at six o'clock in the mornings during winter, and in summer at half past five. The afternoon milking was commenced at half past three o'clock throughout the year. This early afternoon milking was necessary so that the milk might be delivered to the consumers at half past five o'clock. Our experience here causes us to believe that these unequal periods of time between milkings are not detrimental to the milk yield. The cows become accustomed to the arrangements, and being largely creatures of habit they continue to secrete and yield milk as freely as though the periods were more nearly equal.

These animals are valuable for breeding purposes and our aim is to develop their ability to produce satisfactorily. This we do by careful handling and feeding. Coarse and succulent foods are provided them freely, while moderate quantities of concentrated foods are used. Larger yields of milk and butter could easily have been secured by heavier grain feeding.

ROSE.—No. 1802 Maine State Jersey Herd Book. Ten years old. Calved September 15, 1896, and November 16, 1897.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter —lbs.
January	716.7	5.1	36.55	42.64
February	610.7	5.1	31.14	36.23
March	601.0	5.0	30.05	35.06
April	584.3	4.9	28.63	33.40
May	598.4	4.0	23.93	27.91
June	586.5	4.9	28.73	33.52
July	567.3	4.7	26.66	31.10
August	555.3	4.8	26.65	31.09
September	510.6	4.3	21.95	25.61
October	280.9	4.4	12.35	14.41
November	323.7	4.3	13.91	16.23
December	574.2	4.6	26.41	30.81
	6509.6		306.96	358.01

Food consumed, 4,600 pounds hay	$23 00	
3,400 pounds grain	25 50	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$63 00
Cost of food for each pound of milk	.97 cents.	
Cost of food for each pound of butter	17.59 cents.	

ADDIE S.—No. 2383 Maine State Jersey Herd Book. Eight years old. Calved September 10, 1896, and October 8, 1897.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter —lbs.
January	703.0	5.3	37.26	43.47
February	575.1	5.2	29.90	34.88
March	534.7	5.5	29.40	34.30
April	464.1	5.0	23.20	27.06
May	452.4	4.0	18.09	21.10
June	465.1	5.0	23.25	27.12
July	262.7	4.7	12.34	14.39
August	162.6	4.9	3.06	3.57
September	12.5	5.0	.62	.72
October	680.9	4.6	31.32	36.54
November	859.2	4.8	41.24	48.11
December	692.6	4.3	29.78	34.72
	5864.9		279.46	326.00

Food consumed, 4,200 pounds hay	$21 00	
3,100 pounds grain	23 25	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$58 75
Cost of food for each pound of milk	1.00 cents.	
Cost of food for each pound of butter	18.02 cents.	

HOPE.—No. 2368 Maine State Jersey Herd Book. Six years old. Calved October 1, 1896 and October 28, 1897.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter —lbs.
January	504.1	5.7	28.73	33.52
February	440.5	5.6	24.66	28.77
March	450.0	5.0	22.50	26.25
April	399.2	5.4	21.55	25.14
May	400.2	5.2	20.81	24.28
June	342.5	5.5	18.83	21.97
July	333.8	5.5	18.35	21.41
August	292.5	5.7	16.77	19.56
September	91.4	5.7	5.20	6.07
October	....	....	....	....
November	719.2	3.8	27.33	31.88
December	657.5	5.0	32.87	38.35
	4630.9		2376.0	277.20

Food consumed, 4,200 pounds hay	$21 00	
3,000 pounds grain	22 50	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$58 00
Cost of food for each pound of milk	1.25 cents.	
Cost of food for each pound of butter	20.92 cents.	

TULIP.—No. 2501 Maine State Jersey Herd Book. Five years old. Calved February 3, 1897. Took sudden cold and went dry September 30, 1897. Calved again January 31, 1898 in perfect condition.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter —lbs.
January	....	....	....	....
February	752.8	6.0	45.16	52.68
March	915.1	5.2	47.61	55.54
April	826.4	5.5	45.45	53.02
May	788.9	5.0	39.44	46.01
June	759.3	5.6	42.52	49.60
July	692.9	5.0	34.64	40.41
August	639.6	5.0	31.98	37.31
September	601.2	5.0	30.06	35.07
October	....	....	....	....
November	....	....	....	....
December	....	....	....	....
	5976.7		316.86	369.64

Food consumed, 4,600 pounds hay	$23 00	
2,200 pounds grain	16 50	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$54 00
Cost of food for each pound of milk	.92 cents.	
Cost of food for each pound of butter	14 61 cents.	

RUTH.—No. 2369 Maine State Jersey Herd Book. Five years old. Calved October 2, 1896 and December 4, 1897.

1897.	Milk —lbs.	Test —%	Fat —lbs.	Butter —lbs.
January	650.3	4.8	30.21	35.24
February	562.6	4.7	26.44	30.84
March	621.1	5.0	31.05	36.22
April	566.5	4.6	26.05	30.39
May	577.1	4.9	28.27	32.98
June	581.7	5.3	30.83	35.97
July	534.2	6.3	33.69	39.30
August	472.3	5.6	26.44	30.84
September	432.0	4.8	20.73	24.18
October	280.2	4.8	13.44	15.68
November	21.6	4.9	1.05	1.22
December	595.6	4.2	25.01	29.18
	5,895.2		293.21	342.04

Food consumed, 4,200 pounds hay	$21 00	
2,800 pounds grain	21 00	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$56 50
Cost of food for each pound of milk	.95 cents.	
Cost of food for each pound of butter	16.37 cents.	

LOTTIE.—No. 1751 Maine State Jersey Herd Book. Ten years old. Calved October 31, 1896. Due to calve September 29, 1898.

1897.	Milk —lbs.	Test —%	Fat —lbs.	Butter —lbs.
January	800.1	6.0	48.01	56.07
February	666.4	6.0	39.98	46.64
March	619.1	6.0	37.14	43.33
April	547.6	5.6	31.65	36.92
May	546.1	5.6	30.58	35.67
June	554.1	5.8	32.13	37.48
July	516.0	5.6	28.89	33.70
August	579.2	5.5	31.85	37.16
September	591.5	5.0	29.57	34.50
October	511.9	5.6	28.66	33.43
November	366.1	5.7	20.86	24.50
December	309.8	6.2	19.20	22.40
	6,607.9		378.52	441.80

Food consumed, 3,800 pounds hay	$19 00	
3,200 pounds grain	24 00	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$57 50
Cost of food for each pound of milk	.87 cents.	
Cost of food for each pound of butter	13.01 cents.	

ORLETTA. No. 1734 Maine State Jersey Herd Book. Ten years old. Calved October 15, 1896, and November 6, 1897.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter —lbs.
January	560.8	5.1	28.60	33.66
February	496.9	5.0	24.84	28.98
March	543.1	5.3	28.78	33.57
April	522.0	4.9	25.57	29.83
May	560.2	4.6	25.76	30.05
June	551.6	4.8	26.47	30.88
July	501.7	5.2	26.08	30.42
August	419.9	5.6	23.51	27.43
September	203.0	5.7	11.58	13.50
October	....	....	....	....
November	597.6	4.6	27.48	32.06
December	692.2	4.6	31.84	37.14
	5649.0		280.51	327.52

Food consumed, 3,800 pounds hay	$19 00	
3,000 pounds grain	22 50	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$56 00
Cost of food for each pound of milk	.99 cents.	
Cost of food for each pound of butter	17.09 cents.	

DUDLEY—Jersey, high grade. Seven years old. Calved November 1, 1896, and July 27, 1897.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter —lbs.
January	648.5	5.3	34.37	40.10
February	591.4	5.4	31.93	37.35
March	605.3	5.1	30.87	36.01
April	487.4	5.1	24.85	28.99
May	485.3	5.0	24.26	28.30
June	355.8	5.4	19.21	22.41
July	18.8	3.9	.73	.85
August	720.0	4.0	28.80	33.60
September	754.8	3.8	28.68	33.46
October	787.0	4.2	33.05	38.56
November	564.4	4.9	27.65	32.26
December	514.3	4.9	25.20	29.40
	6533.0		309.60	361.29

Food consumed, 3,800 pounds hay	$19 00	
2,900 pounds grain	21 75	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$55 25
Cost of food for each pound of milk	.84 cents.	
Cost of food for each pound of butter	15.29 cents	

PANSY.—Jersey, not registered. Seven years old. Calved March, 1896, and April 13, 1897.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter —lbs.
January	550.2	5.9	31.46	36.70
February	420.0	5.8	24.36	28.42
March	372.9	6.2	23.11	26.91
April	268.3	3.5	9.39	10.93
May	719.3	3.5	25.17	29.36
June	627.6	5.0	33.63	39.23
July	643.6	4.8	30.89	36.04
August	644.9	5.2	33.53	39.12
September	534.2	4.8	25.64	29.91
October	488.1	5.4	26.35	30.74
November	413.1	5.7	23.54	27.46
December	313.7	6.0	18.82	21.96
	6040.9		305.89	356.78

Food consumed, 4,200 pounds hay	$21 00	
3,100 pounds grain	23 25	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$58 75
Cost of food for each pound of milk	.97 cents.	
Cost of food for each pound of butter	16.46 cents.	

ADLE.—Jersey, high grade. Four years old. Calved May, 1896, and April 26, 1897

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter —lbs.
January	495.4	6.6	32.71	38.16
February	387.0	6.8	26.32	30.70
March	251.7	7.7	19.71	22.99
April	55.7	7.6	4.23	4.93
May	652.7	5.1	33.28	38.82
June	709.3	5.8	41.14	47.99
July	675.9	5.4	36.49	42.57
August	682.1	5.6	38.19	44.55
September	553.7	5.0	27.68	32.29
October	597.2	5.3	31.65	36.92
November	401.1	5.4	21.65	25.26
December	330.9	5.9	19.52	22.72
	5792.7		332.57	387.90

Food consumed, 4,600 pounds hay	$23 00	
3,300 pounds grain	24 75	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$62 25
Cost of food for each pound of milk	1.07 cents.	
Cost of food for each pound of butter	16.30 cents.	

TURNER—Jersey, high grade. Seven years old. Calved November 1, 1896, and October 21, 1897.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter. —lbs.
January	706.1	4.7	33.18	38.71
February	553.6	4.8	26.57	31.00
March	528.2	4.7	24.82	28.98
April	531.2	4.2	22.31	26.03
May	563.1	4.2	23.65	27.59
June	543.4	4.4	23.90	27.86
July	453.1	4.8	21.74	25.36
August	401.3	4.6	18.45	21.52
September	202.7	4.8	9.72	11.34
October	129.4	3.8	5.91	6.88
November	778.0	3.5	27.23	31.77
December	646.0	4.4	28.42	33.15
	6046.1		265.90	310.19

Food consumed, 4,200 pounds hay	$21 00	
2,900 pounds grain	21 75	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$57 25
Cost of food for each pound of milk		.94 cents.
Cost of food for each pound of butter		18.45 cents.

MADALINE—Holstein and Jersey. Eight years old. Calved February 23, 1897. Due to calve April 1, 1898.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter. —lbs.
January	....	....	....	....
February	194.9	5.4	10.52	12.27
March	1028.4	4.6	47.29	55.16
April	1108.3	4.2	46.55	54.31
May	975.1	4.2	40.95	47.77
June	878.6	4.0	35.02	40.85
July	839.6	4.0	33.58	39.18
August	824.7	3.8	31.32	36.54
September	747.0	3.9	29.13	33.98
October	587.8	4.2	24.68	28.79
November	354.2	4.5	15.93	18.56
December	177.3	4.5	7.97	9.30
	7715.9		322.94	376.73

Food consumed, 4,200 pounds hay	$21 00	
3,400 pounds grain	25 50	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$61 00
Cost of food for each pound of milk		.79 cents.
Cost of food for each pound of butter		16.19 cents.

FATAMIE—Holstein. Seven years old. Calved March 9, 1897. Due to calve May 19, 1898.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter —lbs.
January	....	....	....	....
February	....	....	....	....
March	905.1	3.8	34.39	40.12
April	1094.7	3.5	38.31	44.69
May	925.6	3.4	31.47	36.61
June	764.4	3.4	25.98	30.31
July	811.6	3.6	29.21	34.07
August	851.5	3.6	30.65	35.76
September	678.0	3.2	21.69	25.30
October	644.7	3.3	21.27	24.81
November	567.6	3.4	19.29	22.50
December	415.0	3.6	14.94	17.43
	7658.2		267.20	311.60

Food consumed, 3,800 pounds hay	$19 00	
2,900 pounds grain	21 75	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$55 25

Cost of food for each pound of milk .72 cents.

Cost of food for each pound of butter 20.3 cents.

LOBLITOP.—No. 1874 Maine State Jersey Herd Book. Ten years old. Calved September 1, 1896, and October 14, 1897.

1897.	Milk —lbs.	Test —%.	Fat —lbs.	Butter —lbs.
January	681.5	4.6	31.35	36.13
February	619.8	4.6	28.51	33.26
March	618.0	5.0	30.90	36.05
April	636.5	4.3	27.37	31.93
May	671.8	4.2	28.21	32.91
June	712.5	4.8	34.20	39.90
July	643.3	4.8	30.87	36.01
August	559.3	4.7	26.28	30.66
September	419.2	3.9	16.34	19.06
October	268.6	3.0	8.05	9.39
November	596.2	3.1	18.48	21.56
December	533.4	4.0	21.33	24.88
	6960.1		302.89	351.74

Food consumed, 4,200 pounds hay	$21 00	
3,100 pounds grain	23 25	
7,000 pounds silage	8 00	
15 bushels turnips	1 50	
Pasturage	5 00	$58 75

Cost of food for each pound of milk .84 cents.

Cost of food for each pound of butter 16.73 cents.

METEOROLOGICAL OBSERVATIONS.

The observations summarized in the table on the following page were made by members of the station force. The instruments employed are similar to those in use by the U. S. Weather Bureau, and include: Wet and dry bulb thermometers; maximum and minimum thermometers; thermograph; rain-gauge; self recording anemometer; vane, and barometer.

Systematic observations were begun at the college in 1869. Results covering so long a period, allowing us to make comparisons with the averages for the entire period, must possess a constantly increasing value.

The season of 1897 was remarkable for the cold, backward spring. The temperatuıe for April and May varied but little from the average. The temperature for June, however, was five degrees below that of the average for twenty-nine years. At the same time the rain-fall was considerably in excess of the usual amount, although the marked dampness was due rather .o trequent than to large rain-falls, rain falling on eleven days in May, and thirteen days in June. The large number of cloudy days also contributed to this result.

The hours of observation were 7 A. M., 2 P. M. and 9 P. M. Lat. 44°, 54′, 2″, N. Long. 68°, 40′, 11″, W. Elevation above the sea, 150 feet.

METEOROLOGICAL SUMMARY FOR 1897.

Observations Made at the Maine Experiment Station.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.	Total.
Highest barometer	30.63	30.76	30.75	30.48	30.14	30.73	30.17	29.99	30.22	30.51	30.48	30.40	30.51	....
Lowest barometer	29.11	29.51	28.80	29.34	29.42	29.41	29.46	29.20	29.53	29.27	29.04	29.19	29.27	....
Mean barometer	29.86	29.86	29.86	29.87	29.80	29.74	29.83	29.71	29.90	29.95	29.84	29.85	29.84	....
Highest temperature	52	43	48	74	76	83	93	85	90	79	59	51	....	....
Lowest temperature	—18	—16	—11	14	29	39	43	41	28	19	3	11	....	....
Mean temperature	17.42	20.24	28.40	41.80	52.12	56.96	66.61	64.17	56.20	46.90	33.79	23.33	42.46	....
Mean temperature for 29 years	16.08	19.16	27.47	40.20	52.36	62.00	66.88	64.91	56.98	45.63	34.14	21.21	42.34	....
Total precipitation	3.03	2.38	3.96	3.03	4.49	3.71	2.02	5.09	2.65	1.01	5.04	3.58	......	39.99
Mean precipitation for 29 years	4.20	3.94	4.25	2.86	3.53	3.53	3.35	3.82	3.42	3.96	4.44	3.90	....	45.20
No. days with precip. of .01 inch or more	7	5	12	10	11	13	9	6	7	3	8	10	....	101
Snow fall in inches	23.2	9.5	6.5	....	....	....	....	....	....	....	6.0	12.8	....	58.0
Average snow fall for 29 years	22.9	21.5	16.8	6.1	0.3	....	....	....	....	1.0	7.9	17.7	....	92.4
Number of clear days	15	9	10	10	4	10	7	8	14	21	8	7	....	123
Number of fair days	6	11	9	6	12	7	11	12	10	6	8	7	....	105
Number of cloudy days	10	8	12	14	15	13	13	11	6	4	14	17	....	137
Total movement of wind in miles	5490	5678	6027	6611	6658	4932	5711	4800	5107	5766	7495	5103	....	....

REPORT OF THE TREASURER.

Maine Agricultural Experiment Station in account with the United States appropriation, 1896–7:

DR.

To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1897, as per act of Congress approved March 2, 1897		$15,000 00

CR.

By salaries:–		
(a) Director and administration officers	$2,423 28	
(b) Scientific staff	5,421 84	
(c) Assistant to scientific staff	1,160 44	
(d) Special and temporary services	11 63	
Total		$9,017 19
Labor:		
(a) Monthly employees	$967 80	
(b) Daily employees	337 44	
(c) Hourly employees	28 00	
Total		1,333 24
Publications:		
(a) For printing	$114 15	
(b) Printing annual report	168 00	
(c) For envelopes for bulletins and reports	111 20	
(d) Other expenses	129 00	
Total		522 35
Postage and stationery		312 48
Freight and express		203 33
Heat, light and water		557 35
Chemical supplies:		
(a) Chemicals	$132 62	
(b) Other supplies	124 25	
Total		256 87
Seeds, plants, and sundry supplies:		
(a) Agricultural	$28 49	
(b) Horticultural	502 51	
(c) Botanical	6 50	
(e) Miscellaneous	51 48	
Total		588 98

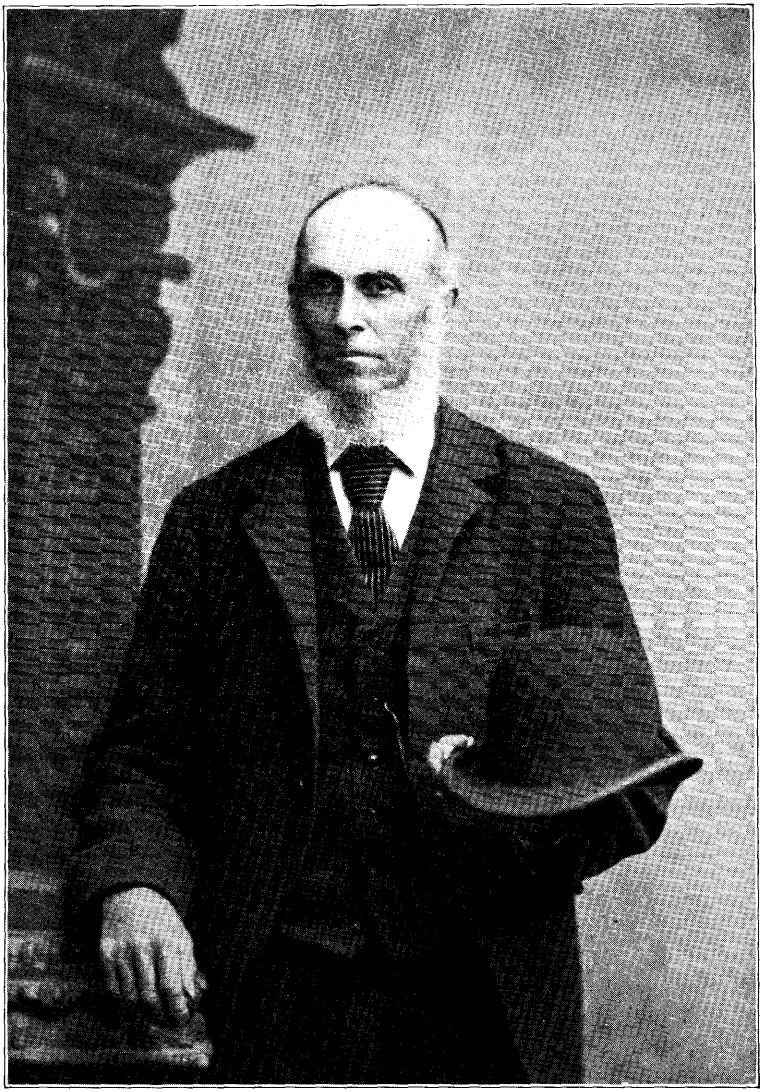
Fertilizers		$67 25
Feeding stuffs		450 88
Library		207 62
Tools, implements, and machinery		34 00
Furniture and fixtures		218 97
Scientific apparatus		299 40
Live stock:		
(c) Sheep	$ 9 50	
(f) Sundries	26 10	
Total		35 60
Traveling expenses:		
(a) In supervision of Station work	$148 36	
(b) In attending various meetings	106 18	
Total		254 54
Contingent expenses		16 36
Building and repairs:		
(a) New buildings	$434 86	
(b) Improvements	95 12	
(c) Repairs	93 61	
Total		623 59
Total		$15,000 00

ISAIAH K. STETSON, Treasurer.

I, the undersigned, duly appointed Auditor of the Corporation, do hereby certify that I have examined the books of the Maine Agricultural Experiment Station for the fiscal year ending June 30, 1897; that I have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000.00, and the corresponding disbursements, $15,000.00; for all of which proper vouchers are on file and have been examined by me and found correct.

And I further certify that the expenditures have been solely for the purposes set forth in the act of Congress approved March 2, 1887.

ELLIOTT WOOD, Auditor.



D. J. BRIGGS.

APPENDIX.

Annual Report of the State Pomological Society.

1897-98.

REPORT OF THE SECRETARY.

"It never rains, but always pours," is the way some cynical philosopher interpreted the course of nature. The fruit situation in Maine the two past years would almost seem to illustrate this.

The year 1896 was a phenomenal year in the generally large crop of fruit produced in all parts of the United States. Various authorities estimated the Maine crop that year at different figures. Your secretary has the idea that there were about 1,500,000 barrels of apples. Of these about two-thirds were sold, and one-third fed out to stock or decayed. Of the two-thirds sold one-half was probably sold without a profit to the producer. One would hardly think after such a season of fruitfulness that we should have a season like that of 1897. For various reasons, some of which are understood, and a great many are not, the State of Maine did not produce as much fruit as was needed for home use. In one case where one grower in 1896 had over 3,000 barrels of apples, the past year he had hardly enough for his own family. To make conditions still worse, the abundant crop of the year before in many cases made the farmers indifferent to the need of watchfulness and care, and the tent caterpillar (*Clisiocampa Americana*) came in large numbers and caused great damage. There were also more or less of the forest tent-caterpillar (*Clisiocampa sylvatica*) and in some places were the cause of much injury to the trees. Large numbers of the insects matured and the apple trees bore many clusters of the eggs of both species. Many of these clusters were removed and destroyed before the snow went off, but enough were left to do great mischief to the foliage in 1898. It would have been better to have sprayed the trees in 1897, or for that matter at any time when there are caterpillars to be found, as this seems to be the only successful method of preventing their ravages.

The season of 1897 was also remarkable for the unusually heavy and frequent rainfalls. To this we ascribe in some measure the small fruit crop, and the inferior size and quality of our apples. The trees in many cases made slight growth, though strange as it may seem, the fruit buds indicate there will be a heavy bloom in 1898.

The same causes affected the crop of small fruits. The winter before was a little severe for vines and shrubs and this had some effect upon the crop of strawberries as well as raspberries.

The conclusion of this seems to be that we have yet very much to learn as fruit growers. Several growers in the State had some apples this year, and the query arises in my mind whether it may not be the ignorance and neglect of others that made the fruit crop of 1897 so small. Adversity is said to be a hard teacher but faithful, but of what avail is it if the pupils will not heed the lessons?

OUR FIRST STRAWBERRY AND ROSE MEETING.

For several years the holding of such a meeting has been discussed at our business meetings, but for one reason or another it did not seem advisable to hold one. This year an invitation was extended by Kennebec Pomona Grange to hold such a meeting in the city of Augusta. The executive committee thinking the time had come for taking favorable action voted to accept the invitation. A list of premiums and a programme were announced, but the season was so backward the first date had to be cancelled and a second one announced. As it happened the day before, the worst storm of the season made sad havoc with much of the fruit and flowers intended for the meeting. The meeting, however, was held, and about 75 plates of attractive berries and a very neat display of flowers made one of the most interesting exhibitions ever held in the State. So far as the secretary knows it was the first exhibition of small fruits. The programme was one of special interest and much enjoyed. Mayor Choate presided over the evening meeting by invitation of President True. He welcomed the society to

Augusta, and expressed the wish in behalf of the city that similar meetings might be held in succeeding years. The impression made, so far as one may intelligently judge from reports, was favorable. It will be wise, in the opinion of your secretary, to continue holding such meetings, and appearances indicate that Augusta people would like for us to hold them in their city. It seems fitting in this connection to recognize our obligation to Dr. George M. Twitchell for the assistance he rendered us on this occasion.

THE ANNUAL EXHIBITION.

The annual exhibition was the cause of not a little solicitude on the part of the executive committee. Look where they might little fruit was in sight from which to make up an exhibition. Special efforts were put forth, however, to call in a large exhibition of flowers and plants, so that the hall was reasonably well filled. The number of exhibitors was less by one-half than the year before. The fruit shown was inferior to that ordinarily seen at our exhibitions, and very much to our regret was no credit to the State. The plants and flowers were good, and to the taste of exhibitors of these we were largely indebted for the excellence of our exhibition.

Perhaps at this time it may be proper to call attention to the fact that the hall in which we have recently made our exhibits is not very well adapted to the purpose. In the first place it is on the third floor of a large building of which the public has more or less fear, and in consequence the number of visitors is much less than it should be when there are so many visitors upon the ground. If it was more accessible we should expect larger exhibits and more people to examine them. In other words in consequence of our environments we cannot expect the most satisfactory results either in attendance or exhibits. Again, the shape of the hall is not the most desirable, and without an unreasonable expense it cannot be put and kept in good exhibition order. When the hall is crowded with people, as it often is during exhibition days, the dust arising from the two floors below is almost unendurable. It is earnestly to be hoped that better exhibition arrangements may be made in the future, for the interests of all seem to be involved, as the exhibition cannot be made as attractive as it should be under such circumstances.

THE WINTER EXHIBITION.

Although there was doubt in the minds of the executive committee as to offering premiums for such fruit as grew in 1897, the usual schedule was made out, and announced. The severity of the storm prevented people bringing in much fruit and the exhibit was very small. It was a great disappointment to the people of Jay and vicinity as many had their specimens selected for the purpose.

THE WINTER MEETING.

A cordial invitation was extended by North Jay Grange to hold this meeting in their hall. Realizing that there are many large orchards in this part of the State, and that the fruit grown here is unexcelled, there seemed to be good reasons for accepting the invitation. The programme arranged for the meeting was one of the best ever offered by the society, and all arrangements were perfected for giving the society a most cordial welcome to Jay. The meeting was called for February 16 and 17. On the evening of the 15th a storm arose that developed into the severest of the winter up to that date. All day the 16th the snow fell and the wind drove it about with fury. The roads were blocked with drifts, and it was impossible for people outside to drive in. Under these circumstances the attendance was very small the first day but increased each session till the close. The speakers were all present, and we only regret we have not space to give their papers and the discussions more fully in the transactions. The Jay people were sorely disappointed over their inability to attend the meetings. We were cordially received by the people, and since the meeting the secretary has received an invitation from the grange to hold our next winter meeting with them.

AMONG OUR NEIGHBORS.

Last fall your secretary was invited to act as judge of fruit at the Provincial Exhibition of Nova Scotia. No sooner was your secretary well established at his hotel than he found himself among the most cordial of people, especially the members of the Nova Scotia Fruit Growers' Association, who were unremitting in their efforts to make his stay among them pleasant. This association, if one may judge from appearances, is an organization created for work in the interests of the fruit growers of that province. The cordial relations existing between that organization and the general exhibition authorities were noticeable on every hand. The new horticultural building, a model in its way, was made in accordance with their wishes, and the prominence given to the place may be inferred when it is stated that in this hall were held the formal receptions given the governor general and his wife, and Sir. Wilfred Laurier, the Canadian prime minister. There was the best of reasons for selecting this place, for the Nova Scotia Fruit Growers' Association had made it the most attractive place upon the entire grounds. The exhibition was delayed several weeks to please the fruit growers, "because," as the general manager assured me, "we could not afford to neglect this important industry in our province." Nova Scotia is Maine's nearest rival in growing fruits. In 1896, it is estimated that the province produced 500,000 barrels of apples, nearly all of which were sent to the foreign markets. Halifax is twenty-four hours nearer the market than either Boston or Portland. It is worth something for us to know of what importance the industry is regarded there, because it sometimes appears as if the industry in Maine was underestimated by the public. They are discussing the same fruit problems that we are, and at their winter meeting in January the disposition of their fruits was given a very conspicuous place.

Perhaps you may expect something regarding the exhibition itself, and I only wish I had the space to speak in detail. There were over 2,500 plates on the tables, and some thirty or more barrels of fruit for examination, besides the canned goods and the nursery stock. This will give you some idea of the extent the exhibition in fruits, and this was supplemented by a large exhibit of plants and flowers, so that the whole exhibit was made very attractive. The fruit in quality was much better than our Maine fruit last year though several varieties were inferior. The fruit growers assured me it was an off year and the fruit poor. It was slightly affected by scab, but very little by insects. There were no traces of the trypeta pomonella in any of the fruit examined, and I was assured they had seen none there. The varieties were about the same as grown in Maine, though greater prominence was given to the Gravenstein, Ribston Pippin, Blenheim Pippin, Fallawater, Golden Russet, Nonpariel, and Tompkins than here. The fruit growers there have the object of fruit growing clearly in mind, and they are intelligently fighting the enemies of fruit culture, studying all the conditions of success known, and investigating for themselves along all lines that will aid in developing the industry which they represent.

D. H. KNOWLTON, Secretary.

OFFICERS FOR 1898.

President.

JOHN W. TRUE, New Gloucester.

Vice Presidents.

S. H. DAWES, Harrison.

D. P. TRUE, Leeds Center.

Secretary.

D. H. KNOWLTON, Farmington.

Treasurer.

CHARLES S. POPE, Manchester.

Executive Committee.

The President and Secretary, *ex-officio*; A. E. Andrews, Gardiner: Miss G. P. Sanborn, Augusta; C. H. George, Hebron.

Trustees.

Androscoggin	County,	Chas. E. Waterman, East Auburn.
Aroostook	"	Edward Tarr, Castle Hill.
Cumberland	"	T. M. Merrill, West Gloucester.
Franklin	"	F. D. Grover, Bean.
Hancock	"	Mrs. S. L. Brimmer, Mariaville.
Kennebec	"	E. A. Lapham, Pittston.
Knox	"	Alonzo Butler, Union.
Lincoln	"	H. J. A. Simmons, Waldoboro'.
Oxford	"	Lemuel Gurney, Hebron.
Penobscot	"	W. M. Munson, Orono.
Piscataquis	"	H. L. Leland, East Sangerville.
Sagadahoc	"	A. P. Ring, Richmond Corner.
Somerset	"	F. E. Nowell, Fairfield.
Waldo	"	Fred Atwood, Winterport.
Washington	"	J. F. Sprague, Charlotte.
York	"	C. A. Hooper, Eliot.

Member of Experiment Station Council.

Chas. S. Pope, Manchester.

Committee on New Fruits.

Willis A. Luce, South Union; D. J. Briggs, South Turner; W. M. Munson, Orono.

TREASURER'S REPORT.

FINANCIAL CONDITION OF THE SOCIETY DECEMBER 31, 1897

ASSETS.

Bounty due from the State	$1,000 00
Due from Maine State Agricultural Society	150 00
Permanent fund	1,350 00
Property owned by the society	250 00
Interest estimated	20 00
Cash in the treasury	63 43
	$2,833 43

LIABILITIES.

Outstanding orders	$125 00

JOHN W. TRUE,
D. H. KNOWLTON,
A. E. ANDREWS,
G. P. SANBORN,
C. H. GEORGE.
} *Executive Committee.*

PUBLIC MEETINGS

OF THE

Maine State Pomological Society.

PAPERS, DISCUSSIONS, ETC.

STRAWBERRY AND ROSE MEETING—G. A. R. Hall, Augusta, July 14, 1898.

ANNUAL MEETING—Lewiston, September 2, 1897.

WINTER MEETING—Grange Hall, North Jay, Feb. 16 and 17, 1898.

PUBLIC MEETINGS.

STRAWBERRY AND ROSE MEETING HELD IN AUGUSTA WEDNESDAY, JULY 14, 1897.

Two o'clock P. M. Easy Culture of Small Fruits, Chas. S. Pope, Manchester; discussion; Possible Home Market for Small Fruits, Dr. Geo. M. Twitchell, Augusta; discussion; Popular Varieties of Strawberries, Willis A. Luce, S. Union; discussion.

Seven-thirty P. M. The Place for Small Fruits upon the Business Man's Table, J. H. Manley, Augusta; Decoration of Home Grounds, R. H. Gardiner, Esq., Boston.

ANNUAL MEETING DURING THE EXHIBITION.

Election of officers, informal reports and business matters.

WINTER MEETING AT NORTH JAY, FEBRUARY 16 AND 17, 1898.

Wednesday, A. M. Tables will be in readiness for display of fruit, which must be properly entered and in place before 1 o'clock P. M.; report of Treasurer, followed by any other business that may come before the society; report of Secretary, D. H. Knowlton, Farmington; address of welcome, E. E. Paine; response; President's Annual Address, John W. True, New Gloucester.

Afternoon. Fighting Insects and Better Care of Our Fruit Trees, Prof. Elijah Cook, Vassalboro; discussion; Horticulture at the Experiment Station, Prof. W. M. Munson, University of Maine, Orono; discussion.

Evening. A New Plan of Work, Hon. Z. A. Gilbert, North Greene; The Object and Value of Tillage in the Orchard, Geo. T. Powell, Ghent, N. Y.

Thursday, A. M. Disposition of Our Fruit—Shall We have a Maine Fruit Growers' Union? F. S. Adams, Bowdoinham; discussion, Led by E. C. Carll, Buxton.

Afternoon. The Possibilities of Small Fruit Culture in Maine, with Practical Suggestions for Beginners, E. W. Wooster, Hancock Point; discussion.

Evening. Advantages of the Study of Natural History, Prof. A. L. Lane, Waterville; Seedtime and Harvest: or Results from their Study. Illustrated by work done in the Bangor schools, Supt. Mary S. Snow, Bangor.

ADDRESSES AND DISCUSSIONS.

AT THE STRAWBERRY AND ROSE MEETING.

The meeting was opened by Pres. True, who said:

It is with a great deal of pleasure that we start in on this new line of work. It is something that has never been attempted in the State before, a strawberry and rose meeting, and we will hope, although the season has been against us, this year, our exhibit is as good as could be expected under the circumstances, and we hope that our successors will continue the work. In years to come the seasons and weather may favor us.

GROWING STRAWBERRY PLANTS.

Mr. Lucius J. Shepard, Experiment Station.

You will all agree with me that there is too much poor fruit on the market. How can we better the standard? It is one thing to grow strawberries for berries, and it is a very different thing to grow them for plants. In growing flowers the utmost care is taken in growing the plants. They must be healthy. It is too often the case in strawberry growing, that we grow all the fruit we can, and the plant is a secondary matter.

One method of raising plants is to let the plants have their own way and take the runners without selection. In order to get good fruit we must make careful selection of plants. At the college we raise tomatoes. We take a tomato that has certain good qualities, and breed it up just as people breed cattle. We look out for certain good qualities tne plants have and then breed for them.

We hear, today, of pot-grown plants. The most common way to get them is take your pots and go into your field and set them in the earth directly under the runners. As the runner fills the pot with roots you take it to the field and transplant without breaking the delicate feeding roots. Another way is to set in hot-houses. If the plants are set this fall we will get a crop next year. Some people prefer to set in the spring, others in the fall. That is a matter of choice.

DISCUSSION.

Mr. Pope—What size pot do you use?

A. I should say a three inch pot.

Q. How soon is the earliest time, plants set now, should be transplanted? A. Plants set now will fill the pots with roots in about three weeks. You save a small ball of earth and the roots of the plant are not disturbed. In setting out plants I have had a good deal of experience with different men. They are bound to set the plants too low in the ground. The crown should not be covered. A person can make good wages at setting plants at one dollar per thousand. The way we set plants is to have the ground good and soft, mark it out, then have a boy distribute the plants in the rows, and follow him, setting the plants and firming them in well. A strawberry plant is something easy to make live, but we should firm them in well with the feet, by stepping as near to the plant as possible.

Mr. Knowlton—Is a plant grown in a pot any better than a plant of equal age grown in the ground?

A. No, only in the advantage in moving. Otherwise no difference.

POPULAR VARIETIES OF STRAWBERRIES.

By Willis A. Luce, South Union.

Early Varieties—Beder Wood, Clyde, Gardener, Hoffman, Michel's Early, Meek's Early, Rio, Staples, Tubbs, Tennessee Prolific.

Midseason—Bubach, (P), Bisel (P), Crescent, Erie, (P,) Haverland, Lovett, Wm. Belt.

Late to Very Late—Brandywine, Equinox, Enhance, Gandy, Hunn, Parker Earle, Princeton Chief, (P), Timbrell.

DESCRIPTION OF VARIETIES.

Michel's Early, the best extra early berry I have ever seen; vigorous grower, makes lots of plants, apt to be too many but lacking in root growth. Perfect flower, color light scarlet, a great pollenizer. Not very productive.

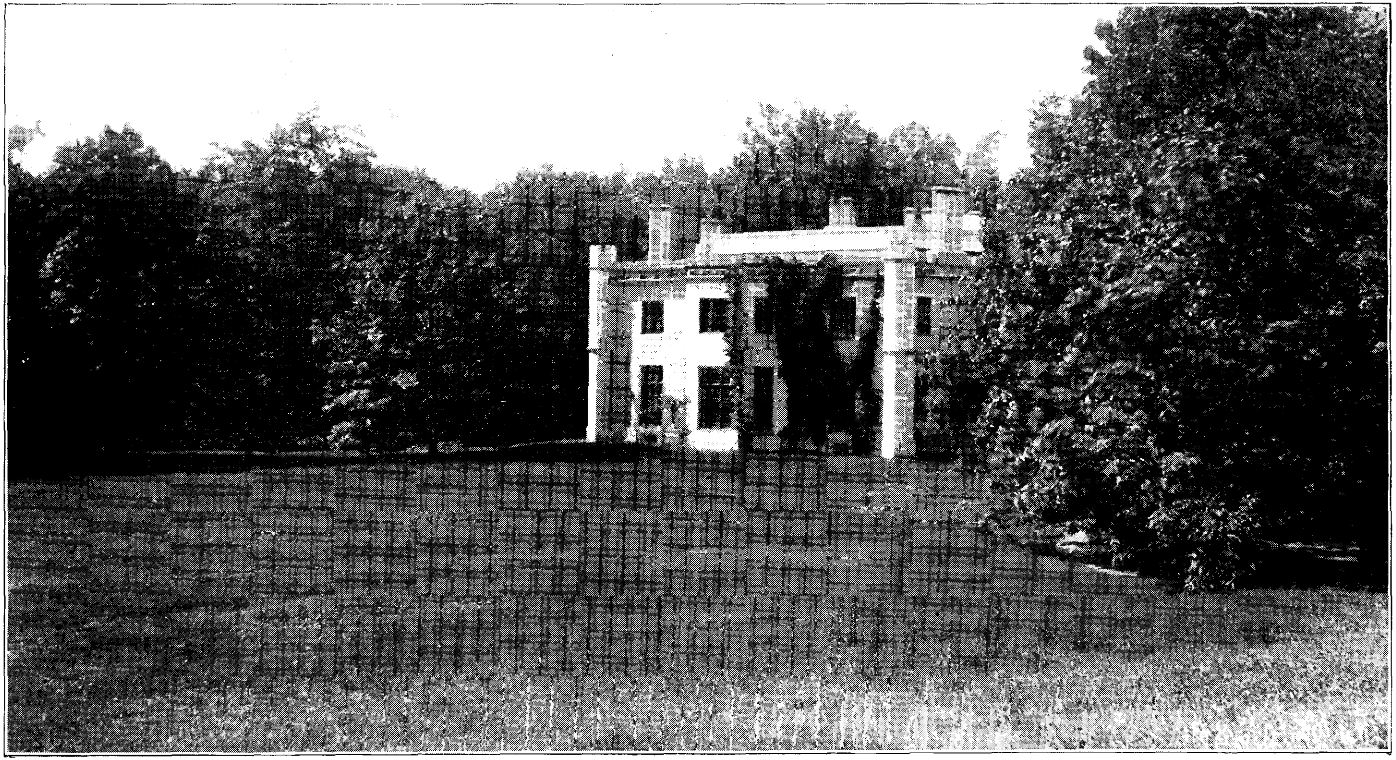
Meek's Early, said to be as early as Michel's Early, compares favorably with other early varieties as to production. Fruit good size, deep crimson color, nearly black, when fully matured. Excellent flavor, perfect flower.

Columbian—Delaware Station Report. Very vigorous and healthy plants, foliage bright green, flesh soft light pink color, quality fair, very productive.

Rio—Mr. Edward T. Ingram, the well known originator of Brandywine, in speaking of this variety says, Rio is the earliest berry found that is worth growing. The plant is strong and healthy with plenty of good foliage. The bloom is perfect, insuring perfect fruit, which is large size for so early. It is of dark glossy color and excellent flavor.

Tennessee Prolific—Is one of the good medium early varieties, very vigorous and healthy with never a spot of rust and is said to do well under most circumstances, perfect flower, a valuable pollenizer.

Staples—Originated by Mr. Staples of Dayton, Ohio, now deceased. A seedling of Warfield and like its parent, of dark glossy red. Very productive, perfect flower, quality superior to most dark berries. Fruit fine, the plant is moderate size but is very vigorous and quite healthy.



OAKLANDS, RESIDENCE OF ROBERT H. GARDINER, ESQ., GARDINER.

TUBBS—Originated by Mr. Tubbs of Baltimore, or near Baltimore, said to be a very nice berry of Crescent type, in size about the same as Crescent, but holding its size through the season, not running down small like the Crescent, perfect flower, vigorous grower.

BEDER WOOD—Holds a high place as a productive variety and pollenizer of pistillates, but a few days behind Michel's, has healthy foliage, makes plenty of plants.

CLYDE—This new berry seems to be gaining favor wherever it is grown. It originated with Dr. J. Stayman. It is a seedling of the Cyclone, which is a cross between Crescent and Cumberland, as large as Bubach, nearly a week earlier and much firmer. It is a strong staminate and is well suited to pollenize among the medium and medium early varieties. I find no trace of disease about it, but very vigorous and healthy. It resembles Haverland in color and foliage, but is a more upright and steady grower. Color of very dark scarlet, and very productive.

GARDNER—The originator says: "This strawberry was found growing in one of our Red Cedar groves eight years ago. When found, there were but four plants. The large berries growing in solid sod attracted our attention. We thought that a variety that would yield such large stems of berries in sod would do pretty well cultivated, and we have not been disappointed. It is a staminate variety; plants very stocky and large, averaging from 16 to 18 inches in height; it fruits very heavy. It is a berry shaped like the Crescent, but very much larger, and holds its size down to the last picking better than any variety that we have ever grown. Ripens very early. It is a fast runner, entirely covering the ground in one season, set three feet apart in rows three and one-half feet apart. Flavor very rich, nearest the wild strawberry of any variety we have ever grown. It will stand very severe drouth, better than any variety now under cultivation, excepting none."

HOFFMAN—The great southern market berry, especially valuable for its shipping qualities, being perhaps the firmest berry grown. When it first turns red, it will bear almost any amount of handling.

MIDSEASON VARIETIES.

HAVERLAND—Too well known to need description, has many friends wherever known, vigorous, productive, but berries are rather soft for market, pistillate. Popular Gardening says, "A berry to grow enthusiastic over, when one sees the fine fruit that entirely covers the ground from beginning to the very end of the season. It is enormous in foliage, enormous in number of runners, enormous in quantity of fruit. Take it all in all, the Haverland is one of the best standards. For a common berry, and where one berry sells as well as another, this is by all odds the one to grow, taking the Lovett for every fifth row to fertilize it, and anyone cannot help making money growing strawberries. They are safe varieties to set."

CRESCENT—This once most popular of all berries is still grown to a considerable extent, but is showing some weak points.

LOVETT—Very productive, medium to large and firm, ripens the bulk of its enormous crop midseason to late, though it often has a few scattering early berries. It is a vigorous, healthy grower and a strong staminate, making it a valuable variety for fruiting pistillate sorts.

THE BUBACH is a pistillate variety, of good flavor, dark rich color and pleasing appearance. The Bubach has taken a very strong place in strawberry culture, in most places; takes the place of the Sharpless, being nearly twice as productive as that variety. The Bubach is a wonder in its season of fruit, which lasts about eight or ten days, completely covering the ground with large berries. It is a strict pistillate variety and needs to be well fertilized with a perfect flowering kind. The fruit is irregular in shape and holds out quite large until last picking. The flavor is ordinarily good and anyone who can sell it fifteen minutes after packing can make no mistake in planting the Bubach. It lacks one thing of being a perfect berry, it is too soft for market. At the same time I suppose it has more friends than any other variety.

ERIE—The Erie strawberry originatetd at Erie, Pa., and claimed by the originator as the best all round berry. The fruit is large and symmetrical, and altogether has a business appearance, and as the blossom is perfect and strong it seems to be just what is wanted to plant among our host of pistillates.

WM. BELT—This variety was originated in Ohio some eight years ago by the late Wm. Belt. Six years ago, he sent it to Mr. M. Crawford on trial, claiming that it was larger than the Bubach, and twice as productive and of a better quality. After testing it on light and heavy soils and in both hills and matted rows, Mr. Crawford was of the opinion that it was the most desirable variety that he had ever grown, and offered it to the American people with the greatest confidence. It has been tested at a number of experiment stations and has made a good record.

ARROW—This is a seedling of the Haverland, the famous Ohio berry which has been so universally successful, and is still a standard variety in many sections. A healthy plant and great productiveness were the Haverlands strong points. Its faults were: extreme softness and too light color, with a lack of uniformity in the size of its fruit, some of it being very large and some small. Arrow is offered as a variety in which these faults do not appear while the best traits of the parent are reproduced. I fruited it last year for the fourth time and was better satisfied with it than ever, in view of the intense heat and dry weather contended with, not only during the early season of fruiting, but throughout the growing season of late summer. Unlike many seedlings it has seemed to increase in vigor and size with each successive fruiting. A strong vein of Crescent blood is marked in the plant, which is of a very vigorous habit, with bright and healthy foliage, absolutely free from rust in all seasons. The fruit ripens with the Haverland and closely resembles it in form, but it is much brighter in color and firmer in texture and of high flavor. With me it is nearly if not quite as productive as the Haverland both in quarts and in number of berries for, though falling below Haverland in the dimension of its largest specimens; it maintains a remarkable uniformity of size and shape; it inherits the valuable characteristic so notable in its parents of being a pistillate.

BISEL—Its originator was D. L. Bisel of Marion county, Illinois, and the following is what he says: "This new berry has attracted the attention of growers and all others who have seen it; is now being offered for the first time. It is pronounced by the leading horticulturists and all others that have seen the fruit, to be a fine berry, well suited for marketing. Points that are essential in making a good variety are hardiness, healthiness and productiveness, with solidity sufficient to place in good condition on the market. Bisel does not only possess these points; is one of the most hardy, if not the most hardy of the strawberry family; in quality it surpasses any known kind; it is not only the best berry but the most profitable for the commercial grower to plant; also a good family variety. Pistillate.

LATE TO VERY LATE VARIETIES.

GANDY—A good reliable standard late variety. Fruit large, very firm, and an excellent market berry. It is productive under good culture. While it is one of the best when properly fed and cultivated, it will not thrive under neglect.

PARKER EARLE—Still holds its well earned standing as a market and home berry. Does not do well on light soil. It sets an enormous amount of fruit and brings it to maturity under proper condition.

THE ENHANCE STRAWBERRY—Small fruit growers of Michigan and Wisconsin agree that this is one of the very best of varieties for late. It is a sure cropper and a large vigorous plant with strong roots. It withstands drouths well and is a large yielder. The berries are uneven and ribbed but they sell and ship well. It blooms late and resists frost and is thus valuable for low ground. It is a fine pollenizer for late varieties and a good all round farmer's berry.

HUNN and EQUINOX—Geneva Ex. Sta. Report, '96—are said to be promising new varieties.

PRINCETON CHIEF—The fruit of the Princeton Chief is very fine; the berries are large and of good shape, a dark glossy red color, and very solid—not hollow like other large berries but solid as an apple. The flesh of the berries is a deep red color throughout keeping its color when canned. The berry is well covered with a large dark green calyx, giving them a fine attractive appearance, and protecting the berries in shipping. Pistellate.

BRANDYWINE—This new candidate for public favor originated with E. T. Ingram, Pennsylvania. He claims it is of immense size and of fine quality; quite firm and shapely for so large a berry. Foliage of the largest and thriftiest, entirely free of scald or blemish. Heavy peduncles. In average size it is as large as any ever raised and the shape is more uniformly good than that of any of the other large varieties. In general it is heart shaped often broadly so without neck. Its most pronounced irregularity inclines toward a Sharpless shape, occasionally of two berries joined together calyx and sepals broad and many. Medium red and flesh red, firm and solid for so large a berry; none more so. Quality not the best but fully as good as the Sharpless and better than Bubach. Vines exceedingly prolific. The best berry in our collection of this season up to date. Brandywine continues a long time in fruit, and is of superior shape, quality and size for so large a berry. Foliage perfect.

TIMBRELL, (Pistillate)—"The Queen of Strawberries," considered by many eminent authorities as the best strawberry in existence; it is certainly the best late pistillate and seems perfection in every way—is destined to become wonderfully popular when further disseminated, as reported from them who have grown it enthusiastically praise it. The magnificent berries are borne in immense clusters often twenty-six to thirty berries to a stem and are of the largest size and delightful flavor, rich, juicy and sprightly, by some thought the finest quality of any strawberry in cultivation. In shape nearly round and generally symmetrical, very solid and meaty; color very dark crimson, a little patchy at first but when fully ripe a solid crimson. Those who have the means of knowing say that it will endure more wet weather without injury and will keep longer before or after picking than most varieties. It is very late in blooming and in consequence the flowers are not liable to injury from frosts. The fruit always ripens very late. The plants are pictures of health, strength and vigor, and are so distinct that they can be picked out of a hundred varieties at a glance. This is more a family than a market berry.

These berries will not succeed everywhere nor with everybody. I have come to the conclusion that it is more complying with the laws of growth and development than all else beside. Some varieties of strawberries put me in mind of persons that you and I have seen; if they can have everything to their liking they are very sweet, but you cross their path a few times and the sweetness is gone. So far as I know I have discarded those varieties that you have to pet and coax all the time in order to get any fruit, nearly all the varieties I have mentioned I have either grown or seen growing. I find the experiment station reports very helpful and have noticed this that the vigorous healthy varieties in nearly every instance maintained these qualities whether in Texas, Michigan, Colorado or Maine.

POSSIBLE HOME MARKET FOR SMALL FRUIT.

By Dr. George M. Twitchell.

If by any means nature could be coaxed into having "things grow wild where there's a market for them," the hidden springs of ambition would have no uplifting or propelling power. This food of support, whatever its cost, comes only in return for well expended effort, and as conditions have changed and steps been taken out of cruder and plainer up into more comfortable and elaborate forms of living, there has resulted a corresponding change in demand. To-day it is not the coarser but the finer, not the barrel of salt pork and corned beef in the cellar, but the fruit in the garden and upon the tree, the chickens and lambs about the farm, which should supply the home market. With this change in desire for quality and variety there goes still the necessity for providing, and in these latter days we have been learning that along with craving of palate must be considered length and depth of pocket book.

Whatever lessens the expense of the food of support is at once a blessing as well as necessity. Under complex conditions surrounding the business man of to-day, the farmer here stands side by side with the merchant, the problem of food supply for the family has become a matter of supreme importance. Whatever will tend to prolong life, promote health and aid in maintaining that mental activity so necessary to measure accurately the bearing of problems entering in, and centering about the home of the man of moderate means, must be recognized and utilized.

Slowly have we been learning that the pocket book may be relieved, the butcher and grocery dealer's visits made less frequent, and equal or better health insured by increasing the output of the garden, orchard, sheepfold, poultry yard and field. We are finding that in the increase of choicer and finer products of the farm the expenses of living may materially be reduced.

So first of all would I urge the home table as the possible home market to be cultivated. When the day comes and the producer so increases business that his own table will be loaded with the fruits of the season, from the luscious strawberry in June to the Golden Russet of April; when the skill of the housewife shall make rich the store for winter and spring use; then shall it be that the larger grasp of business has been taken and the net balance tell the story of profit on the farm. In this study of the possible market at home it must be that fruits and home grown products will take the places held formerly by the rich cake and pastry, but not to the loss of health or wealth to the man on the farm.

A few years ago, as we count time, 100 crates of strawberries supplied Chicago market. During the present season 120 crates or more have been coming into Augusta daily and the demand has not been met. Not a village and hardly a corner grocery but is regularly supplied with California fruit and bananas this season. Demand all along the line has increased at a marvelous rate, far beyond the possibility of home supply, even of the natural products of our own State. For this reason would I urge secondly, the substitution of choice, fresh, home grown fruit for the immature and necessarily imperfect supply coming from distant sections of country. The sharp distinction between absolutely fresh and choice, and that from which the bloom has departed, and which bears the touch of age, must be made clear to the consumer. The grower of Dighton berries found an open market, at increased price, for his fruit picked in the early morning and placed in South Market street with the dew still sparkling on each berry. The assumption that consumers will not pay more for fresh than old goods is false, the trouble being the object lesson is not set clearly before them. Place a crate of freshly picked strawberries side by side with those twenty-four hours old and which will be selected.

Cultivate the home market for a right down choice berry, plum, pear, currant and gooseberry. In one of our country towns the past year, the enterprising wife of a plum grower marketed forty-eight bushels fresh from the trees, simply because they were fresh, selected specimens put up in attractive form. The possible home market in this direction is not appreciated by growers, else the home supply would be multiplied many times.

We delight in singing the glories of the Pine Tree State, its beauty of rugged coast-line scenery, its grand old mountains, its fertile valleys and landscapes of surpassing loveliness; its rivers, lakes and forests; but we have not yet sung as we should the richness of its fruitage or the glory of its fields. Hither come the city dwellers by the thousands, scattering in every direction, yet to our shame be it said, that before they can once be fed we must turn to the city from whence they came, for the products of the farm, which alone can appease their hunger. Possible home markets? Why, they are all about us, to be multiplied, in coming days, over and over again, as the sturdy inhabitant of Maine turns his attention, with singleness of purpose, to growing, or making, the products which these wealth distributors so strongly crave. So long as the proprietors of our larger summer resort hotels must rely upon the city commission dealers, and the surplus from Maine farms be turned over four to six times before being returned to the county from which they started, will there be need for urging the homely lessons which confront us to-day.

SECRETARY KNOWLTON.—It seems to me the true idea is one the doctor has touched on here, and that is, creating a market for our own products, as far as possible, right around home. And certainly our friends, the officers of this society, have aimed at two things: One, the coaxing people to grow these small fruits because they are nice in the family and will produce money in return, and then we have tried to induce our people to use these fruits, and some of the most interesting features of our meetings, have been conducted by Miss Barrows, and others, explaining how to extend the use of small fruits, and the results have been very gratifying, indeed, for where, fifteen years ago you would find one acre now you will find ten or twelve. There used to be a prejudice against raising small fruits, but that has been gradually removed from the minds of the people; they see what their neighbors are doing, and they are raising more and more.

This idea of consuming in our own State all the fruit possible, deserves all the intensifying we can give it. First of all, enjoy every possible luxury that the Almighty permits us to produce, and if we have any to spare, share with others.

THE DECORATION OF HOME GROUNDS.

By Robert H. Gardiner, Esq.

The decoration of our homes should be not an addition to the burdens of work which most of us have to carry, but a refreshment and relaxation and inspiration. It has a commercial value, for it makes us more fit for our daily work, but because its products can not be weighed or measured or counted, like hay or grain or apples, we are too apt to neglect it in the blind struggle for the more tangible means of life. We seek for ourselves and our children the fullest and richest life, and it is but a poor instrument of our time and strength to seek only the means of material life and to neglect to feed our minds and souls with the marvellous beauty of nature. "God made the country, and man the town," and though you may not live in the beauty of the country, you can, if you will, transport some of it to your city home to remind you that there are things in this marvellous world far more desirable than the almighty dollar and the man-made things it buys.

The decoration of our home grounds is a good investment, paying us rich dividends of renewed vigor, mental, moral, physical. And in Maine we ought all to be landscape gardeners, for there are few, if any, other states where can be found our glorious variety of sea and river and lake, mountain, hill and valley, field and forest. Few have our profusion of trees and flowers and all we need to do is to adapt our efforts to our surroundings and to encourage and direct nature in her continued effort to make our State a garden of beauty.

And first of neatness. The home is the product of civilization, the symbol of man's dominion over the forces of nature. The savage, naked or clothed in skins, has no home. He wanders from place to place in the wilderness of untamed nature, enduring as best he may the hardships of wind and weather. We have harnessed the strength of nature to our service and the victory should be symbolized. Close to the house, nature should be tamed. The grass should be kept close cut, the paths and roadways well defined, not running hither and thither like cow tracks in a pasture or as if our home domain were only part of a wild common unredeemed from the wilderness. Poultry should be kept to their proper places and not allowed to usurp our front dooryards and make them look as disorderly and unkempt as a gypsy encampment. We are not gypsies, we are citizens, respectable, law abiding, permanent, orderly, and our respect for ourselves compels us to make our homes respectable, orderly, regular, so that all who pass by may see that we respect ourselves and require that others shall respect us.

Near the house, too, should be garden flowers and shrubs and ornamental trees. Tastes and opportunities differ and time and my ignorance prevent a full discussion, so I shall not undertake to suggest specific varieties, but only to remind you that a few of the most common varieties well cared for will do far more to carry out the symbolism I suggest than a profusion of rich varieties allowed to grow in untamed luxuriance or to run out through neglect. For beautiful trees in Maine, we have but to go to the nearest wood lot. If your place be large you can have a number of trees of different varieties, if small, you can select the one or two which best suit your taste or your surroundings. Do not, however, sacrifice the health and light of your home to your trees. Home shall before all things be healthy and cheerful, and it can never be either if it is buried by thick foliage from the life giving and inspiring light of the sun. Set your trees, then, a good distance from the house on most of its sides that your cellar may be dry, your rooms free from dampness and mildew, that you may have flowers close to your windows and that you may have space in which to see the vigorous beauty of your trees. And if a tree is to be ornamental, it must stand far off from buildings and from other trees. If you want to make timber, you compel it to grow only in one direction, straight upward. If you want ornament, you must let it grow in every direction, so that it may be graceful, symmetrical and complete. Spend something sometimes for beauty, and though it will diminish your yield of hay or fill a load or two with leaves and sticks let an oak or a pine grow out in the middle of a field that you and generations of those who come after you may see the magnificent development it will reach. As you know that grass and corn will not grow under trees, remember that no more will garden flowers. You want the flowers near the house to fill it with their fragrance and that they may be close enough that your eye may see their delicate beauty of form and color. The tree is larger and grander and needs more distance to comprehend its graceful bending of shape and color and strength.

In our first attempt at neatness, I think we are too apt to run to fences. They do stand for the conquest of nature and for neatness, but I believe they are too often used from mere conventionality and not because they are needed. A few bound-stones will mark our lines as well, certainly in the town, and often in the country. To my eye, a house fenced in from the rest of the world is not attractive. It looks too exclusive, as if the owner had forgotten the great principle of the brotherhood of man, the corner stone of civilized society, and wanted to shut himself off from his fellows. The home should be individual, but should show that its owner recognizes that he is a member of society. It should be private, but its privacy should be natural and easy and not artificial and repellent. I would see then a smooth expanse of close cut grass extending from the house to the road, outlined by neat driveways and paths, and diversified and enlivened by flowers and shrubs, which may be so planted as to secure the needed privacy, and yet not offend the eye, as does a picket fence. This green or lawn should not be allowed to end abruptly in the disorder of the ordinary road. We should feel responsible for the highway in front of us. The highroad stands for the combined community, the city or town, and by our care for that part of it which lies between our bounds we want to show that we are free members of that community, not thinking how much we can make our neighbors do for us, but how much we can contribute to the common good. Therefore we shall keep it in harmony with our own premises. In town, we shall sweep and wash the sidewalks as we do our own doorsteps and mow the grass on the roadside and water grass and road as we do our lawns and driveway. In the country, we shall keep the stones raked out, the grass mowed when we mow our fields, and remove the choke cherry and wild apple trees, the unsightly but prolific nurseries of caterpillar life.

But fences are often necessary. The paling is too artificial. It will not harmonize with nature. It interrupts the vision and tires the eye by its monotony, while its obtrusiveness prevents the repose that comes from a long sweep over flowerbeds, field and orchard to the forest. The old fashioned fence of roots in zigzag rails, while they are very picturesque, are bad farming, wasting land and affording a refuge and breeding place for animal and vegetable vermin. They are, for my purpose, not artificial enough for the immediate neighborhood of the house. They suggest too much the log cabin. Near the house, hedges or the stone wall are to my mind better. Hedges well cared for will maintain themselves against weeds. You can mow clean up to them, much closer than to a fence. They harmonize as well with the artificial beauty of the flowerbed and ornamental shrubs as with the more natural, but not less beautiful sweep of orchard or field of grass or corn or grain. But they take time to trim, and though the time to trim them is in the interval which comes after the gathering of the summer's crop of hay and before the fall crops are ready, when there does not at first appear to be anything particular to do on the farm, yet we all know how delusive that appearance is, and how those days are all too few to do the thousand things that offer, and if we be wise, we shall not take on too many more things to do. The stone wall seems easier, but it is not, altogether. The scythe and the plough cannot go close enough to it to keep it clean of weeds, but if a furrow or two be drawn parallel to it, and the remaining space spaded as needed by hand, you may make the stone wall beautiful by combining the colors of plants or vines with the more sombre but not less beautiful tints of most of our common field stones.

And next of harmony. We are to guide and help nature, not distort her, and if we are to do that, we must learn all her secrets first. And her first secret is harmony. Her very contrasts are harmonious. The fruit and evidence of refinement and civilization is harmony, the absence of startling and violent contrasts. The eye is a machine of marvellous delicacy and violent contrasts shock and tire it. The flowerbed should be an orderly arrangement of harmonious masses of color, not a mere jumble of small, ill assorted fragments of color, as crude as a cheap kaleidoscope is the bonnet of the untaught domestic, who, fresh from, yet forgetful of, the soft and harmonious colors of her green isle, rest not till she has attired her person with samples of every color which the milliner and the dressmaker can supply.

Better have masses of two or three common flowers, whose beauties fit into and supplement each other, than a greater number of rarer flowers, perhaps each more beautiful in itself, but whose beauty is constantly at war with that of its neighbor. In such a contrast, the beauty of each is lost because the eye is worn out by the struggle of each color to assert itself over its rival. The home is the abode of peace and order, and we do not want to have its surroundings marred by any struggle, even that of flowers and colors. And nature teaches us this. She deals in large masses, great sweeps of grass or trees, beds of violet, columbine, mayflowers, rhodora, white weed. When she mingles masses, she mingles harmonious colors. When she intersperses a mass with a single color, it is used sparingly, not so profusely as to create a conflict, but only enough to define and accentuate the beauty of the mass.

And the home grounds must not only be harmonious with themselves but with their surroundings. The home must be at peace with itself and with all the world. Study your situation and make the most of its opportunities. The bare stern grandeur of the rocky coast, the placid beauty of the inland lake, the regular expanse of level fields, the more broken surface of the river valley, the steep slope of the hillside, each needs a different treatment to bring out its perfections.

So, too, if you have only a small house lot on a village or city street, your grounds must be more artificial than if you have a large farm. You cannot deal largely, and your flowers and shrubs must be more artificial if they are to harmonize with their surroundings. The Japanese practice of trying to reproduce on little bits of land, by dwarf trees and mimic lakes and streams the beauties of nature's greater scale, while it makes us wonder at their skill and patience, does not commend itself to our taste, for it is but a caricature of nature's greatness, and yet minus the beauty of her more delicate handiwork, as the dwarf pine tree has neither the tender grace and freshness of the sapling nor the strength and grandeur of the monarch of the woods. If your lot is small, combine with your neighbors, and plan your flowerbeds and shrubs so that you and they may have the advantage of all the lots combined, and so can gain varieties without the drawback of pettiness. Then, too, you can have a succession of flowers, from the earliest bulbs of spring, the crocus, and the snowdrop, lifting their delicate heads amid the remnants of the winter's snow to the hardy late blooming annuals which linger almost till the fresh snow comes again.

To the farmer the problem is bewildering, for there are no limits to what he may do, but fortunately the most important thing, the first requirement if he would have his home beautiful, is good farming. His buildings must be arranged conveniently and in order, and kept in constant repair. The barnyard and the space close to his buildings must not be nurseries for the weeds he struggles to eradicate from his fields. His tools and machines must be kept under cover, his wood piled compactly and neatly. His orchard must not be neglected, his fields must be kept up to the highest cultivation, his pasture in good shape, his woodlot cut intelligently. He must do this if he be a good farmer. He may do more if he wishes, but he need not, for his home will be beautiful. Prosperity and contentment will greet him on every side. His eye will revel in the delicacy of the apple blossom, or rest contented on the red or golden gleam of the ripe fruit. It will find rest in the broad expanse of mowing field, laid down by his skilful plough in smooth and level stretches as grateful to the eye as they are easy to the mower, or he will find a contrast which will be a new rest in the long straight lines of even furrows turning up the rich color of his fertile soil.

DISCUSSION.

Mr. HOWARD OWEN—Some Maine farmers see more of the hen house than they do of the house where the family gathered; this question should be agitated until the spirit of light, and life and beauty has permeated the farmers of Maine; it is possible for the poorest to beautify the home; money expended for pleasure and comfort was money well expended; Mr. Gardiner had outlined that which is not visionary, but that which is possible for the humblest to have in the home; the vine over the door, and all the adornments that go to make the home attractive.

Mr. B. WALKER McKEEN, Secretary the Board of Agriculture—I have listened with a great deal of pleasure, and especially upon the latter part of the address where he dwelt upon the beautifying of homes, which is within the reach of every farmer of the State. I feel, with him, and Mr. Owen, that this is something that demands our attention now as never before. It is a subject we can well afford to spend money upon. If we had thought of these things before we would have had less cause for the leaving of homes by our farmer boys. There is much for the society to do in this direction. It is well for us to stop, even in the busy season, to consider these things. I am more and more impressed, as I grow older, that many things we are striving for, are not the things we most need. I certainly hold that a great deal of pleasure will be afforded the society in bringing about a feeling which shall lead to the beautifying of homes, even in the simplest manner.

EDWIN WIGGIN, Master of the Maine State Grange—I was unavoidably detained from meeting with you during the day, and thought I would come in this evening, and get something of the inspiration of this meeting. The subject of the address this evening is one in which I am deeply interested. The lesson of the exhibit is a lesson of the beautiful. As we looked out, to-day, on the dark clouds that surrounded you during this meeting, it might seem as though this was a dark world, but when we look upon the flowers and berries we see there must have been sunshine somewhere. This lesson teaches us that although the dark days may come in the world, yet the sunny days by far out-number the cloudy ones, and when the dark days come we should sit by the windows of hope and look out patiently to the clouds that shall tell of brighter days.

The subject of decoration of our homes is one in which farmers are becoming more and more interested in as the days go by. In former days greater interest was in the stable and in the henyard, but now the home and the fireside are the true farm center. And it is well to have them more beautiful for human beings to live in, to be born in, and nurtured in. You pay for the beautifying of your homes, for the more you are adding to the value of this State of ours. It is the home that gives value to the State.

Hon. G. T. STEVENS, Judge of Probate Court, Kennebec county, spoke in part as follows:—We have heard a good deal about decoration of the farm home, but little about decoration of the city home. There is advantage, in my opinion, not only in beauty, but in health, in properly decorating our city homes. We have here, in our city, shade trees that so shade the streets that they remain damp and wet from one storm until another. I am in favor of shade trees as much as anyone, but give us a little sunshine. Another thing for the beautifying of our city homes. Let us take down some of those old fences that have been braced up because rotten. Let us turn our yards into the street, and let us be more sociable. It is not necessary to build a barricade between our home and the home of our neighbor. In Massachusetts they have, in many towns and villages, an improvement society. They take all these things into consideration, and where there is not sufficient shade they set out trees and then have them protected. Where there are old fences they try to have them removed. The beautiful city of Augusta, the capital of the State of Maine, I am sorry to say, has more unkempt door yards and tall grass than some of our sister cities. Let us have smooth lawns. We shall make our homes more pleasant, and our families will be more happy and our community better.

Hon. LENDALL TITCOMB—There is, of course, fashion in everything. We wear a suit of clothes cut in one style, to-day, and another next year. There is fashion in the way of carrying on the farm; there is fashion in cloth; in everything. Some few years ago the terrace became the fashion. It is a work of art when first put up. It shows very nicely. When turfed over, it is very pleasant to the eye. I think the time is coming when the terrace will have gone out of fashion. When, instead of the terrace, built to the sharp pitch, you will see the true sweep of the ground to the street. The terrace shows, on the steep side, if the grass is cut short, a raw and dry side. You look directly through the grass at the earth; you don't see it at the angle that you do on the top. The terrace, of course we all know, here where we have frosts will never stand. These artists in the arrangement of earth—I don't refer to gardeners—always tell us the terrace will stand, but it does not stand. The water runs out of the side, and the greater part of the time it is not pleasant to the eye. I will be glad when the fashion of the terrace is past and instead of the terrace we will have the true even sweep of the lawn to the street.

AT THE WINTER MEETING.

ANNUAL ADDRESS OF PRESIDENT.

JOHN W. TRUE, New Gloucester.

Ladies and gentlemen, members of the State Pomological Society: The present winter meeting of 1898 brings us to the quarter of a century of our existence, and we feel that if we knew all of the awakened interest and benefits conferred upon our fruit growers and those interested in fruit culture, we would feel amply repaid for all the labor and expense that the members of this organization have spent in that direction.

Twenty-five years ago such a thing as shipping a carload of apples from our railroad station was not known; how different the case now, with the exception of the present season, when, as you ride through our State, you will see cars being loaded at nearly every station throughout the winter season. Also the amount of small fruits has increased to a great extent, so that at the present time large quantities are being raised for the market, and many farmers are now raising a home supply; and we feel that to a great degree the State Pomological Society, and its parent, we might almost say, the State Board of Agriculture, which is working to a certain extent on the same lines, are responsible. Perhaps it would not be out of place to look back over the year and see what has been done by the society, leaving it with our secretary to give a detailed account of our transactions.

Our winter meeting was held at Winthrop, a location that last year was in the very center of the great fruit crop—apple buyers located there for the season, and the apple question the all-absorbing topic of the day. In such a location we could not fail to have one of the best, if not the best, exhibit of winter fruit ever made in the State of Maine. It was grand, and we were proud of it. A full programme was carried out, and much interest taken in the subjects presented, especially in the matter of disposing of our apple crop. Since that time an organization has been partially perfected in which we hope to accomplish good results in that direction. It takes time to get such organizations into working order, but we are hoping that by another season, if the apple crop should call for it, means will be provided to handle it to better advantage to the fruit growers of the State than ever before. We have the impression that if some such organization had existed to handle the apple crop of 1896, every barrel of it could have found a market at paying prices, and it would seem as though we, as fruit growers, could well afford to put enough capital into such an organization to warrant its success. It has been estimated that as many as 500,000 barrels of merchantable apples of the crop of 1896 were either wasted or lost from improper handling, or finding no market at all. If such were the fact, what an immense loss was sustained by our fruit growers in a single year, and what a small part of that amount it would take to perfect an organization that would be a lasting benefit to the apple growers of the State. Therefore it would seem to us that this meeting would be a good opportunity to exchange views on the subject, talk the matter over thoroughly and see if some definite conclusions cannot be reached, so that the next heavy crop shall not find us in the same unorganized condition that existed a year ago.

We have been much interested in the subject of a summer meeting, and something in that direction was attempted the past season, in the Strawberry and Rose Exhibition held at Augusta. We were very unfortunate in both the season and the weather, the season being very backward, making a postponement of the meeting necessary, and the dates on which it was held proving to be the same as those announced for one of the most powerful storms of the season, which had the further attribute of being strictly on schedule time. Under these circumstances the exhibition was not what it would have been under more favorable ones. As it was, we had an exhibit of some seventy plates of berries and a good showing of flowers, together with a short programme, making it apparent that under favorable conditions such a meeting can be made interesting and profitable.

Our exhibition held in connection with the State Agricultural Society came too early in the season for a fruit exhibit, all of our winter varieties being in such an immature condition that visitors could scarcely recognize them, and I apprehend that persons coming from other states get a very erroneous impression of the quality of apples raised in our State. Therefore we would raise the question whether it would be best to continue offering large premiums for winter fruit so early in the season, or to turn the money into other channels where more information can be given our fruit growers with the same expenditure of the public funds that come into the hands of our society.

In looking over the situation a short time before the fair it was evident that we could not make nearly so good an exhibition in the line of fruit as in former years, and it was thought best to supplement our premium list with special premiums on flowers, therefore the pansy, sweet pea and nasturtium were selected and generous amounts offered for exhibits in that line. The result was that our tables presented a much better appearance than would otherwise have been the case.

The question has been asked, and in many cases answered, whether or not it is time for the farmers of the State of Maine to stop setting the apple tree, some agricultural writers contending that when the trees already set come into bearing there will be an over production of apples.

I would ask if there is any reason why Maine should not stand in the front rank in the production of apples, in whatever portion of her area is suited to that purpose. Vast tracts of our soil are the very best for the production of apples of the best quality, no other state having produced their equal.

We see no reason why our orchards should not be doubled in the next decade with profit to every man who plants, fertilizes and properly prunes an orchard. The world is our market and we think it is a fact that the population is increasing faster than orchards are being planted and that apples properly placed on the market will net the producer two dollars per barrel with the markets continually calling for an increased amount of good fruit at a reasonable price. Europe, with its dense population and unsuited to the production of the best quality of fruit, will for many years look to America for her apples, and the State of Maine is provided with the best shipping port during the exportation season of any state in the Union. Let us take advantage of that condition of things, and encourage that branch of industry to its fullest extent, thereby elevating our people to that place in human society which rightfully belongs to the intelligent tiller of the soil. For who has ever heard of a successful fruit grower who was not thereby made a broader man, with a more extended influence over his fellowmen for good, and giving his family an elevated appreciation of life and nature, as exemplified in the work of a horticulturist.

The financial condition of our society is better than ever before. We now have about $1,350 in our permanent fund, all invested in what is thought to be a safe manner. This permanent fund, as all members of the society know, consists of the life membership fees, the interest only being available for the uses of the society. It would seem as if every person who raises fruit of any kind, or who owns an acre of land for tillage purposes should become a member of this society, thereby benefiting themselves many fold and increasing the usefulness of the society itself. It is our hope that the affairs of this society may be so managed that people having funds at their disposal may make additions to our permanent fund, by bequest or otherwise, so that other lines of work may be taken up, and its usefulness may be extended.

The enemies of our fruit interests are still with us. The "apple scab" has not been as troublesome as was the case two years ago, but we may expect that when climatic conditions are favorable we shall receive another visitation which means the loss of a crop of fruit unless its ravages can be checked by some economical method. Spraying has been practiced to some extent, but it is expensive. We must devise some way to reduce the cost or we shall lose more than we gain out of the operation. We are looking to our professor at the Experiment Station to solve these problems for us, and we will express the hope that they will keep us in mind. We have on our programme a speaker who has given this subject of "Insect Enemies" much thought and observation, and we hope to learn much from him.

I have given you these few suggestions hoping they will call out more or less discussion here or elsewhere and in that way some good may be accomplished. I have great faith in our society to become more and more a leader and helper to all fruit growers who will take the trouble to attend our meetings and exhibitions or read our published transactions.

FIGHTING INSECTS, AND BETTER CARE OF OUR FRUIT TREES.

By Professor Elijah Cook, Vassalboro.

Every day's report emphasizes more and more forcibly the necessity of better care of our fruit trees. We must have better cultivation, more fertilization and more complete subjection of the insect tribes which threaten the destruction of all fruit raised by the negligent orchardist. The insect tribes multiply and constantly offer new dangers to the unwary.

Very few orchardists in Maine or elsewhere realize what might be accomplished by thorough, systematic and liberal cultivation and care of our orchards. Men from the North have sought the far off fields of Florida and invested from one to two hundred dollars an acre, and they keep a man and a mule constantly at work the year round upon each acre, cultivating, spraying, applying fertilizers and irrigating their orange groves. It has been proven and can be established beyond question that this same kind of liberal and extensive care of the orchard at the North will meet with as satisfactory returns as are obtained in the orange groves of the South.

I visited a short time ago, an orchard which has received this kind of treatment ever since the trees were set. It has been plowed or cultivated several times every year, most liberally enriched and most thoroughly sprayed, and the result was 2,000 barrels of apples, 1,800 of them first quality, gathered from the orchard the ninth year after they were set, and one year since produced an average of four barrels to the tree, though they had not been set more than thirteen years. When mentioning these facts at a meeting, not long since, a gentleman remarked that Maine orchardists have not the money and are not able to treat their trees in this manner. This is partially true, but is it not a fact that they can treat at least one-half acre in a proper manner, and from twenty-five trees thoroughly cultivated and enriched, pruned and sprayed, receive more profit than they now receive from several acres, and with the additional profit and the encouragement given, properly treat a whole acre the next time?

What would you think of a farmer who would sow wheat, year after year, on the same ground without applying any fertilizer for twenty years, and expect to get any crop at all? And yet it has been plainly shown that an orchard each year takes from the soil in the growth of the tree, leaves and fruit, as much plant food as an average crop of wheat. How many orchards may be found in the State of Maine which have been set twenty years and have received practically no fertilization at all? How many orchardists are properly supplied with a spraying apparatus? Truely, a very small proportion, and yet a farmer with any considerable number of trees needs a spraying apparatus as much as he does a plow.

The Bordeaux mixture has become an actual necessity in the orchard and potato field as well. It seems to be almost a perfect fungicide. A thorough application of this mixture applied under proper conditions before the buds start and three or four times after, will double the value of the apple crop. Some may think this an exaggerated statement but it certainly has been repeatedly done and can be accomplished with very little cost. In these times when there is such an abundance of everything that the land can produce, with competition so sharp and prices so low, one prominent and constant aim with the farmer should be to secure the best quality possible of everything he undertakes to produce.

There is always a demand for the best at a satisfactory price and large solid apples with neither a scab nor worm hole will always bring a good price.

The second or third spraying accomplished just after the blossoms have fallen should have with the Bordeaux mixture, Paris green, one pound to two hundred gallons, and this combination will not only lessen the apple scab, but largely prevent the destruction caused by the codling moth. Very few really understand the extent of the injury caused by the apple scab. It takes from the vitality of the tree as well as the value of the fruit. It saps the life from the limb, leaf and apple.

I was told by a man in Kennebec county early in the spring several years ago that he should have a very heavy crop of apples that year. A few weeks later I went through the orchard with him and we found most of the apples and a part of the leaves on the ground, and very soon he became convinced that a few dollars expended in spraying at the right time would have made a difference of several hundred dollars in the receipts from his orchard.

An excellent plan for most farmers is to prepare a quantity of the Bordeaux mixture for future use.

Suspend 50 pounds of sulphate of copper in a bag in a barrel which has previously been measured and a 25 gallon mark made upon the barrel. Add sufficient water to dissolve the sulphate of copper. After it has all dissolved, remove the bag and add water to bring it up to the 25 gallon mark. Then take 50 pounds of lime and carefully slack it. After it is thoroughly slacked, strain it into another barrel with a 25 gallon mark. If not strained, care must be taken to see that no solid particles go into the barrel—then add water to bring it up to the 25 gallon mark. When wanted, thoroughly stir the copper solution and take out 3 gallons which will give 6 pounds of blue stone. Thoroughly stir the lime and take out 2 gallons which will give 4 pounds of lime. Add this cold to the 3 gallons of the copper solution and dilute to 50 gallons.

It is important to know that the mixture will be safe to apply to tender foliage, and one way to determine this is to insert the blade of a knife into the mixture after it is thoroughly stirred, and the blade allowed to remain in at least one or two minutes. If, on removing, the polished blade is found to be of a copper color, the mixture is unsafe and more lime must be added.

The farmer now has a considerable quantity ready for use and if kept tightly covered will be ready for the orchard and the potato fields. The spraying, which occurs just after the blossoms have fallen or when the apples are about the size of peas, should always have the addition of Paris green, 4 ounces to the 50 gallons. The Paris green in no way affects the action of the copper, neither does the copper affect the action of the Paris green.

The mixture must be kept most thoroughly stirred during the application. Some have used, with excellent effect, a less amount of Paris green, 4 ounces to 75 gallons.

The success depends largely upon the manner of spraying. The spray should be as fine as possible and thrown with considerable force, and care taken that every part of the tree is wet.

The apple scab and the codling moth are by no means the only enemies with which the fruit grower has to contend. The oyster shell scale is prevalent most everywhere, and does much more damage by weakening the vitality of the tree than we are usually aware. They should be persistently fought until their numbers are greatly reduced, if not altogether destroyed.

The kerosene emulsion applied in May and June is the proper remedy for this pest. In preparing the kerosene emulsion it is important to procure fish oil soap. It is sometimes said that we should use whale oil soap. There would be no difference in the effect, but there should be a difference in the price. A gentleman who bought the ingredients for spraying in large quantities purchased fish oil soap at a cent and a half a pound in New York city, and blue stone at four and one-fourth cents a pound. That was several years ago; I do not know how much cheaper they may be now.

One other great curse to the orchard which I will mention at this time is the tent caterpillar. I saw hundreds of trees last spring almost bare of leaves from this pest, and what excuse could be given for permitting it, is more than I can tell. The pest is so conspicuous, so destructive and so easily destroyed that it seems to be a shame and a disgrace for any farmer to permit its depredations. If taken in time, they may be easily destroyed with the torch when their tents first appear. If they are too numerous or have made too much advancement for this, the orchard should be most thoroughly sprayed with Paris green—4 ounces to the 50 gallons. The expense would be but little, the gain would be very great. Paris green is an excellent remedy for all gnawing insects and by its application depredations of all caterpillars can be easily stopped.

Wild cherries seem to be a favorite breeding place for the caterpillars and some have suggested that they be used as traps, but a better way would be to cut them down and burn them up and watch the orchard very carefully in the spring and destroy the first appearance of the caterpillar. A man may be excused for not seeing and properly fighting the different scales if he has poor eyesight, but nothing can excuse him for permitting the depredation of the tent caterpillar, and every intelligent, progressive farmer should not only be sure that his own orchard is kept free from this pest, but should, if he finds his neighbor's orchard infested, use all his influence with the neighbor to induce him to destroy the caterpillars. Breeding these pests upon any orchard is not only a loss to the owner but a curse to the neighborhood and we cannot use too strong terms in urging the farmer to keep these marauders in check.

There is another blight to fruit raising which is nearly as conspicuous as the tent caterpillar and if allowed to exist in large quantities as we sometimes see, is nearly as disgraceful—and that is the black knot upon plum trees.

Every appearance of the knot should be removed with the knife and if the tree is badly affected it should be removed at the root, and be carefully, and completely burned up, not thrown down for a more convenient season and then the trees should be thoroughly sprayed with the Bordeaux mixture which will check this growth as well as the apple scab.

We are living in a new age, new conditions and new dangers surround us, and if we are satisfied to continue in the same old ruts that our fathers followed, omitting the new and better ways of culture, we shall surely be driven to the wall. Let us then be up, with the knapsack sprayer buckled to our backs and fight the pests of the orchard until we know our fruit is safe.

DISCUSSION.

Mr. POWELL—The fighting of insects has become one very important duty of the fruit growers of late years. We shall be meeting new things continually and we have got to study very carefully how to meet them. The canker worm has been doing a very great amount of damage in New York state for several years and the spraying has not been of very much benefit from the fact that the treatment was not strong enough. Recently one pound of Paris green has been used to 100 gallons of water, a small amount of lime has been added and the canker worm is almost under control. I can cite instances where the orchards have been fully protected and the canker worm has come right to the fences and the pest has been staid right there.

Ques.—How much lime would you use?

Ans.—Five or six pounds to 100 gallons.

Mr. POWELL—The first tent caterpillars hatch in colonies and they work in colonies. I do not know that it would be necessary to spray the whole tree if you could see their first appearance. If you see a bunch upon a limb, go out and spray that limb thoroughly and I think you can go over and clean them off that tree. Keep your tree well covered with Paris green and "it will fix them," as Prof. Cook says. The insects can be destroyed by using the Paris green and you can protect your foliage by putting in some lime.

Mr. KNOWLTON—How much is the expense per acre or per tree, to do this thorough spraying?

Ans.—I have not tested it for these other caterpillars, but for the tent caterpillar it will vary according to the size of the trees. In New York state we carry some very large orchards. I have made some estimate upon the spraying in my own orchards, and for the Rhode Island Greening, or the Tompkins County King, our best trees, thirty years of age, and one application of the Bordeaux mixture upon trees of that kind ought not to exceed four cents per tree. That means thorough spraying, wetting every portion of the foliage of that tree. This includes the labor and the material. In smaller trees, the labor will be reduced almost one-half. One and one-half or two cents will cover the cost of spraying trees from twelve to sixteen and eighteen years of age; and that means thorough work to cover all the foliage and the fruit upon the tree. There is a great deal of spraying that is only half done. You don't get the value then. I believe in spraying every leaf if it is possible, and where we spray the fruit to cover every particle of the fruit. On the large trees put on three or four gallons on a tree.

Prof. COOK—The cost is no comparison to the advantage gained. A bulletin issued by the Cornell University says that the cost should not be over five or ten cents a tree a season in all the spraying. I would like to ask Mr. Powell whether there is ever a season when there is no need to spray?

Mr. POWELL—That is just where people make the mistake in not spraying in seasons when they think there is no necessity for doing so. There may be germs enough there to multiply a thousand fold in the next season. I think there is no season when we should not spray. As Mr. Pope says, it should be continued as a matter of prevention. My own experience has covered ten years and I have not missed a season in the ten years. We are now seeing the effects and I am getting just about the same quantity of fruit each year. I attribute it largely to spraying. Other causes may come in but I think the spraying is the principal one. I have had a better development of wood, and a better development of bud, and my trees have had a much better development of fruit, and at the same time a larger production of fruit. I feel so assured of this that I would not dare to allow a season to go by without spraying my trees with Bordeaux mixture, even though there were no fruit in the orchard. If you go into an orchard in the month of June or July, if there is no fruit upon the trees you will scarcely see an apple leaf that is not injured by the insects if it has not been sprayed. I am confident to say that half the foliage will be taken off those trees. It will have the whole of the leaves or the edges eaten down about one-fourth or one-half and you will see that from one-third to one-half of the foliage is gone and that tree is impaired in its ability to bear fruit the next year. The apple scab will take your tree and the crop will be gone in thirty days just by not having Paris green or Bordeaux mixture upon your trees. I consider that the off year is the time to do spraying.

Mr. Niles—How many times will you spray?

Ans. Sometimes two sprayings do for the season. Last year I sprayed a portion of my trees nine times, because the conditions were so entirely different. We had excessive rain-fall and excessive heat temperature and so long as these conditions continued I sprayed my trees. We cannot give any rule, we have to study the conditions and spray according to the conditions. I think in an ordinary season with moderate rain-fall and moderate temperature that two sprayings would answer. With the unusual conditions given I would spray oftener. Sometimes I would spray before the buds open at all to protect them from the scab fungus.

EXPERIMENTAL HORTICULTURE.

Prof. W. M. MUNSON, University of Maine.

PLANT BREEDING.

One of the most important lines of work which can be taken up is the amelioration of our native fruits and the production of types valuable in special locations. This work to be of the widest application must be based on general laws, and it is within the province of the Experiment Station to determine what those laws may be.

The development of the great number of varieties and forms under cultivation has been the gradual outgrowth, in many cases, of centuries of care and selection on the part of man. The apple, the pear, the bean, the cabbage, wheat and some others have been under cultivation for more than 4,000 years; while most of our cultivated fruits and vegetables have been grown for from 500 to 2,000 years. Until a comparatively recent date, however, no systematic attempts at improvement have been made.

Crossing and hybridizing form important features in the improvement of plants; but the production of hybrids and the study of the laws by which they are regulated is quite a different matter from raising plants for general utility.

The latter is comparatively easier of manipulation and more encouraging, because of the magnificent results often obtained and the profits attendant on it. But in the investigation of true hybrids, manipulation is often difficult and failures are innumerable; the labor is incessant and unless conducted with order, watchfulness, and a spirit of fairness and freedom from prejudice, with accurate judgment, is entirely useless—or worse than useless, as wrong conclusions will be drawn. The great variety of objects demanding attention, the length of time required for even the simplest results, the careful labelling of every plant, and registering the phenomena as they appear, the difficulty of preventing confusion among hundreds or thousands of seedlings, all of these conditions enter into the study of plant breeding and must precede the most important part of the work, that of generalizing upon the observations made and formulating laws which shall be of real value in practical work and in future study.

Perhaps no part of the work of a horticulturist is the subject of greater misapprehension in the minds of people generally than that of plant breeding or the improvement of cultivated plants. By the breeder of fine stock, the importance of pedigree and of careful selection of individual parents, has long since ceased to be questioned; but by the average fruit grower or nurseryman, little attention is paid to the development and the inherited tendencies of the plants he is growing or propagating.

Plant breeding bears the same relation to horticulture that the improvement of live stock does to animal industry. Pedigree is as valuable in the one as in the other. Care in the parentage of each successive generation is essential to the future value of the race. Pedigree is valuable only as historical evidence of such care.

Right here I wish to digress for a moment and refer to the importance of pedigree in plants. At horticultural exhibitions the inherent value of a given variety should receive quite as much consideration as is given to individual excellence. At present exhibitors go through the orchard, picking a fruit here and there, wherever specially fine individuals may be found, without reference to the general habit of the tree, its usual productiveness or hardiness; and awards are too often made on the general appearance of collections without reference to the quality or adaptability of given varieties to the locality where grown. Again, we know that there is a marked individuality among trees as among animals, yet I venture to say not one nuseryman in one hundred pays the slightest attention to this fact in propagating a given variety. As a rule scions are taken from the most available source, either from nursery rows or from any convenient tree of the variety in hand, without reference to individual characteristics. There is little doubt that this fact has more to do with the failure of orchards than any other one condition. This is one very potent factor in the "running out" of varieties. Breeds of horses, cattle or swine treated in a similar way would very soon "run out."

DOMESTICATION.

Domestication or the inuring of plants to cultivation, offers a field much wider than is commonly supposed. In fact, there is little doubt that there are more edible fruits and vegetables still in a wild state, but susceptible of improvement, than are now grown by man.

PRACTICAL PROBLEMS.

If the production of valuable types is important, care in rearing is not less so, and many of the questions concerning the treatment of fruits and vegetables are legitimate subjects for the most careful study at our Experiment Stations. But I would not include in this categorgy such questions as, How shall we cut potatoes? Will plants grow if set upside down? etc. Such questions may best be answered by a single sentence: Use common sense!

Among the questions which may very properly receive attention, however, we may suggest, first of all: The treatment of orchards, with reference to feeding, culture and pruning. Little careful and accurate work has been done along any of these lines. True, in most of our manuals of pomology we have the accumulated traditions of years; but many of the statements made are based upon personal opinion rather than upon accurate data. One man is positive that the only proper treatment for an orchard is to practice clean culture—a position which is entirely untenable in many of the best orchard sections of New England; another is sure that the best treatment is to turn in the sheep; while his neighbor is quite as positive that hogs will do better service. One man would never use stable manure; another would never use "chemicals." One man would prune severely; another regards pruning as unnatural and would never use a knife, and so the problems multiply.

Small fruits offer problems of like importance. We know—or think we know—that the character of the soil and the nature of the food have a marked influence on the quality and physical character of fruit, but little careful work has been done. About the only reliable data that we possess are the reports of Stone of Indiana and Goessmann of Massachusetts. The most widely different views are held as to time and methods of pruning; and the importance and the best methods of winter production. The origin, development and classification of varieties is also an important study—the problems concerned with which, can only be made at an Experiment Station. The problems attending the forcing of fruits and vegetables under glass are by no means solved, and this is one of the important industries in many sections of New England. Studies of methods of construction; of methods of heating and ventilating; of the practice of sub-irrigation; of the influence of electric light; and various other questions have already received attention. Some of them at least, have been considered with the double purpose of ascertaining facts which should be of immediate value and of studying the physiological effect on the plants, and thus deducing general principles. But there is still opportunity for valuable work in this line.

Propagation affords many lines of investigation that are of vital importance. For example, the mutual influence of stock and scion; the relative value of seedling stocks from different sources, the importance of top-working certain varieties, and many others. Vegetable and ornamental gardening also offer numerous lines of investigation, one of the most important of which is the selection of hardy trees and shrubs for ornamenting home grounds and the school yard.

As already intimated, we do not regard variety testing as of paramount importance in experimental horticulture. The plan, suggested in some quarters, of having a law passed compelling the originators of new fruits to have the varieties tested at an Experiment Station before being offered for sale is not a good one for many reasons. In the first place, trial in many localities and for many years is necessary to establish the value of any given variety. Soils and climatic conditions, as well as the seasons through a series of years, vary so widely that a report from an Experiment Station for a single season, or even for several seasons, is of little value to the general public. A variety which may succeed admirably under the conditions afforded at one place may be of little or no value at a point ten miles distant, or even in the same locality under different conditions.

I may be pardoned for referring briefly and more specifically to some of the work that is being done at Orono at the present time. Along the line of plant breeding some reports have already been published and the work is being continued. The fertilization of orchards with special reference to the effect on apple scab will receive attention during the current year. The culture and improvement of the blueberry is also receiving attention. There are large areas in the State which at present are practically worthless but which with a little attention and the planting of a few hundreds or thousands of blueberry bushes might, in our opinion, be made to yield profitable returns. Again, if the little dry, unsatisfactory June berry is worthy of culture in the garden, and it is cultivated to quite an extent, there certainly seems to be a field for work in developing improved varieties of the much more promising blueberry.

When the work in horticulture was established at Orono, a number of trees and shrubs were sent to different sections of the State for trial. This plan has been found unsatisfactory since very few men are willing to devote the time, or possess the patience necessary to care for a varied collection of fruits. At the present time we are preparing to send out several trees of some one variety to each of several growers in the more trying localities and trust that good results may follow.

Commercial gardening and fruit growing are receiving more attention at present than formerly for the double purpose of illustrating methods of culture and of increasing the revenue of the Station. With small fruits, questions relative to time and manner of pruning, value and methods of winter protection, the use of fertilizers and adaptability of varieties to different conditions are being studied.

In the line of vegetable gardening the more important work is carried on under glass for as stated in our last annual report, the field for successful work in "glass gardening" in the vicinity of our larger cities is very promising.

Every good farmer understands the importance of careful selection of seed and the fact that varieties "run out" when grown under the same conditions year after year. As already intimated, "running out" does not necessarily imply deterioration, so in our study of the problems of heredity as affecting cultivated plants we are trying to determine whether valuable characteristics as well as defects may not be transmitted to offspring.

We have glanced but hastily at a few of the problems which confront a Station horticulturist. The field, however, is limitless. The work at the Experiment Stations is each year becoming more practical; not necessarily less scientific, for to be of value, work must be conducted on a scientific basis. But the knowledge gained concerning the habits and capacities of plants, their laws of growth and their enemies and diseases, is made to serve a practical purpose in aiding the farmer and fruit grower to meet intelligently the questions which arise in his daily work and in order that the work of the Experiment Station shall be of the greatest value there must be the fullest sympathy between its officers and the people whose interests it serves.

I will say in this connection that the principal reason I brought up this question of "Experimental Horticulture" at the present time was to bring the Experiment Station nearer in touch with the Maine Pomological Society. I wished to get some of the ideas of the fruit growers as to the difficulties they are having, and if possible make the Station serve a more important feature in working out these difficulties. I have brought before you some of the difficulties, but you may have others.

DISCUSSION.

Mr. POWELL—I fully believe in the principles which have been set forth here and that there is value in plant breeding. If we look back over the past we will find that there has not been enough attention paid to individuality. We have looked upon trees as trees, and have not considered the individuality enough and yet I am satisfied there is a wonderful field open for the improvement of our varieties. When we come to examine the bud principle upon trees we will see there is a very great difference in them. With those that have the best conditions for development, this best development will be found in the extremity of the branches. They get the best advantages of sun and light for fruit and bud. I am a thorough believer in the individuality of the bud. I am not to-day planting orchards upon any other principle than by bud and scion selection, and they have to be of a certain type too. I am planting my entire orchards to one kind of tree; I set nothing but the Northern Spy as the stock and type, working everything upon that. For instance; the Tompkins County King is constitutionally defective. It is constitutionally weak and will not live in New York state more than twelve or fifteen years before it goes down or forms a blight. So it is not a safe variety to grow upon its own stock and I am propagating King orchards in this way by planting the Northern Spy which is a vigorous hardy tree in itself, and then taking the King, the typical tree at that, and just the best buds upon that tree to work in upon that Spy stock. I feel sure in that way that I shall get permanent King orchards, and overcome the constitutional weakness of the variety.

In this matter of selection there are very few trees that I would select buds from, from the fact that there is a very great difference in the character of the King tree. I have some trees that are perfect in every respect, that are perfect in their growth, they have grown symmetrical in their character, requiring very little pruning. Nine-tenths of the blossoms will be perfect blossoms right out against the difficulties they have to meet, while other trees in the same orchard will grow with very great variations in the tree and fruit. I select only what I consider a typical tree and just the best buds from those trees, and propagate only upon that stock. I am following upon your line of thought and believe that I shall get some very satisfactory and profitable results.

I follow the same principle with my currants. I have fifty currant pickers and as they bring in their baskets, I look over the currants and I notice very great variations in the fruit. Every once in a while there comes in a basket of the Fay currants better than all the rest and finer in every way. I send the man who picked that basket back where that basket came from and mark that bush. If another man comes in with a very fine basket, back goes that man and that bush is marked. Then we take those cuttings and plant them. In the Fay currant there has been a bud development superior to all the rest.

So I have been very much interested in this paper as it is exactly along the line of my own practice, and I have so strong faith in the matter of selection that I do not plant a single stock unless it has the finest scion and the most typical buds that I can find in my own, or some other locality. I am planting only upon those principles to-day and I have great faith in them.

THE OBJECT AND VALUE OF TILLAGE IN THE ORCHARD.

By George T. Powell, Ghent, N. Y.

I think perhaps there are few subjects which are more important for us to consider in our orchard management than that of tillage, in fact, my experience is that it is the one subject that needs more attention than almost any other, for the reason that thorough tillage is not the practice or the rule, so far as my observation goes, in my own State nor in many other states of the Union. Somehow we seem to get the idea that it is only necessary to set the orchard to trees and depend upon providence for the rest. While providence is very good, quite a responsibility devolves upon us in the care of our orchards; so I am a believer in tillage for orchards the same as in anything else.

If I were to ask the question, what is the great object of tillage? I presume the large majority of answers would be, for the purpose of keeping down the weeds or other things that we do not wish to have grow upon our soil. While that is true to a certain extent, I do not look upon tillage as for that purpose entirely. I look upon tillage as something very much more than a reduction of weeds.

We often hear it said that the land of New England is exhausted of its plant food. I do not believe the statement, I do not believe there is an acre of exhausted land to be found anywhere in New England. There is no question but what the soil is depleted, to a certain extent, of its fertility, but as to its being exhausted, I do not believe you can find any exhausted soil in New England.

I look upon tillage as a further unlocking of plant food. Tillage should be for the purpose of setting free this plant food which we have still abundantly stored in the soil.

I shall be glad to give an outline of the manner in which it is carried on in my own business and you will see by the results I obtain, the value that comes from tillage.

In the first place, I lay a great deal of value upon the plow that is used. I think we have not studied sufficiently the character of ploughs. Two firms sent their agents to my place with the claims they had to make for their implements. The first one claimed his was the easiest running and of the lightest draft that had ever been made. The second said he had no such claims to make, that his was not a light running plow. They put them into the field and just as the first one claimed, his plough would run through the soil a certain distance alone, but the second would not remain in the soil ten feet unless some one was holding it. The ploughs were tested and the man who was to hold the plough upon the place, was called to come and give his opinion. He decided on the first, the light running plough. I said, "that is the one that I don't propose to buy;" we want the plough with which we can get the most out of the soil. With one, the furrow was simply cut and turned over, with the other, it was literally ground to pieces, and broken up, crushed and refined and you could see the difference between the furrows each time. One was not a properly constructed plough, although it was built upon the principles that run toward easy draft. The other was so constructed that it possessed the features of a good plough. I believe that in tilling the soil, that every movement should be for the purpose of supplying the plants with the food it contains. That is the real object of tillage. There are thousands of pounds of nitrogen and phosphoric and potash acid in every acre of our land and it is better to handle the soil so as to get this material out of it than to put our hands in our pockets and buy it. It is better to use that than to purchase artificial food.

After the ploughing has been done, we follow with an implement you doubtless are using, the cut-away harrow, reducing and pulverizing with its revolving shears; it is simply continuing the tillage. Then we put in another, further manipulating the soil; the spring tooth harrow upon wheels. This is so constructed that when set in the soil it repuires a team of six horses. This still further pulverizes the soil in reference to using the plant food. It can be adjusted so as to use two horses when it is necessary. Then having gone through with the use of this, we still use another for any crop we raise, particularly in the cultivation of orchards and that is the Acme. This is in early spring tillage. As this goes through the soil it crushes every lump and large pieces of the soil that has not been worked up by these other implements. This completes the implements that I use in my tillage. This makes a very thorough reduction of the soil in the process which it has been put through with these implements.

Another point I consider very important in addition to unlocking the plant food is this: The actual object of tillage next to getting plant food is for the conservation of the moisture of the soil.

We cannot depend on the rain fall for the moisture we need during the growing season. We often fail in the production of crops from that source. If we would have the fullest yield we must seek to utilize the water in the soil. So tillage should be practiced with reference to this very important principle.

If we could look into the soil and see what is going on there we should see some very interesting things. If we could examine the soil minutely and see the water movement through it, we should understand how we can hold and conserve its moisture. If we could lift up a section of soil we should find that it is full of spaces, the section would be found to be porous and underneath there is a certain amount of water and a certain movement in the soil moisture which is constantly going on. We hear very much about the action of water rising in the soil. We know there is a movement of the water in the sub-soil of the moisture and that movement is all through the soil. It is constantly moving in all directions and it is what we might claim continuous in its action; it is constantly drawing upward and forcing to the surface and it is through the changes of temperature by which the water is drawn up and passed off into the atmosphere by the process of evaporation. Hence one object of tillage should be to hold in reserve the water in the soil, and when we understand this, we see the importance of beginning the tillage exceedingly early in the spring. So rapid is this movement upward that the loss by not stirring the soil early in the spring means the loss of thousands of tons of water. Then let us begin our tillage very promptly indeed, just as soon as the surface is in any condition to work. Work it very promptly in the early part of the season; let the tillage be deeper early, and as the season advances, let it become shallower.

Now the kind of tillage which I have given you a description of seeks first to reduce the soil to the finest possible condition. If the soil is only partly stirred, broken up in coarse particles, the plants cannot get at the food if left in this condition, hence it must be thoroughly pulverized in order that the plants may get their food from the soil which is there abundantly.

The important point is this: the very fine condition in which we have put our soil tends to utilize the water which is in the sub-soil abundantly. By frequent tillage, we have cut off the sources of the escape of moisture except it passes off through the plant. As this water passes up and attempts to escape, we break up the soil and stop its passage.

So the drier the season, the more frequent should be the tillage for the purpose of holding back the water held in reserve in the soil below. I have practiced this for many years and have been able to carry through large crops with great success with no more moisture than was already stored in the soil. In 1894 , we had a very dry season and in 1895 there was not sufficient rain-fall to wet the roots of the trees during the entire season, yet during that season my orchards carried a large amount of fruit, nearly as large as usual, and of a quality that was very superior. I attribute it to the frequent tillage, holding in reserve the water supply so there was sufficient moisture to carry the crops through to perfection. That process can be carried on with small fruits as well as with other cultivation. A person in my State grows the Red raspberry which we know to be a very sensitive fruit. In the dry season of 1895, he started in with thorough tillage and kept up the system until the fruit matured itself and came to the shipping season. Without the aid of rain, he brought his crop up to a splendid condition for shipping, and in July with a magnificent crop of raspberries upon his bushes, while his neighbors were praying for it to rain, he was praying for it not to rain, for he had reached the point where rain would be a positive injury to him, for we know how the delicate raspberry will be ruined by heavy rains. He carried his crop through that season and harvested it with splendid success, while upon the general plan of half tillage the crop was a failure. So I think it is not necessary to depend upon an expensive system of irrigation. Upon our heavy loams and clayey soils, we can carry most crops through any season without the aid of surface irrigation. Upon our sandy soils no doubt, a supply of water running over the surface would be very beneficial.

Then, thorough tillage has in view these two important points: 1st, reduction of the soil; 2d, to conserve its moisture.

You can readily see by this frequent stirring of the soil how it is possible to carry through crops successfully in seasons of drouth. The dryer the season, the farther the roots are going to extend to obtain moisture, and that explains why it is that crops can be carried through successfully in dry seasons, when the soil has been early and thoroughly stirred.

It is surprising what we can do by lowering the root system by drainage. We cannot get the plants to go down into the water, for they don't like wet feet any better than you do, but if we put in a drain and lower the water line we enable the plants to send their roots down deeper into the soil. This is the real value of drainage, to so lower the water line that we get a deeper root system which helps greatly in the seasons of drouth.

Another help in maintaining soil moisture is the incorporation of plants in the soil for the purpose of adding humus or vegetable material. One reason for the present depleted condition of the soil, is that for over two centuries we have been wearing out the vegetable matter, and while we may get as much rain-fall as ever, the rain-fall is soon dissipated and passes off.

I have been working for several years upon plant covering, or the incorporation of humus material in my soil. I began by using buckwheat and rye, ploughing them in. I undertook to mulch my orchard by putting a mulch on the under side of the soil. In the month of May, we started in to mulch with rye on the under side, hoping to carry through our crop of pears more successfully.

We fixed a system of chain and jointer on the plough, by which we turned that great amount of rye completely on the under side. It was a very dry season, and there was so much of the coarse material with no moisture to decompose it that it did more harm than good in allowing the moisture to pass off through the open spaces. So the experiment, while it was very successful in turning the mulch under, did not give me the results that I had anticipated in holding back the moisture for the use of the trees.

Then I became interested in the subject of crimson clover culture, and I have for four years been co-operating with that clover, and I am glad to give you the results which have been very satisfactory indeed. My conditions may not meet those in the State of Maine, but you may get some ideas that you can apply in your own state. When we speak of crimson clover, let it be understood, that we speak of it simply as improving the soil, from the standpoint of what it will do by incorporating the vegetable matter and adding nitrogen which is so much needed. I want to give you exactly my practice for that is the part that you want to know about.

In the cultivation of the orchard, as I have already stated, we start very early in the spring with our tillage, keep it up until the first week in July when we have very largely secured the growth of our trees. We have as much growth as we shall get that season by that time. Then cultivation should cease, just as soon as we have got the annual growth of the trees, for we don't want to stimulate the trees to an unnatural growth. So cultivation ceases with us, as I have stated, about the first or second week in July in the orchards, when we sow the crimson clover seed.

There are two reasons for this: When we have put the soil in that fine condition, reduced it to the finest condition possible through the process of frequent tillage, we have done that at the cost of the soil to a certain extent. If we leave it in that condition, we shall lose nutrition unless we cover it with some plants before the heavy rain-falls that come during the autumn season. After you have liberated the plant food in the soil, you don't want it wasted. So we want to cover that soil just as quickly as we can again after its reduction to that condition.

I use the crimson clover for the reason that it is one of the most rapidly growing clovers we have. It makes its growth quickly, and I sow it because it is an annual plant and grows very rapidly.

2nd. I use the crimson clover because of its mass of fine roots, which holds the soil together and keeps it from being washed by the heavy rains and it adds a very important plant food, nitrogen to the soil. We have been told that clover adds nitrogen to the soil, and yet I do not know that this has been demonstrated on a large scale, on a farm. It has been proven in the chemist's laboratory on a small scale. I have known for three years that I have been certainly improving the soil upon my farm to a very remarkable extent. I have realized in the splendid growth of trees, in the annual production of fruit, and another fact that has interested me is the regularity with which the orchards have borne fruit for several years.

In 1896, there was a phenomenal apple crop all over the country, in 1897 my crop was only a little less than in 1896 and in 1895 it was about the same. I find that each year is showing regular bearing, and this has been an interesting feature of the clover system to know how steadily the fruit bearing tendency has been brought about in these trees, which can only be accounted for by the superior supply of plant food the trees have had through tillage and supplied by the clover. In addition to bearing fruit, there has been an early growth of wood and full development of well matured fruit buds during the same season.

While discussing this system of tillage and clover culture at some of the horticultural schools which have been held in New York state, the assistant chemist at Cornell University, Mr. G. W. Cavanaugh, became interested in the subject and asked for a sample of the soil for analysis.

A sample was sent him of the soil that had been under this clover treatment and also some that had not. The soil was taken out in the month of June, early, at a pretty dry period. We had had no rain for nearly three weeks.

The boxes arranged for the samples were of the same size and the same shape, so the conditions could be as near alike as possible. The soil taken out at a depth of about six inches, we cultivate very thoroughly to that depth. The test was taken for the moisture in the soil, to get at the amount of water in it.

The chemist found that the soil with no clover had 8.75% of water in a hundred pounds of soil. When he applied the test where the three crops of clover had been grown and plowed in, he found 15%, almost double. What does that mean? It means that there was that much more water in one soil than in the other. It is understood that in most soils the weight of an acre taken about six inches deep will run about 750 tons, and it was found upon my own soil where three crops of clover had been ploughed in, that more moisture, or about 47 tons more of water in an acre was added. Now the chemist corroborates just what I found by experience, that I was carrying my crops successfully through dry seasons because I was obtaining more moisture; and that was what I was doing through the agency of the clover plant.

It was also shown by the test for the humus or vegetable matter that there had been a gain of 1.03% in the clover plant.

Another important fact obtained is the amount of nitrogen added. It is not necessary for me to explain how this is done. You understand the general statement that clover does improve the soil, that clover is one of those plants that has the power to take nitrogen from the atmosphere and bring it in contact with the soil.

By examining the clover you will see that it has a large supply of tubercles. I have had boys and girls go out from school and dig up some clover and wash the roots and see the tubercles with their own eyes; so anyone can see this condition of roots by examining the plants.

There was found to be in the field, adjoining, where no clover had been sown, 12% of nitrogen; upon the clover soil, 21%, giving an addition of 9%. What does this indicate? Simply this. The addition, upon the acre, of 1,350 pounds of nitrogen. This result was so surprising to the chemist, that he doubted his work, and he made three tests with the same result each time. Scientific men are very careful about making statements and he repeated his work several times. This is a very important fact to be ascertained, viz: that plant food can be added so rapidly. It has been proven not only from the chemist's figures, but from the marked improved condition of the soil. I would be glad to have you see the trees and the thrifty condition they indicate.

In June, the farmers of my county were invited to come and spend a day upon my place in a horticultural school. Two hundred and fifty with their families came and it was an astonishment to every one to see the size of the leaves upon the trees. The leaves upon the Spitzenburg were almost as large as my hand.

The Esopus Spitzenburg is one of the finest apples that grows in New York state. Ten years ago, this variety was good for nothing, the trees were in a condition of decline. The leaves would drop off early in September and the apples would hang upon the trees with no foliage. By this system of tillage and by the incorporation of nitrogen, these trees have been brought up to a condition of strength and vigor, and they have borne their 9th annual or successive crop. They have borne steadily for nine years. Upon these trees there is to-day, in addition to the growth of wood, a splendid development of buds for next year. Here we have an excellent result in the high quality of the fruit when plant food is supplied abundantly.

What else was found? To the surprise of the chemist, he found that a large amount of phosphoric acid had been liberated from the soil. It is difficult for a chemist to determine just how much there is available, but it was found that there had been set free, or added in some way, 105 pounds of phosphoric acid in three years. We knew it had been added, of course, for I had put no fertilizer upon the orchard outside of the crimson clover. How does the chemist explain this? By the existence of a large amount of humic acid which thereby liberated the phosphoric acid more liberally. In addition to this he is working at the present time upon the question of potash. He has not worked out the results but the indications are that they will be quite as significant as the development of phosphoric acid.

The crimson clover has an enormous quantity of fine roots. Their fine roots add much of humus to the soil. There are some very important questions that arise at this point. I have put in crimson clover the past year for the fourth time. It is a question in my mind how far it will do to carry this clover system. Is there danger of adding too much nitrogen? Shall my trees be turned into forest trees growing too much wood? I asked Prof. Roberts while he was in the orchard. He said, "So long as they are loaded down with apples as they are now I don't think you need to ask that question yet."

Ques. When do you sow crimson clover?

Ans. I sow it the first and second weeks in July, and when we finish up our vineyard culture it is the third week in July and that is as late as I would sow it. I don't dare sow it in the vineyards often, because in grape culture we do not want too much nitrogen as it would make too luxuriant a growth of wood. We finish up our currants about the second week in July and on goes the crimson clover on the currant plantations and I get a splendid growth of wood. When we get through with our gardens we sow crimson clover there and also on the potato fields. At the time the corn is cut, it frequently is not more than two inches in height and yet in my corn field to-day it is covered over thickly like a carpet. Whenever we get a piece of ground free from vegetables the crimson clover is made to occupy the soil.

Ques. How much clover do you sow?

Ans. Ten pounds of seed per acre I find to make a good covering. I haven't failed in four years and some of them have been the dryest years that I have ever known.

Ques. Do I understand that you plough it in in the spring?

Ans. Just as soon as we can get upon the land it is ploughed in. As I have already explained we want to hold the moisture in the soil and if the clover comes through alive and grows in the spring the plants take the moisture out immensely fast. So if it comes through alive we plough it down just as rapidly as possible. I want every plant killed by the spring freezing.

Ques. About what time do you get out to plough?

Ans. About the 10th of April, sometimes not until the 20th if we have excessive spring rains.

Ques. What time do you sow in your corn field?

Ans. When the corn is about four feet high. From the 4th to the 10th of July.

Ques. How do you cover it?

Ans. With the cultivator lightly, just as soon as possible. The finer the cultivation of the soil the more successful you will be in growing the clover. The secret of success in growing this clover is to have the ground under such cultivation that the plants can send their roots down into the moist soil.

Ques. Notwithstanding the different conditions is there anything to hinder our sowing it in our orchards and ploughing it in in the fall?

Ans. I should say plough it in the spring. Suppose the plant kills out at any time during the winter it has developed its nitrogen and you have the plant food in the soil. I had rather leave the land covered during the winter. Anytime the top is killed you have the benefit of the root in your soil if it has grown at all.

I think you would have to sow it in July. I would recommend that you take a piece of land and sow with crimson clover in June, sow again the first week in July, another strip in the second week in July. Side by side put on some southern cow peas and perhaps the peas will make a stronger growth than the clover. It is well to experiment with different things and out of that you will learn some things of value.

Ques. How deep do you plough?

Ans. About six inches. If you leave the orchard for years without tillage you will get roots near the surface and for that reason I like annual tillage as it will keep the roots deeper below the surface.

Ques. Your young trees from the Northern Spy stock are limbed very low down, are they not?

Ans. No. I trim them up, making the head five feet.

Mr. TRUE—You never have tried the red clover?

Ans. No. The red clover grows slower than the crimson clover and you don't get the results in the short season that you do from the crimson clover, it being a biennial.

Ques. You used other dressing beside clover?

Ans. For three years I have used nothing but clover. If in addition to the clover you spread on stable manure you are liable to get too great a growth of trees. I would use potash. I used to apply stable manure but I have reduced my stock. I used to carry upon 100 acres something like sixteen head of cattle, eight to ten head of horses, 100 hogs and fatten 500 sheep in the winter, so that I made a large amount of manure. Since taking up the system of clover tillage I have disposed of my stock and I am not now depending upon the stock agency at all for keeping the land. I think it would be only necessary to use in addition, potash and phosphoric acid once in two or three years to keep up the condition of the soil. There is a difference in conditions and localities and each must work out these problems.

Ques. Do you think that your trees are going to be long lived?

Ans. If not they are going to pay me while they do live. I had rather take the same amount out of the soil in fifteen years than to take it out in twenty-five years. I do not see any reason why the orchards will not be in good condition for many years to come unless I carry this clover culture too far. The facts are simply these. In our orchard culture we need to improve our methods, to produce a better quality of fruit. We must aim to produce a finer quality of fruit. There is no trouble in growing fruit of that quality, and such as I know you have grown in this State.

It was one of the pleasantest experiences of the World's Fair to see the fruit from your State. While it was not as extensive as that of New York, yet it was a very elegant display that you had from your State. While it was not large, it was exceedingly choice. Your fruit was of a beautiful color. The finest colored fruit at Chicago was from your State.

We must not forget that if we are to grow the choicest apples and apples of good quality, we must have healthy, vigorous trees because it is from the foliage that the fruit and the bud are developed. Hence, the more abundantly you supply your soil with plant food, and moisture the better will be your fruit.

If we can't till ten acres let us till five, but let us grow good fruit and such fruit as will bring good compensation to those who grow it. There are people who will pay as high as $6 to $8 a barrel for fine apples. They want every apple in the barrel perfect, and not a wormy or a scabby one among them.

I find that the better fruit is grown, the better it will keep. That is where spraying helps. Since taking up spraying I find the keeping qualities of my fruit very much improved. Before I began spraying when shipping to Europe the report would come back, ten, twenty and thirty per cent slack packed apples and every European shipper knows what that means. Since I commenced spraying scarcely a report comes back of slack packed apples.

A NEW PLAN OF WORK.

By Z. A. GILBERT.

Time works changes. The modified conditions thus brought about reach out to and call for a corresponding change in everything with which they come in contact. As these surroundings are an improvement on what has been displaced, and the changes taking place are ever onward toward an improved condition, so is the progress of our time brought about.

This State Pomological Society is one of the instrumentalities organized for the advancement of the fruit interests of the State. At its organization the writer was placed in a responsible official position in connection with its work and served in that capacity for several years. I, therefore, am myself responsible in a measure for the system of work established in the outset, and under which we have since been carrying on, the business of the society without essential change up to the present time. The system of work then established was believed to be well adapted to conditions as then existing, and certainly all those familiar with its efforts concede that the society has been an important factor in the progress made during the years since its organization. No other evidence is needed in proof that its methods have been suited to the work in hand.

The plan or system of work mapped out by the society at the start, and perfected from time to time as further experience dictated, may be briefly set down as follows:

The society should hold an annual autumn general exhibition of fruit, flowers and other horticultural products for competitive prizes. This exhibition should draw samples from all parts of the State. In arrangement it should be a model of system and order as an example for other less prominent exhibitions to follow. Through its influence it should serve not only as an educator but also should stimulate growers to greater effort and better products.

In addition to the above there has been held an annual winter meeting, designed chiefly for bringing out information of value to those engaged in fruit production. Incidentally to this main purpose there has also been coupled with it an exhibition of some of the leading winter varieties of fruits. This has been, however, more for an embellishment, or a sort of a side show to the main object, rather than an effort for a general representation of our winter fruits from all parts of the State.

Now, I do not for a moment question the efficiency of the labors of the society in the years that have past. But time, (with the labors of this society), has worked changes in the condition of the fruit industry in our State during these years. The enthusiasm before lying dormant is now awake and getting in its work. The stage of knowledge of the business in every namable feature has advanced step by step and year by year till what was then in possession of the few is now common to all. Hence I raise the question whether a change in our system of work, somewhat radical in certain of its features, will not better meet the demands of to-day than the line of effort through which we have labored for so many years. If old methods were right in their day they cannot be best adapted to conditions as we find them at the present time. A sameness of work long continued becomes monotonous and fails to inspire effort and awaken enthusiasm with those in contact with it.

It is more especially our regular annual autumn exhibition that I claim and fully believe has outlived its usefulness and should be laid away for a more effective expenditure of our funds. This exhibition never was designed for a money making machine—a nickel in the slot to draw out a prize. Yet to one who has been familiar with the exhibition all these years it is easy to see it has enlisted a class of exhibitors who are in it for the money they can make out of it. Year after year, and for a long time it has continued, a large part of the money, and especially the fat prizes, has been paid out to substantially the same old annually returning exhibitors. And these parties are not mainly the ones who most need the encouragement feature of our work. While this is largely true in the fruit classes, it still more applies to the flower department. The only stimulus thus given to either the fruit or floral industry by such awards is to arouse increased effort to secure more of the plums the next year. The real mission of the work is thus largely lost, and the faithful and efficient labor of our officers, by them gratuitously rendered for the upbuilding of the industry they represent, fails to reach the end designed, and therefore it is to that extent wasted.

Then the opportunity to learn the merits of the different varieties of fruit, observe their characteristic appearance and learn their names, once so important, is not so needed as formerly. The nomenclature of fruit in our State is generally correct. All these things, important in the time of their need, have been learned by those annually returning exhibitors.

There is still another reason for discontinuing the usual autumn exhibition, and possibly of even more force than any before mentioned. It is well known by our members that experience taught us that a general exhibition by our society held distinct and alone could not safely be relied upon to pay its expenses. The State Agricultural Society must necessarily run an annex of the kind with their annual State Fair. An arrangement was entered into, satisfactory to all hands, to hold the regular autumn Pomological Exhibition with the State Fair at Lewiston. This as you well know has been the plan for several years. But it has come to be that the State Fair is now held at so early a date in the season that it does not give the fruit department a fair representation.

Showing Ben Davis in August is an insult to that fruit, poor as it is when at its best. In fact, with the exception of some half dozen summer varieties the whole fruit exhibition at that early date is a reflection on the judgment of our society and a waste of its money. So far as fruit is concerned, the exhibition is largely degraded into a scramble after the money. That which should be and was originally intended to be the real mission of the exhibition is wholly lost. Only the floral department is at that time at its best. But the encouragement of floriculture is not the principal feature of our work. This is only a secondary attachment—an embellishment to the leading work of fruit growing consigned to our charge. We cannot properly make a subordinate department our chief concern. Hence it is easily seen that under these changed conditions our former methods of exhibition work do not apply. A change is called for that will more effectively carry out the work for which the society was chartered, and in aid of which a liberal grant from the State is provided.

The plan of work I would suggest for the consideration of the society may be roughly outlined as follows:

Abolish the present all-round annual autumn (or rather summer) exhibition with its large expenditure in premiums and heavy cost of carrying on the work. In its place, introduce a series of field institutes, each for a specific purpose and in its proper time. That is, one should be held in the interest of strawberries, and called to meet on the grounds of some successful grower of this fruit, and at a time when the fruit is at its best. An object lesson would be presented of soil, varieties best adapted to it, methods of culture and results obtained, all in that most convincing manner of seeing for yourself. The forenoon could be spent in this field work. In the afternoon, retire to the near-by school house or any other comfortable shelter at hand and discuss the subject matter of what had been seen and what the occasion has suggested. Along with this, prizes should be offered for basket samples of different varieties of the fruit, and the growers present would very properly be the experts to make the awards. Later on, a similar institute should be held in the raspberry field, and a few days later still with the blackberries. In its proper time, a noted plum orchard might be visited on a similar mission, and finally the apples and the pears, and each time with prizes offered to draw together samples of fruit when at its best. In this way, a direct and forcible impression would be exerted that never could be reached with our former and more formal methods of work.

Then to crown the year's work with fullness, I would make the annual winter meeting the great competitive exhibition of the year. The apple is the king of fruits. Winter apples have come to be our chief reliance. Think of the insignificance of an August show of winter fruits, the utter folly of such a farce, compared with the same in midwinter.

This is simply an outline of the plan I have in view. The filling could be put in of a kind and in a measure to reach the case and suit the occasion. The plan involves no gate admissions. All is free as the sunshine that paints the fruit and flavors its delectable juices. Nor would the carrying on of such a plan be expensive. The whole machinery would be flexible and could be easily directed where its influence was most needed.

In view of the old routine of work grown monotonous from a long continued sameness, and in the belief that changed conditions call for a corresponding modification of effect, I ask the candid consideration of the society to the suggestions I have attempted to outline.

Such a work, arranged for its best effect, would have a specific application, a directness, an emphasis far beyond that which we are now exerting. It would also admit of a greater variety and a broader application. The paying out of the larger part of our money in premiums has outlasted its usefulness. Instruction is now the power called for in moving our fruit growing on to an advanced position.

I have named only this method of object teaching and field instruction. Other opportunities of disseminating information broadcast among the people are not wanting. New methods of educational work are opening up almost every day. We are developing lines of such work heretofore unknown. Means admitting, the field of work I have thus outlined for this society having been fully covered, there is still left the opportunity to extend our efforts in this broader educational line without limit.

One thing more: The State, by making us its beneficiary to the extent of a thousand dollars a year, carries with it the requirement that the money shall be judiciously expended. True, this requirement is not worded in the act granting us the money. The obligation, however, lays over the society with the same force as if it were written law. Hence the society is under obligation to endeavor to carry on its work to the best possible advantage to the interest it is commissioned to foster. In the belief that an improvement in the work of the society can be made and is called, these suggestions are offered.

DISCUSSION.

Mr. KNOWLTON—There is a great deal of doubt in my mind as to the wisdom of the autumn exhibition in the way it is conducted. I have before me the book of premiums, and to emphasize one statement Mr. Gilbert made as to the money making feature on the part of the exhibitors, that is all right as far as the thing exists at the present time.

One exhibitor had premiums to the amount of $82 in 1896; that year there was awarded $912.25, including the awards on fruits and flowers in all departments, or nearly 10% of the whole amount awarded, and there were over a hundred exhibitors that year. Last year the same exhibitor took in premiums $57.75 and the total awards were about $553. It does not seem to me that it should be possible for one exhibitor in a society like ours to take such a large part of the premiums. I have frequently called the attention of the executive committee to this situation.

Sometimes it isn't just right when the premiums are awarded, as the thing is now. If we could draw the line just at excellence and insist upon its being there, and being maintained, we could get better results than now and not pay so many premiums. One case comes into my mind where the second premium was awarded but no first premium. There were two exhibitors, and they were both offended. The second premium was awarded because the judge thought possibly the quality might admit of it, but the other was not entitled to any premium. I would have been ashamed to exhibit such fruit, and would not have shown it with my name on it.

This new plan of work calls for a great deal more of institute work and if we can have the right kind of institute work in the State it would be of great advantage. There is nothing like going among fruit growers and seeing what their methods are, and if they have anything good you can copy it, and if they have anything that is not just right and there is a crowd of people looking things over, they are pretty sure to find it out.

If we could have a well organized field meeting at some point in the State and have one good speaker, I say one good speaker, I mean if I could I would have one good speaker out of the State, one of better authority on the special lines taken up than anybody in the State, the people would take pains to go and hear him.

[The discussion closed by the appointment of committee to take Mr. Gilbert's paper into consideration and report at annual meeting. See Business Transactions.—Secretary.]

STRAWBERRIES.

By Ernest W. Wooster, Hancock Point, Maine.

ITS CULTURE.

The first and most important lesson to be learned in the culture of the strawberry is the fact that the berry plant is a living thing, just as much as your cow, your horse, your sheep or your hens, or any other animal that you may have, and subject to the same laws in regard to feed, treatment and care. The organisms of life differ somewhat from the animal, and their sensibilities are not so high, but the same grand law which regulates and governs one life regulates and governs the other.

Conditions vary so much in different parts of the country and even in the same sections that it is impossible to lay down a complete set of rigid rules which will have a general application in any locality. There are only two rules upon which all the great experts seem to be well agreed: "Good cultivation and good fertilization," but even in these they disagree as to what constitutes good fertilization and good cultivation.

The rules to follow are: 1st, good cultivation; 2d, good fertilization; 3d, plant in the spring as early as you can get your ground ready; 4th, mulch the season of fruiting; 5th, winter protection where the ground freezes.

HOW WE PLANT AND CARE FOR AN ACRE OF STRAWBERRIES.

Our market is such that it appreciates fancy fruit, or in other words, we cater for that trade and take the other only when we are obliged to. On this acre of ground we want to grow the greatest crop of fancy berries possible under the conditions that are and will exist, and at the smallest cost. In other words we want to do every thing we can to that patch which will add to the profit side and nothing more. Bear in mind that we are not after experience in this case, we are supposed to have had that, but after profit.

We have been looking ahead two years for this planting and had selected two plats of woodland, second growth, of one-third acre each; one on upland, sloping gently to the south; the other on bottom land with same kind of slope only to the north. It cost $50 to have this done. The plants cost about $25, making the entire cost of preparing the land after the brush is burned about $75 per acre. The stump piles were burned as soon as they became dry and then we laid off the land in beds two rods wide on upland and from one to one and a half rods on the bottom plat. We back-furrowed several times, dragging them down after each plowing, with the spring-tooth, and finally finished with the road-machine and brush-harrow. These beds were made up just the same as a good road bed should be made; the highest in the middle so as to afford perfect surface drainage. Unless this is provided for, the plants are liable to winter-kill by ice making over them. Along where the rows are going to be we sowed ten pounds of Cumberland Corn Fertilizer to a row and worked this in with the "Planet Jr.," 12-tooth. The rows were three feet apart and were made as straight as we could draw a line. The upland plat we set to Beder Wood, Warfields, Haverlands and Lovetts; using Beder Wood to fertilize Warfield and Lovett to fertilize Haverland, setting one row of the staminate to two of the pistillate. In setting the plants we use a mason's trowel, setting the plants two feet apart in the rows, carefully spreading out the roots fan-shape, against the back side of the excavation, then pushing the earth back against them, firming them well in by a pressure of the hands.

The upland patch we tried to have all prepared the fall before planting, so there would be but little delay in getting plants set after the ground was in proper condition. All we want to do in the spring in the way of preparing the ground is to cultivate the phosphate in and brush down the beds. Upland prepared this way the fall before can be worked in the spring just as soon as the frost is out of the ground. It is a great advantage, this getting plants set early so as to give a good start and have them well rooted before the summer drought comes along. Then you can laugh at it. In fact, it's just what we want, if our soil is deep. This great cry for water! water!! water!!! which some fruit growers are always howling for the strawberry I don't join in with. They can have the water from the sky if they want it, but we much prefer to water our plants from the reservoir of the soil with the cultivator, hoe and mulch, than to be obliged to take it in such quantities from the skies as we were obliged to last summer here in Maine.

As the lowland patch will not be in condition to set till about a month later we heel the plants intended to be used here in a cold frame where the soil is very rich and fine, Bubach with Beverly, and Princeton Chief with Parker Earle. When the ground is ready to receive the plants they are transferred from the frames to the beds, set the same as the others. While setting, the roots of the plants are never allowed to get dry, and we try to avoid dry, windy days, setting neatly in the P. M.

Cultivate as often as necessary to keep the crust broken and the weeds down. As the runners commence to grow, train along the rows the way the cultivator runs and assist them to take root. After the plants have matted a row about one foot wide with plants from four to six inches apart, put the runner-cutter on the "Planet Jr.," and thereafter keep all runners cut as soon as they grow. Sow the phosphate when there is no wind and the plants are dry along the rows before each cultivation, using the potato brand which has a greater per cent of potash. We put on during the season fully one ton to the acre.

In a dry season we cultivate about three inches deep making a dust mulch of that depth, obliging the main roots to go below that depth for the water. As the fall rains set in we cultivate more shallow, that the fine roots may come nearer the surface but not nearer than one inch; cultivation should be kept going at that depth as long in the fall as growth continues. This method of cultivation in a dry season will give the plants an immense root system, and is the most practical irrigating and food gathering system to be given the strawberry patch. It is a system that works automatically—self-acting and self-regulating—which will pump water and give food to the thirsty and hungry plants while you are enjoying your peaceful slumbers. Towards the fall we sow phosphate between the rows, as under this inch of dust mulch the soil will be completely filled from row to row with the net work of roots.

In a wet season it will be impossible to get this great root system, as the roots will then spread out near the surface and will be much shorter and more thickly matted. Frequent cultivation is necessary to keep down the weeds in the soil and the crust broken. When fall comes and there is danger of injury to the plants by alternate freezing and thawing of the ground, we put on some artificial covering to protect. I say artificial covering because nature's covering is snow and most decidedly the best in quality inasmuch as it is the best non-conductor of any substance known.

The best artificial protection we find available are evergreen boughs or little trees. The little trees from three to twelve feet tall are the better, as they are great to catch and hold the snow. To make them lay where they are put, trim off the limbs from one side and lay that side down next the ground. We cover both patches with this material; but before we put it on the lowland we cover between rows with salt hay or straw. This is to hold the plants back somewhat so that they will fruit a little later than if covered with boughs alone. In the spring, just as soon as the freezing nights are over, when the green foliage begins to lift up, we take off the covering from the upland plot, and sow on one-fourth ton of potato fertilizer just before a rain; and then cultivate lightly once a week till well into blossoming, then put on one ton of straw, working it well up under the sides of the rows of plants. On the lowland plot we leave the brush on about two weeks later, when it is taken off and phosphate put on as on the other, only there is no cultivation or disturbing of the hay or straw mulch, something which would induce early fruiting, just what we don't want.

Now, before we go any further, let us see how much expense we have been to thus far with these two half acre lots:

Getting the ground ready from start to finish.......	$75 00
One and a half tons of phosphate.................	45 00
Applying half ton of phosphate..................	10 00
Cultivating in an ordinarily dry season............	50 00
About 7,000 plants, $3 per M.....................	21 00
Setting of the same.............................	12 00
Keeping blossoms off...........................	2 00
Two tons salt hay...............................	10 00
One ton straw..................................	8 00
Putting on hay and straw........................	8 50
Putting on brush...............................	12 00
Taking off	5 00
Extra	5 00
Total	$255 50

CONTRA.

2,000 quarts from upland patch at average price per quart of 12 cents..............................	$240 00
3,000 quarts from lowland patch at average price per quart of 12 cents..............................	360 00
Total receipts..............................	$600 00
Total expense in gathering the fruit, including rent of crates, commissions, etc., 3½ cents per quart.....	175 00
Expense as above..............................	255 50
Total expenditure.	$430 50

Net proceeds, $169.50.

It must be borne in mind, that to grow a good crop of berries and get them ready for the pickers does not include one-half the battle.

Then comes the time that will test your mettle, try your generalship, and prove whether you are equal to all the emergencies that are sure to arise. From this acre we should have from 100 to nearly 1,000 quarts to be gathered daily to the close of the season. In order to gather this fruit in the best shape we must have from one to twenty pickers each day, as, owing to weather conditions and other circumstances we are often obliged to gather our fruit in a very short time. Our customers are fastidious, exacting and not considerate of the many trials which surround us. They expect choice berries delivered in fine shape each day regardless of all weather conditions, and if they do not always receive them thus our reputation suffers.

The largest part of our capital is here invested, and we feel that we must protect it at all hazards. To do this we are called upon to give our personal attention to almost every detail, trusting but little to our best man. We must be here, there and everywhere, all at the same time, among the pickers, seeing that they are doing their work right; into the packing house, superintending the packing and shipping; at the station, seeing that the crates are being carefully handled; at the desk, answering correspondence.

My first attempt was with potted plants eight years ago and every year since I have grown and planted thousands of these. If I could be assured of twenty-five cents as an average price for all the strawberries that I could grow by this method I would use it altogether. By this method we can grow the largest average sized berries, the best formed berries, the most beautifully colored berries and the firmest berries grown by any method we have ever tested.

Our trade for these fancy berries, at the price we can afford to grow them, is limited to about 3,000 quarts yearly, and we grow these more for reputation than for direct profit. As this is our hobby branch of the strawberry business, we have tried very hard to develop it to a high standard, to grow the largest and best crop of berries at the smallest possible cost, and to this end have experimented very largely. It is really a trade by itself, and to become proficient one must needs have much experience. We feel certain that it is the only practical and profitable way to fruit plants the next season after that seed set in the late summer or autumn, and this method of growing the strawberry cannot be generally advised.

VARIETIES.

We have altogether too many varieties. They go up into the hundreds, and yet the really good ones, that one can afford to grow here in Maine, if he is growing for fruit alone, can be counted upon the fingers of both hands. What those varieties shall be every man should determine largely for himself; but whatever his selection may be, they should be from those that have been well tested in the State, and have a record with the "upper tens." "Go slow" with all novelties, no matter who recommends them, unless you have time and money to throw away on experimenting. Among the many new varieties introduced every year under the highest rating, only a few are destined to have even a local popularity, and not a chance of one in fifty of becoming generally popular enough to supersede the best standards. It is clearly evident that the larger proportion of these new varieties are sent out by those who trust to their ability to defend their reputation for honesty by the many excuses they can present when the truth regarding the value of the variety becomes well known.

Most people planting the Parker Earle in Maine for general field culture, would give it up as a failure because of its seeming inability to mature the fruit set, but we find if we give it the treatment it requires it is the most profitable variety that we can grow and the most reliable. It demands plenty of room for each plant, very high culture and deep, moist, retentive soil. On the other hand the Crescent will stand the most abuse of any variety that I know of and yet give a fairly good yield. However, it is not in our line of most profitable varieties, so we discarded it some five years ago.

We have here in Maine a certain commodity which we yearly have a large crop to dispose of, and of which we

COULD SELL MILLIONS OF TONS

without selling one cent's worth of the natural fertilizing elements of the soil. Though it is wholly made up of that which is absolutely necessary to support life, the supply is so inexhaustible and self supplying that it is impossible for us to sell ourselves short. Every dollar we receive from abroad is clear profit to Maine. Now with this most stupendous fact staring us in the face it should need no argument to convince every one that such an industry should be encouraged to the extent of the limit of individual profit. If there is any one present who has not yet guessed what this commodity is, it is better for me not to tell him, because the longer he is gathering in the fact the more indelibly will it be stamped upon his mind.

There are some farmers in Maine who seem to think that they can afford to grow hay for five mills per pound, which after being well cured has only a very small per cent. of water, while its solids contain all the fertilizing elements in about the right proportion for all vegetable growth, if not in the right condition for that growth. It is a complete food for most of our domestic animals, and will by them be quickly converted into available food for vegetable growth.

The strawberry contains, in the condition we place it upon the market, from 95 to 98 per cent. of water, so the chemist tells us. Now if we sell a pound of strawberries, which is the weight of a standard quart of this fruit, for ten cents, we are selling the strawberries for twenty times the price of the hay, pound for pound.

ADVANTAGES OF THE STUDY OF NATURAL HISTORY.

By Prof. A. L. LANE, Waterville.

The first Pomological Society had two members, Adam and Eve. They were placed in an orchard "to dress it and to keep it;" and though they came to grief by taking the advice of an outsider as to the use of their fruit, they might have been very happy if they had been true to their opportunity. Whether the story be history or allegory, or as likely both, that is, allegory embodied in history, it is certain that man gets nearest back to Paradise when he makes the best use of the resources given to him in nature.

When Antaeus wrestled with Hercules he received new strength from his mother Earth every time he was thrown to the ground and Hercules could only conquer him by lifting him into the air. So to-day man is strongest with his feet upon the soil. He gathers strength by the touch of the ground, and is most effective when he gains fullest mastery of the conditions that surround him. All the triumphs of our complex civilization grow out, on the one hand, of the subjugation and utilization of the great forces of nature, such as gravity, heat, light, electricity, and on the other, of bringing into service the natural resources of land and sea, of plant and animal.

Improved methods of cultivation, progress, both in quality and quantity of products, are as necessary to the growth of our nation in the utilities and comforts of civilization as are advances in mechanical invention, in methods of transportation, or in the transmission of intelligence. The commissary department of the army of civilization is absolutely indispensable. It is a great pity when the man from whose hand inventor and merchant must be fed is overlooked and underestimated. It may be a fair question, however, if the farmer is left behind in the race, if it be not partly his own fault, and if he would not find himself more nearly abreast with the times and more adequately compensated for his labor, if he would give himself to the study of his vocation as eagerly as the lawyer or physician to his profession. In all forms of business old methods are giving place to new, and better results may be expected in agriculture when as much study and care are given to the farm as to railroads and steamship lines. In fact, these results have already been attained in some cases as for example in the management of those immense wheat fields of Dakota.

There is one respect in which the farm is still ahead and in no danger of competition and that is in the raising of men. The city is only saved from utter destruction by the infusion of the fresh life that comes from the country. The best place to bring up a family is where the sky is not hidden by the smoke and dust and brick walls of a city, and where the life may come into direct touch with nature and all its sweet influence and aspirations. A careful study of nature in the home, in the school, in the fields and woods will greatly strengthen these influences and will add to the value of the product in self-reliant and happy manhood. A boy or girl in the country absorbs unconsciously from field and forest, from meadow and mountain, from brook and river, from birds and flowers a wisdom greater than that to be found in the dusty streets of a city.

Larkin Dunton, principal of a Boston Normal School, after defining true scholarship as a knowledge of things as they are, declared that a child in the country had far better chance to see things as they are than in the city and therefore a better chance to obtain true scholarship. It is no small part of a liberal education for one to spend the first fifteen or sixteen years of his life gaining familiarity with all the lore of fields and woods and the ever changing mysteries of nature, new every morning and fresh every evening.

Even without formal instruction the knowledge thus gained is of no small value, but of how much greater value it would be if the powers of observation should receive regular training, be more carefully directed and more wisely used. Others have been before us in nearly every department of study and if we can learn what they have attained and how they have gained it, we may stand on their shoulders and take in a broader view. When we know something of what others have accomplished we are better prepared to make observations for ourselves. To say that one should ignore all truth that others have discovered and find out everything independently for himself, is to go back to savagery, to wander from the true path, to put out the light that comes from the experience of others. Results are multiplied many fold by mutual co-operation and helpfulness. He is a happy boy or man who has something to give as well as to receive, to receive as well as to give, in those pomological exhibitions in which the fruits of observation and discovery are compared. The joy of discovery is heightened when we find that others have seen what we have seen for ourselves, or when some fact or form in nature that has been a puzzle to us is explained by some one who has had keener insight than we. How it sharpens one's wits and puts him to the proof to read the records of some keen observer like John Burroughs or Thoreau, or C. C. Abbott, or Olive Thorne Miller, or Frank Bolles, or Bradford Torrey, or W. H. Gibson. It is a great thing to see again what such observers have seen, but if we catch their spirit we shall not stop with that; we shall find the fields so wide and rich that new material will reward our search.

One very important reason for the study of nature is that it will form new points of attachment to country life; it will strengthen the bonds that bind the young to their early home; it will not only make them less likely to leave it, but it will cause them to think of it with pleasanter memories if they should enter the busy whirl of city life, and to return to it with keener zest and more delightful recreation when they can secure a brief respite from busy cares. As yet, more than half the population of this nation are living in the country, but the tendency towards the cities is rapidly increasing, the current is setting that way, and a sad thing it will prove for our people unless something can be found to stem this tide. Everything which gives increased charm and zest to country life is certainly to be warmly welcomed. Many things may be mentioned as likely to do this; among them such as these: Changes in the home life wherever needed to make it brighter and happier, greater care of the buildings and the home lot, lawns and shade trees and flowers, books and papers, better postal facilities, the free delivery of the mail, better roads, free libraries, magazine and newspaper clubs, improved fruits, the use of machinery to lighten labor out of doors and in, making more of social life in all worthy and helpful ways, improved schools, assigning special parts of the farm to each of the boys, girls, too, to care for and to profit by; these, and many others; but among them all, and by no means the least, place an intelligent observation of the phenomena of nature, of plant and animal, of the rocks under foot, of the stars overhead, of the very clouds and storms, of brook, river, pond, lake, as deepening the attachment to country life and strengthening the bonds which bind one to his country home.

Thoreau was more at home in his solitary hut at Walden than in the crowded city, and without going to such an extreme, one whose eyes are once open to the attractions and teachings of nature will find companionship and pleasure in any aspect of her ever changing appearances. The more one knows of the wonderful story of plant life or of animal life, of the constant changes going on out of doors, the stronger the bonds that bind him to the country, and the less likely he is to be overborne by the temptations to city life. It is a dreary thing for the country home when the young life goes out of it to try the fortunes of the city, and though in many cases it is better for the young man or young woman, better for the world, yet it is a great pity that the country itself should not afford better privileges and opportunities, and that an honorable and successful career should not be found without such wrenching of the heart strings, such risk to health, character and success. Is it not true that the instances of honorable achievements made by country boys in cities may blind our eyes to many cases of lamentable failure? If one aim of this society is to add to the resources of country life so that its toil may be made more productive, its homes more attractive, and if such results will be best reached by the most careful study of all the conditions of the case, then the subject of plant life, of climate, soil, of fruits most profitable in special localities, of improved varieties of fruits, of methods of guarding them from their insect enemies, the protection of birds, the preservation of game birds and larger game, the stocking of our ponds with fishes—all these and other matters pertaining to the best use of the natural resources of the State are kindred to the purposes of this society, even though not directly included in its avowed objects.

Pomology is a branch of practical botany, and botany is only a part of the broader study of natural history.

What are some of the advantages to be gained by such study? To give new attraction to country life and strengthen one's attachment to it has already been mentioned. A very similar object is to open one's eyes and train to accurate habits of observation. "It has opened my eyes; it has given me a new view of life;" are the exact words of a student after a brief course of study and reading in natural history. "I feel indignant," said a prominent lawyer of Massachusetts, after a visit to his earlier home in this State, "whenever I think that no attempt was made by my teachers to open my eyes to the wonderful things that were all about me in nature." "I am going through life blind to a thousand things in the world that might interest me," said another, a college professor, "if I had only been taught at the right time how to see them." Materials for investigation, objects of interest, will never be lacking if once the habit of careful observation be formed. "Small pitchers have large ears," and children have large eyes, as truly, and they will see wonderful things in root and branch, in leaf, flower and seed, in insect, bird and quadruped, if we will but fairly open their eyes by teaching them how and where to look. For a simple illustration of what may be seen by one who has eyes to see, let us take the common dandelion, perhaps the most familiar plant about our doors, and one of the earliest in bloom. Its root is somewhat thick and fleshy, going down deep into the soil, dividing, perhaps, and storing up in its structure the nourishment which is to give the young plant a rapid growth in the early spring. It has a very short, condensed stem just raising the leaves to the surface of the ground, where they lie low down, escaping the danger which would threaten them if the stem were longer. The leaves are so shaped, irregular, wrinkled, incut, as to give greater breathing capacity in their lowly position. The yellow disks, golden coins, of the young blossoms lie low down also, so that the lawn mower often skips harmlessly over them. The flowers themselves will repay careful study. They belong to the great composite family, and are akin to the daisies, asters, and goldenrods. Each flower, as we call it, is composed of hundreds of little flowers standing crowded closely together on a circular platform, and surrounded by an involucre or railing, like a double picket fence, for the protection of the florets. Each little flower has the four parts of the complete flower, calyx, corolla, stamen, pistil. The calyx is so modified by the crowded condition of the flowers, that, hidden away in the dark as it is at first, its sepals are reduced to fine, thread-like silvery hairs, instead of the usual green leaves of the calyx in other flowers. At first these white threads, or pappus, as they are called, are low down upon the akenes, or seed boxes which each contain but a single seed; but as the seeds ripen, the stipe or stem of the pappus lengthens until it is long enough to hold each little parachute or umbrella out from the disk until, together, they form a feathery globe of ripened fruit, ready to have its parts scattered by every breath of air. The corolla, also, of each little floret is lengthened out into a long tongue or strap with five notches at the end, reaching out as far as it can to have the freest access to sun and air. The scape or stem of the flower is a hollow cylinder, just as a wheat straw or a bicycle frame is made hollow, because a hollow cylinder is the strongest form into which a given weight of material can be fashioned. This stem, at first, is short, and the flower lies low down in the grass for safety, but as the time of ripening the seeds approaches, the stem lengthens, until at last it may be a foot or more in length. Nor is this all. The flower passes through three distinct stages. In the first, the blossom opens in the early morning and closes in the early afternoon for three or four days, giving ample time for insects to pass from flower to flower and secure cross fertilization by a special arrangement by which the pollen of one flower is shed and carried to another flower before the stigma of the first flower is ready to receive pollen from the other. When this work is finished the flower passes to its second stage. In this the flower goes to sleep again for perhaps a week or more. The stem becomes less rigid and frequently the flowers lie down, hiding in the grass in a sort of chrysalis condition with the involucre closely wrapped about the ripening seeds, while the lengthening stipes of the pappus are pushing out the corolla, stamens and pistils, which have done their work, and sloughing them off in a withered mass from the narrow opening at the top of the involucre. The birds have understood this stage of the flower better than the botanists, for when they want the silky pappus to line their nests, they do not wait until it forms an open globe, its parts standing out from each other and easily falling to pieces at their touch, so that they could gather very little of it at once, but they come when the whole is still shut up in its wrappings in a mass and tearing open the coverings they fill the bill at once and carry away the mass to form the soft and silky lining of their nests. In the third and last stage the stem stands upright again, stretching itself to its full height so as to overtop surrounding plants, the involucral wrappings turn completely back and down, lying snug to the stem out of the way, and the pappus, each little balloon with a ripened seed in its basket, makes a complete globe each part of which is ready to be blown away and sown broadcast. A microscope will tell us that each little seed basket has projecting points on its sides directed upward like the flukes of an anchor ready to catch on the first favorable opening for a dandelion seed. This is only one illustration out of the many of what may be learned by careful observation.

The study of nature also gives excellent training to the judgment and the reasoning faculty. It requires as careful discrimination to decide to which of several closely related species a certain plant, bird or insect belongs as to choose between two renderings of a doubtful word in Latin or in Greek. On what evidence do you base the claim of a plant to belong to a certain group? What proof is there that a certain peculiarity of structure was caused in this or that way, or that this or that object is to be accomplished by it? Why are the branches of some trees opposite on the stem and of others alternate? What are the special functions of every part of the plant from root to leaf, flower and fruit, and why does each part vary so greatly in different species of plants in form, in size, in color, in duration? How can you show that the flower and fruit in all their parts are only transformed leaves? Is it true that all plants and animals have been developed under Creative direction from some original primitive type of life? The questions are endless which may be asked and which only the nicest balancing of evidence can answer.

Again, acquaintance with nature will bring one into such touch and sympathy with it as to make one feel at home in the world. As one is most alone in a crowd of strangers, so one who knows nothing of the mysteries of earth, air, sky, is a stranger to the great world that presses upon him on every side. It gives no small pleasure to life to know the flowers and birds as they come and go through the changing year, and one who recognizes them as old friends need never feel solitary or alone.

> "To him who in the love of Nature holds
> Communion with her visible form she speaks
> A various language;"

but these voices with their mild and healing sympathy are all unheeded by one who has no ears to hear. Real ownership of anything consists largely in the pleasure we get out of it, and one whose heart is attuned to all the sweet influences of nature really owns the earth and all that it produces. The sweetness of the bird song, the purling of the brook, the beauty of the flower, the glory of the rising or the setting sun, the grandeur of the night, all the beauty or the majesty of nature are yours or mine just in proportion to our ability to perceive and to possess. "All things are yours" is solely a question of fitness to appreciate and to enjoy. Long ago the great Teacher taught His disciples to "behold the birds of the air" and to "consider the lillies of the field how they grow," and still from such beholding and considering, one may learn most precious lessons of homelike trust.

In the school room, nature study will serve to connect school life with out of door life, and will lessen the shock of transition from the warmth and freedom of the home to the chill and repression too often felt in the school atmosphere. Prof. Lee, of Bowdoin, tells of the way in which the Terra-del-Fuegian mothers deal with their troublesome children. The whole family live in a large boat with a fire upon the domestic hearth in the middle of it, and when one of the children is too boisterous the mother takes him by the ankle and dips him overboard into the chill waters of the Southern sea. Almost as chilling as that is sometimes the transition from the warmth and tenderness of the home life to the regime of school government, and it brings a little of the pure air of the outer world into the school to introduce into it the study of plants and animals. Such study gives new meaning to Geography, new charm to language work. When words are full of meaning to the pupil he will readily learn to use them. In this way the dry bones of school studies are clothed upon with living flesh, as if one should transform the black skeleton of an X-ray picture into the cherished photograph of a friend. You cannot teach a child anything unless he already knows something to which the new truth is akin, unless it fits in and joins on to something which the child already possesses; hence, the very great advantages of connecting by as many points of attachment as possible, the world of books with the actual world in which the child has already begun to live.

For older persons also, acquaintance with nature will lead to a better appreciation of books and of the best literature. More and more our higher literature is full of nature lore, allusions to plant and animal life, and descriptions of natural scenery and phenomena abound in the writings of our best authors. To understand and appreciate these we must ourselves be familiar with the objects to which they refer.

T. W. Higginson in his "Out-of-Door Papers" gives a graphic picture of a deserted bird's nest on one of the trees of a village, in winter. He recalls the happy, busy life of which the nest had been the center, especially when occupied by the young birds, and then imagines the effect, if by some power, all the lines of flight of birds coming and going to and fro and circling around the nest could be made visible. Try to imagine the maze of lines that would be seen, growing more and more complicated and involved as one approached the nest, like the meshes of some enlarged spider-web with the nest, as the spider, at the center. Just so our life, and hence our literature is shot through and through with threads of influences, interwoven and interlinked, that come to us from our touch with the outer world. The presence of this element is specially noticeable in poetry, but it is by no means wanting in prose. Our own poets, Longfellow, Whittier, Bryant and others, abound in passages that have the very life of nature in them. In Longfellow's "Tales of a Wayside Inn," "The Birds of Killingworth" is simply a plea for the birds which every teacher ought to read if she would teach to her pupils for "at least ten minutes each week," as our State law requires, "the principles of kindness to birds and animals." In his tribute to Agassiz on his fiftieth birthday Longfellow compares Nature to a nurse telling stories to a child upon her knee.

"And Nature, the old nurse, took
  The child upon her knee,
Saying: 'Here is a story-book
  Thy Father has written for thee.'
  * * * * * *

And he wandered away and away,
  With Nature, the dear old nurse,
Who sang to him night and day,
  The rhymes of the universe.

And whenever the way seemed long,
  Or his heart began to fail,
She would sing a more wonderful song,
  Or tell a more marvelous tale."

Whittier's poems are even more fully penetrated with the voices of our New England climate. This is marked in "Snowbound," "The Tent on the Beach," "The Mayflowers," and many others of his poems; but the one that seems to me just now to be peculiarly redolent of the woods and fields is his "Barefoot Boy." How true the picture which he draws of the varied "Knowledge never learned of school" which the little barefoot, at first hand, gains for himself. Who can doubt that it was from just such rambles that Whittier acquired something of his gentle and tender spirit. "I was once a barefoot boy," he tells us, and in his confession he discloses the secret of his nature lore. Bryant is equally rich in touches of nature. Besides the oft-quoted "Thanatopsis" many others of his poems could be named. "To a Waterfowl" is a hymn of trust, "The Yellow Violet," "To the Fringed Gentian," make the flowers of which they speak still more beautiful. But the time would fail me to tell of Burns, of Scott, of Wordsworth and of Tennyson. I must leave untouched our prose writers whether they be essayists, historians, novelists or writers of travels. There may be false worshippers at the altar of Nature, but one whose heart is really true to her cannot help being the better for her influence. How full of truth is the little poem of Tennyson to the flower plucked from the wall.

"Flower in the crannied wall,
I pluck you out of the crannies;
Hold you here, root and all, in my hand.
Little flower—but if I could understand,
What you are, root and all, and all in all,
I should know what God and man is."

By the side of this deserve to be placed these other words from Coleridge's "Ancient Mariner."

"And now farewell, but this I tell
To thee, thou wedding guest;
He prayeth well who loveth well
Both man and bird and beast,

He prayeth best who loveth best
All things both great and small;
For the dear God who loveth us,
He made and loveth all."

As a matter of the simplest, every-day economy the one who loves plants and animals will take the best care of them and will be the most successful in his work.

SEEDTIME AND HARVEST, OR RESULTS FROM THEIR STUDY.

Miss MARY S. SNOW, Bangor.

I don't know as much about fruit as I wish I did. I do know what our children are doing in the schools at home in regard to nature study which Prof. Lane has outlined so carefully to us tonight.

I wish to agree with Prof. Lane when he says that if the children do not get this spirit of kindly love and sympathy in their childhood the man and woman will never have it, and that is why we are interested in introducing nature study in the public schools at home. Many of the results are very surprising to me. You people who come from suburban districts where the boys and girls know the trees in the spring, they know every bird, they know his song, they know every flower, they know seed time and harvest so well, and as they go trooping to school nature is an open book to them though read with the ignorance of childhood.

But if in our cities where the children can see the sky only between two brick walls we can create an interest and love for nature there is no pains we take that is too much; there is no burden that is too heavy to bear.

If any teacher should ask me when to begin the study of nature, I should say tomorrow, indeed I might say, yesterday and then they would know something about it.

Tomorrow in our public schools at home there will be some study of nature. The children at the present time are making a study of the evergreens; collecting spruce, fir, and pine. They are studying the habits of the tree and the way the branches are grown.

These are some of the things we try to teach the children. We try to make them keen to see the reason of things; we try to make them understand that God knew when he made the evergreens that they were to stand in our climate and that they would have to stand in the snow. The snow will shake off in a few days from the branches, and the branches that were weighed down to the ground, if they have heart enough and life enough, will go back to their places just as soon as the snow is off. They are ready to obey in the sunshine, ready to obey in the shadow just as we should be.

They are making a study also of flowers and a few apples, very few, as perhaps you have discovered. The other day I went into a primary school and the children were drawing apples. There was an apple on every desk, Heaven alone knows where they came from. The children were studying away and would look first at their apple and draw, then study on the apple and draw again. The teacher was working with them and instructing them. They were putting in the color; they were expected to draw not only the form of the apple but to put in the color. One little boy, a wild kind of a boy looked at his drawing and with a long breath said, "Seems tho' I could set my teeth in it, it looks so good." It looked marvellous to him. The children were also expected to bring out the defects in the apples.

(Drawings were shown by the 4th grade children.)

The object of drawing is two-fold, 1st, to give the child facility with his hand. The 2nd, to see the details of things. Before the child is allowed to draw he must talk about the object he is to draw. He must tell how the apple looks; how the stems grow; the shape of the apple, etc., these things bring about carefulness of perception on the part of the child; these things are what brings the child into a more living touch with the object.

Prof. Lane has spoken of the tendency on the part of the country children to move toward the city and Heaven knows it is an unfortunate circumstance. We are always talking to the children about the beauty of the country and you don't begin to know how successful we have been in inducing them to go forth into the fields and the country in the search of flowers. In the springtime it is especially fascinating. The things are not so common then as in the summer and it is a joy to go.

In one of our schools the teacher in introducing the nature studies, by the way the class was all boys, took in the Trailing Arbutus and showed it to them, called their attention to the beautiful coloring, and the boys nudged one another and did all the unruly things that boys do. She persisted and because she got one rebuff she was not cast down. After the flowers had been passed around and examined; the pistil and stamens were found she collected them and said we will put them in a glass of water and see how long they will last. You will say it was a failure and humanely speaking it was. In a few days she brought in an Hepatica, nothing could be so beautiful. She said to the boys: "We had such a good time the other day and you enjoyed it so much I am going to bring some more flowers into the room to talk about, and how far do you suppose I went to get them. I went out on the street car three miles and I had to walk all the way home, but I got the flowers. They thought that was a pretty good thing if she would do that. She showed them the exquisite beauty of the coloring of the flowers, the petals of it and they began to take a little more interest. Just a little interest was awakened, and before the month was over I was down in that vicinity one Saturday morning and met about one dozen of the boys. "Where are you going?" I said. "Going up to Hepatica hill after some flowers, teacher wants 'em for Monday morning. We are going to have another lesson and we have got to have some flowers." Whenever she wants any flowers, she says to the boys, "We want some flowers Monday, and its 'sure we will.' "

The love of the beautiful that the teacher will get into their eyes and their souls better than anything they ever knew before will save them from sin some day. I believe it, just as much as I believe that I am here talking tonight.

(Showing of drawings in the higher grades.)

We work in industrial lines along with the beautiful. It is very simple work to do that, of course everything is from life. They don't take a picture and copy it, they are not allowed to do so. In springtime we always have a great planting time. We plant seeds in boxes in the school rooms, and also give the children some to take home, that gives them the sense of proprietorship which is so pleasing to us all.

O, blessed be the love of nature. I never in all my life saw a child, a man, a boy, a girl, or a woman who got any nearer to nature's heart who was not refined by that nature and made the neater, sweeter, cleaner, better by it. Blessed be the noble impulse going all over this broad land raising up the love of the beautiful.

Then I say, that if in the care of these children we can put a little more into their lives of the love of the beautiful, of the high, of the lovely, then shall we be the most pleasing in the sight of Him who said, "Inasmuch as ye did it unto one of the least of these, my little ones, ye have done it unto me."

BIOGRAPHICAL.

Died in Turner, January 19, 1898, David J. Briggs, aged 70 years and 11 months.

The subject of this notice was a prominent citizen of his town and a man well known in agricultural circles throughout the State. Always a farmer, and recognized as one of the best among us, he possessed a fine farm which he had brought up to high state of productiveness and on which he built a fine stand of large and commodious buildings and furnished them with every outfit needed for comfort and convenience. He was endowed with a rare good judgment which applied with a steady purpose to his business worked out for him the rich reward he had drawn around him.

Mr. Briggs had long been interested in and actively connected with public agricultural affairs. He was an early and active member of his county agricultural society and a regular attendant upon its exhibitions. For several years he served his county on the State Board of Agriculture and was a regular attendant on the State dairy conventions. His last appearance at a public farmers' gathering was at the dairymen's meeting at Bangor but a few days before he was prostrated with what proved to be his final sickness.

In his earlier years Mr. Briggs gave a measure of his attention to the business of lumbering. On giving undivided attention to his farm one of the first moves made was to set out an orchard. Like his general farming, from the time the trees were set until the labors of the hand that planted them had been completed these trees received all the attention their thrift and productiveness called for. Interest in the growing of fruit directed his attention to our Pomological Society and he became a member in the early years of its existence and was a regular attendant upon our exhibitions and our conventions to the last. He possessed a receptive mind and was with us to learn.

With the allotted span of three score years and ten more than covered, he closed a life of activity and usefulness, and we who knew him longest and best could truly say that a good, a true, a successful man has gone to his reward.

Z. A. GILBERT.

William R. Wharff, son of Joseph Wharff, Jr., and Phoebe (Webber) Wharff, was born in Litchfield, Maine, February 18, 1817. He married Mary Elizabeth Williams of that town and followed the trade of a blacksmith there for several years. About 1850 he moved to Gardiner where he continued his trade of blacksmith, and was also much interested in the cultivation of small fruit and had a fine orchard of choice trees. Mr. Wharff was a member of the Maine State Pomological Society. He was one of Gardiner's most respected citizens and died there December 18, 1897.

O. B. CLASON.

Billings H. Ridley, oldest child of Jonathan and Louisa (Marston) Ridley, was born in Lexington, Maine, May 9, 1826. The family moved to East Livermore when he was a small boy, and to Jay when he was fourteen. He lived at home till he was sixteen when he bought his time of his father but continued to work at home and in adjoining towns for two or three years, then went to Newton Upper Falls, Mass., to work in the cotton mill, from there to Clinton. His first savings were sent home to buy a farm joining his father's because he thought it was "good orchard land."

When at work in the mill in Clinton he bought land and used all his spare moments in raising vegetables and fruit trees. In the spring of 1852 went to California where, after recovering from a ninety day siege of acclimating fever, he engaged in mining, gardening and fruit raising. Came home in the summer of 1857, being one of the few passengers saved from the

Central America. He built a commodious house on land which he had bought joining the home farm which he received for caring for his father and mother in their last days. December, 2, 1858, married Mray S. Dickey of Manchester, N. H. Seven children were born to them, the third, a son, was born and died while he was in the army. The others, threee daughters and three sons are living; the youngest, Johnathan Dickey Ridley, on the home place where the many thrifty fruit trees set by his father will help to keep his memory green. The most of his trees he raised from seed sown, transplanted and grafted by himself, but bought some new varieties of tree agents every year since they began to infest the country. A life of toil and hardships met with cheerfulness and courage, and many months of severe suffering, borne with uncomplaining fortitude, often telling his family "Whatever is, is right," ended August 26, 1897.

M. L. B. PURINGTON.

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A GENERAL INDEX TO THE SUBJECTS IN THE VOLUMES OF THE AGRICULTURE OF MAINE, FROM 1850 TO 1897, INCLUSIVE.

Note.—The volumes are numbered by years and where a reference is given as "1874, Ab., 127," the Abstract or second part of the volume, is to be understood.

The abbreviation "Sta." signifies the Experiment Station Report; the abbreviation "Pom." the Pomological Report; and the abbreviation "App.," appendix.