Public Documents of Maine:

BEING THE

ANNUAL REPORTS

OF THE VARIOUS

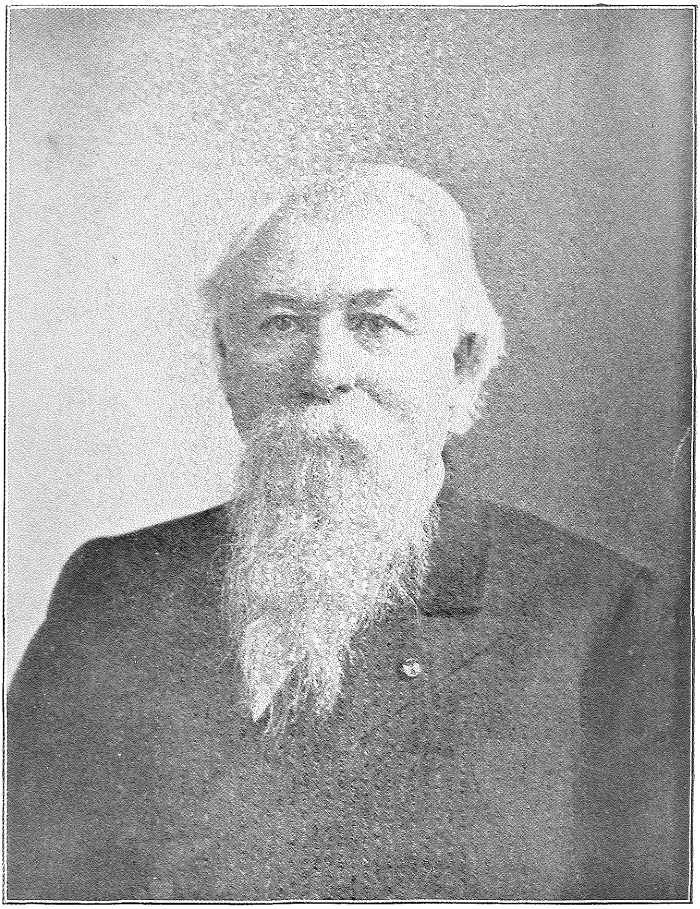
Departments and Institutions

FOR THE YEAR

1899.

VOLUME I.

AUGUSTA
KENNEBEC JOURNAL PRINT
1900



JEREMIAH M. RUSK,
First Secretary of Agriculture, 1889-1893.

AGRICULTURE OF MAINE.

FORTY-SECOND ANNUAL REPORT

OF THE

SECRETARY

OF THE

BOARD OF AGRICULTURE

FOR THE YEAR

1898.

PRINTED BY ORDER OF THE LEGISLATURE.

AUGUSTA
KENNEBEC JOURNAL PRINT
1899

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 1898.

B. WALKER McKEEN, *Secretary.*

AUGUSTA, May 1, 1899.

MAINE BOARD OF AGRICULTURE—1898.

OFFICERS.

W. H. MOODY, President.
E. E. LIGHT, Vice President.
B. WALKER McKEEN, Secretary.

Members Chosen by Agricultural Societies.

Term expires third Wednesday 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 "	F. H. Rollins,	Chesterville,	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.

MAINE BOARD OF AGRICULTURE—1899.

OFFICERS.

E. E. LIGHT, President.
JOHN M. WINSLOW, Vice President.
B. WALKER McKEEN, Secretary.

Members Chosen by Agricultural Societies.

Term expires third Wednesday in January.

Cumberland County,	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 "	F. H. Rollins,	Chesterville,	1901
Knox "	E. E. Light,	Union,	1901
Penobscot "	George N. Holland,	Hampden,	1901
Piscataquis "	W. H. Snow,	Milo,	1901
Androscoggin "	B. F. Briggs,	Auburn,	1902
Kennebec "	A. N. Douglass,	Chelsea,	1902
Waldo "	Joseph Ellis,	Brooks,	1902
Washington "	E. F. Allen,	Columbia Falls,	1902
Lincoln "	John M. Winslow,	Nobleboro,	1902

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.

ANNUAL MEETING, 1899.

The annual meeting of the Maine Board of Agriculture was held at the rooms of the Board, State House, Augusta, January 18 and 19, 1899.

WEDNESDAY, JANUARY 18—FORENOON.

Meeting called to order by E. E. Light of Union, vice president. Committee on credentials, appointed by the Chair, L. O. Straw of York county, S. H. Goodwin of Somerset county, and Jonathan Benn of Aroostook county.

Dr. A. W. HARRIS—Mr. President: This morning is taking place the funeral of one of the most distinguished men of Maine, the Hon. Nelson Dingley, who needs no eulogy, and it seemed to me that it would be appropriate that we should adjourn until the time set for the afternoon meeting. I therefore move that we do now adjourn.

Adjourned to 2 o'clock P. M.

AFTERNOON.

Met according to adjournment.

The committee on credentials reported John M. Winslow of Lincoln county, B. F. Briggs of Androscoggin county, E. F. Allen of Washington county and Joseph Ellis of Waldo county duly elected members of the Board of Agriculture for the constitutional term of three years from January, 1899, and Geo. N. Holland of Penobscot county and F. H. Rollins of Franklin county for the constitutional term of three years from January, 1898. This committee also reported that the election of A. N. Douglass of Kennebec county was illegal, and he was therefore not a members of the Board. This report was accepted.

Officers were elected as follows: President, E. E. Light, Union; vice president, John M. Winslow, Nobleboro; executive committee, E. E. Light, John M. Winslow and John F. Talbot; member of advisory council of the Experiment Station, B. Walker McKeen.

A committee of three on pay roll was appointed as follows: John J. Frye of Cumberland county, John F. Talbot of Oxford county, and W. H. Snow of Piscataquis county.

REPORT OF THE SECRETARY.

Mr. President; Members of the Board of Agriculture:

In making my report of the work of the Board for the year 1898 I have to say that there have been no very marked changes in any direction. The same conditions which confronted the farmers of Maine one year ago appear to exist very generally to-day, although there have been various slight changes in certain directions, and mostly along lines of improvement. I believe the farmers of our State are turning their attention more than ever before to the production of many of the articles which they need for home consumption, which have formerly been purchased in the markets. The tendency of the markets on nearly all of these articles is somewhat in an upward direction, and will probably continue so for some time to come. It is well, therefore, that the attention of the farmers and of this Board should be turned continually toward solving, as far as possible, the problem of making the farms of Maine self-supporting. With the varied productions which grow to advantage from our Maine soil and the ready demand in our markets for them all, there may be a noted gain in cash receipts as well as a lessening of the expenditures in work along this line. We have to reiterate our statement made one year ago, that the true elements of success upon Maine farms are self-supporting crops and carefully husbanded fertility. At the same time we should never let an opportunity pass for extending the amount and number of our cash products, always striving to put as much of skill and thought into these products as possible, to the end that they may represent the highest possible price in the markets together with the lowest cost of production in plant food and labor. Skill pays to-day better than anything else, upon our farms as truly as in the workshop or manufactory.

The crops of our State for 1898, with the exception of apples, were again abundant. Never before in the history of our State has such an abundant and valuable crop of hay been harvested as during the past season. This hay is, as a rule, being fed advantageously to the various classes of farm animals for which there is a quick demand in our markets at paying prices. The only regret is that in some sections of our State there is not a sufficient quantity of live stock for properly disposing of this abundance of fodder. It is to be hoped, however, that these farmers, as far as they possibly can, will carry over their hay and other fodder crops for another year, looking for either a higher price in the markets or for a larger amount of live stock to consume them. It appears to me that the work of this Board should be intensified along lines of live stock production. Successful agriculture in Maine to-day depends upon some system of live stock husbandry. As the number and value of our farm animals increase, so must the prosperity of our farms increase.

According to the report from our special correspondents from all sections of the State the apple crop for 1898 was fifty-three per cent of an average crop. I think this report is fairly correct, as I have inquired somewhat extensively as to the amount of apples shipped from various stations. It was a peculiar fact, however, that in many of the larger fruit growing sections of the State the crop was almost an entire failure, while in other sections where but little fruit had been placed upon the market in previous years, quite large quantities were shipped. One dealer in York county told me that he started out to buy one car-load of apples, thinking that would be all that he could find, and at that time he had already purchased six car-loads and there were many more in sight. This abundance of fruit in the northern, southern and coast sections of our State helped to bring the average up to where it was reported, Aroostook county shipping out a very large quantity of apples, all of which sold for high prices. The amount of money brought upon our

Maine farms for the apple crop of 1898 is no small sum, and represents quite a proportion of the available resources of many of our farm homes.

Better prices have been maintained for Maine potatoes than for many years in the past, and with the large quantity which our farmers have had to sell this crop has also been a means of increasing their revenue materially.

NEW AVENUES OF TRADE.

The efforts of Secretary Wilson to extend the sale of our dairy goods abroad have been continued, and, as far as I am able to judge from various reports, have been a decided success. Much experimental work has been done, and the results appear to indicate that the butter from many of the dairies of our country may finally find a market abroad. Much interest appears to have been awakened in Aroostook county in the production of wheat to manufacture into flour. Two large, well equipped flouring mills have been started in the county during the past year, and the farmers are generally patronizing them to such an extent that they will be practically independent of the outside markets for their flour. The wheat crop of the county was hardly up to an average in amount or quality, but with the new and improved methods of manufacturing it has turned out a large quantity of valuable flour. I remember to have been somewhat severely criticised several years ago for prophesying that the time would soon come when we should find Aroostook flour upon our markets, but I believe that it is growing nearer every day, and that Aroostook county is capable of growing wheat in sufficient quantities to bread the entire State.

I am quite sure there is a legitimate work for this Board along lines of developing markets for the products of our Maine farms. While we have been continually working to increase the amount of the productions of our farms and to put these productions upon the markets of the world at a less expense, we have somewhat neglected the cultivation of these markets. A successful farmer should know how, where and when to sell his products, as well as how to raise them to the best advantage. I believe that some united effort along this line may be productive of much good, and would recommend it for the consideration of the Board. It may take the course of co-operative selling, or it may be developed by efforts to call the attention of the consumers to the amount and quality of our products. If it were possible to establish some central shipping point or trade center for our various products, where they might be collected and where the attention of the buyer could be called to them to good advantage, I am very sure it would prove a very valuable factor in their sale. It is possible, also, that there may be new lines along which we can reach the markets, either with our products put up in uniform and attractive styles and under a central supervision, or by the creation of some new form which will command attention in and of itself.

OUR LIVE STOCK.

We are able to report an encouraging increase in the number and value of our farm animals. I am informed by the State assessors that the value of these animals, as returned by the local assessors, has been materially increased in the returns for 1898. I also quote from the commissioner of industrial and labor statistics some compilations of the numbers of farm animals as taken by him from the reports of the State valuation commissioners and the board of State assessors, for most of the years since 1879.

In looking over these tables in a general way, we find that we have 3,562 less cows in 1898 than we had in 1879. We also find there was a gradual decrease in the number of cows from 1879 to 1892, and from 1892 to 1896 there was a gradual increase amounting to 7,050. This period, I believe, was at the time of the greatest depression in the sheep industry, and when so many of our farmers were dropping out of the beef breeds of cattle. From 1896 to 1898 there has been a decrease of 8,600.

The commissioner further says: "By adding the number of young cattle, one, two, and three years old in the above table we find the totals for the different years as follows:

1879	147,716
1889	130,229
1892	111,992

1893	114,220
1894	93,309
1895	85,430
1896	92,705
1897	102,304
1898	109,517

It will be noted that the decrease in this class of animals during the ten years from 1879 to 1889 was 17,487, and from 1889 to 1892, it was 18,237, or 35,724 in thirteen years. During the next year, from 1892 to 1893, there was a gain of 2,228, but the two years following show a further decrease of 28,790. The increase since 1895 has been 24,087." It will also be noted that the gain from 1897 to 1898 is 7,213 or about six per cent. This increase in the young stock of our State is a matter for congratulation. I presume it is fair to conclude that far more than half of this number are females, which will materially increase the number of our cow population. It is also probable that there are many of these two-year-olds and three-year-olds now among our dairy herds, which are not included in the statement of the town assessors.

OUR DAIRY INTERESTS.

There has been a marked increase in the attention which the farmers of our State have given this important industry during the past year. It is but seldom that an institute is arranged without a request from some party who is interested, that the matter of dairying shall form an important part of the program. We have not called any speakers from outside of the State to speak directly upon this topic, except at the dairy meeting. But our local speakers have treated the matter at some length in nearly every one of the forty-seven institutes held. I believe that there is still work that should be done along this line. I am aware of the necessity for laying much stress upon the improvement of the quality of our dairy goods. I believe that an active campaign of education is necessary, but it should include the creamery men of the State as well as the farmers. It is of the greatest importance to this industry that all hygienic conditions are observed, not alone in the handling of the animals but in the handling of their product all the way from the farm to the consumer's table. I believe it would be a very great step in advance if the creamery men in our State would unite in demanding that all cream purchased by them should come into their possession perfectly sweet, to the end that it may be ripened uniformly, and thereby materially raise the average quality of their output. I am firm in my opinion that all of the more intelligent and progressive of our farmers would gladly conform to such rules, and I know it would tend to remove an element of unfair competition which they will be obliged to suffer from careless and indifferent men as long as the present loose methods continue.

I also believe that continued effort is necessary to increase the output of our dairies; because, before any community or state can become known as a producer of any article it is necessary that enough of that article shall be in sight at one time to command the attention of the market. It is an undisputed fact that there are but very few months in the year when Maine is not an importer of butter. As long as this fact remains, we cannot hope to cut much of a figure in the market centers of New England, but must expect that our butter will occupy an unsatisfactory position in these markets.

It is also true that our cow population is not dense enough to allow of the most economical production of dairy goods. The greatest drawback to economical work in many of our creameries to-day, is that they are not handling cream enough to work to advantage. In some sections the cream gatherers from several creameries travel over the same routes, thus adding unnecessary expense to the work. In other sections they pass more farms where cows are not kept than where they are kept, showing a lack of confidence in the business. As these gaps become filled, as this duplication of cream gatherers is stopped, we shall be able to secure a larger profit from our creamery work and to place it upon a better basis.

I note with pleasure the increased interest in dairying which has led to the formation of a State Dairy Association, made up of the best and most progressive farmers of our State, for the purpose of working, as I understand it, along the lines named above. It should certainly be the object of the Board, as it is my personal desire, to co-operate with this association by every means in our power. I am quite firm in my opinion, however, that it would be a detriment to this important industry to have any division of interests. It seems to me that the Board of Agriculture is the proper institution to have general supervision of the work, and that all money appropriated by the State for work in this direction should be paid out under the direct supervision of an official of the State. I base my opinion somewhat upon observation and information which I have been able to obtain of the results of these divided interests in other states.

STATE DAIRY CONFERENCE.

The matter of a possible interstate dairy conference for 1898 was discussed at some length by the members of this Board and others at the dairy meeting held in Bangor in 1897, and the idea of holding such a meeting, where butter from the various New England States should appear without distinguishing marks and be scored at the same time and place by the same expert, was first set in motion there. At the last annual meeting of the Board, as will be remembered by the members who were present, the matter was more fully discussed and finally left in the hands of the secretary and executive committee. After consultation with the secretaries of the various New England boards it became evident that an interstate meeting in the strict sense of the term would not be practicable at this time, and it was finally decided that it would be feasible to invite dairymen from the other New England States to participate with us in our exhibition. A rule was established that all butter to be scored should appear in uniform ten pound tubs without distinguishing mark or label, and that each exhibitor should contribute his tub of butter as a fund to be distributed in the pro rata prizes. Exhibitors from nearly all of the states responded quite liberally to this invitation, and it resulted in a very large exhibition of butter. It was a matter of some regret that the creameries of our own State did not respond more liberally, but our dairymen came out in good numbers. In this exhibit there were twenty-seven tubs from Maine, fourteen from New Hampshire, twenty from Vermont and five from Massachusetts. The highest score for creamery butter went to Deerfoot Farm at Southboro, Mass., and was for butter made from pasteurized cream. The highest score for dairy butter went to Mr. A. J. Abbott of North Paris, in this State. The highest creamery score was ninety-seven and one-half. The highest dairy score was ninety-six and three-fourths. It may be well to add that the butter was scored entirely by numbers, without being divided into creamery and dairy classes, so that at no time could the judge tell whether the tub of butter he was at work upon came from a private dairy or from a creamery. The result of this meeting appeared to be such as to warrant a continuance of the same method. A new departure was made in this conference by the addition of a department for dressed poultry, eggs and general poultry supplies. While this exhibit was not large, it was of a superb character, and attracted that degree of interest which would appear to warrant its continuance in future meetings.

HEALTHFULNESS.

It is gratifying to note that the healthfulness of our Maine herds has been fully maintained during the year just past. This question is largely becoming an economical one, and along this line the farmer should be ever alive to his own best interests. No herd can be a valuable or profitable one unless it is maintained in a condition of health; and no herd can remain healthful unless the proper precautions are taken to maintain good sanitary conditions around them. I would call the attention of the Board to the admirable lecture delivered at our State Dairy Conference by Dr. Theobald Smith on "Sanitary Aspects of Dairying." Dr. Smith is the acknowledged authority of America on these matters, and his remarks have great weight with scientific men of all classes. It is very gratifying to me, and should be, I believe, a matter of just pride for the Board to know that all of those who are at present giving the matter of contagious and infectious diseases the most study appear to be coming nearer all the while in their ideas, to the position taken by this Board two years ago, and which it has maintained during all of the agitation in relation to the possible dangers of these diseases. It will be noted that Dr. Smith makes the statement in his lecture that the dangers from these diseases have been very much over-estimated, that nine-tenths of all the writings in relation to them have been pure guess work. I know that his views are shared by many of the medical fraternity of our own State, as well as of the entire country. I am firm in my opinion that the tuberculin test as at present managed in our State is a detriment to the best interests of our live stock industry, and am not sure but that some legislation in relation to it similar to that in Massachusetts, which prohibits its use except on the written consent of the owner or person having the charge of animals or upon animals which have been condemned as tuberculous upon physical examination, would be wise.

EXECUTIVE COMMITTEE.

The executive committee has been called together but once during the year, but has been frequently consulted personally and by letter, and has rendered efficient service, particularly in arranging for the evening meeting at the State Fair and for the State Dairy Meeting at Portland.

REPORTS.

The reports of this Board for several years have become quite rare, and we are having frequent applications for copies of back numbers, many of which we are unable to fill. As the years pass there appears to be an increased demand for these reports, and I believe that it would be well for the members to take measures to secure as many of these back numbers in their respective counties as they possibly can. The numbers that are particularly lacking in this office are for the years 1891, 1893 and 1895. The reports for the years 1861 and 1862 which contain the scientific survey of the State are very valuable numbers, and we have only one of each in the office. If by any possible means extra copies for these years can be secured, they will make a valuable addition to the list, and will enable us to assist parties who are interested in agriculture in completing sets.

SEED AND FEED INSPECTION.

The laws governing the inspection of feeds, and calling for a guaranteed statement as to the percentage of purity in seeds have come to be very generally observed. These laws have gone into effect without any friction whatever, and although experimental at the start have become a necessity to our people, the dealers apparently vying with the consumers in insisting upon having their goods properly guaranteed. Laws very similar to ours have recently been enacted in the state of Vermont, and various other states are moving in the same direction. An amendment to the seed law, calling for the naming of the foreign seeds, was discussed by the Board at the dairy meeting and finally placed in the hands of a committee, with instructions to prepare a draft and present it to the legislature at the earliest possible moment. In accordance with this action, the committee selected met in this office on Tuesday, January 3, and, after consulting counsel, drafted the proposed amendment, which has been presented by Mr. Farnsworth, a member of this Board, and is now before the committee on agriculture.

PURE FOODS.

There has been a constant move along the line of laws relating to pure foods, and the Board will be called upon at this time to act upon a proposed bill relating to the adulteration and misbranding of foods. The State Board of Health has been consulted by your committee, and has given the proposed movement its endorsement. I trust that something may be done along this line, as I regard it necessary for the proper protection of producer and consumer.

CROP BULLETINS.

The publication of the crop bulletins has been continued during the year with increasing interest. Our list now numbers about 7,500, and is continually increasing. Our correspondents in various sections of the State have responded freely to requests for crop reports and for remarks upon the many questions relating to our agriculture. I believe that this is one of the most effective branches of our work.

CATALOGUE OF THE WORK OF THE EXPERIMENT STATIONS.

The catalogue from the office of the experiment stations at Washington has been continued during the year, cards covering additional work reaching this office every month. We now have nearly 60,000 cards, covering all of the work of the various experiment stations of the country, which have been placed in our cabinet, and as we have nearly all of these bulletins, they form a valuable adjunct to the office.

INSTITUTES.

I wish to again acknowledge the faithful and efficient work of the members in arranging the details and carrying out the institutes in their various counties. I believe I can truly say that, generally speaking, the interest in these meetings has been fully maintained. A two days' meeting was held in June in Hancock County, in which dairy subjects, chiefly, were considered. This meeting was fully attended, and was very successful. Quite a number of evening meetings have been held in connection with these institutes, one or more of the regular speakers going to some near-by place for an evening meeting, and the regular evening meeting being held at the institute. I believe that this work should be continued and increased, and would like the co-operation of the members in an effort to so divide our institute speakers that we may have several meetings going on at the same time, to the end that more meetings may be held throughout the State.

We continue the permanent record of these meetings and their cost, and invite the attention of the members to this record, as well as to the 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, 1898, to the third Wednesday in January, 1899.

The appropriation for farmers' institutes has been expended, with the exception of a balance which is left over for the payment of institutes held in Sagadahoc County since January 1st, and also for one or more meetings which may be held in Knox County at some later date, as may be arranged by the member for that county.

Forty-seven institutes have been held as follows:

Winthrop, Casco, Waterford, South Paris, Peru, Cooper's Mills, Branch Mills, Warren, Yarmouth, Danville Junction, Greene, East Livermore, Corinna, Chester, Mattawamkeag, Princeton, Baring, West Pembroke, East Machias, Cherryfield, North Bluehill, Riverside, Windsor, Pittston, South Jefferson, Damariscotta Mills, Castle Hill, Caribou, Bridgewater, Smyrna Mills, Island Falls, Houlton, Thorndike, Waldo, Saco, Newfield, Cornish, North Jay, New Sharon, West Mills, North Anson, Pittsfield, Foxcroft, South Sangerville, Brownville, Brunswick and Bowdoinham; also an evening meeting at the State Fair, Lewiston, and State Dairy Meeting at Portland. In addition to these meetings three evening meetings have been held, and twenty testing meetings.

The average cost of the institutes, including the evening meetings held in connection with them, is $22.74. The average cost of the testing meetings, $5.55. Cost of the dairy meeting, $773.97.

PROSECUTIONS FOR THE ILLEGAL SALE OF OLEOMARGARINE.

On January 27th we received a letter from Mr. George M. Whitaker of Boston, acting executive officer of the Massachusetts Dairy Bureau, informing us that eight ten-pound tubs of oleomargarine had recently gone through that city, marked for Lewiston, Maine. Deeming it a matter of great importance to the dairy interests of our State, we immediately employed a detective and were able, at a later date, to secure two indictments in Franklin County. One of the parties indicted immediately plead guilty and paid the fine and costs. The other party filed a demurrer to the indictment, and the matter is now pending in the law court. It is the judgment of the county attorney, however, that this action was simply for the purpose of obtaining delay and that the fine will ultimately be paid.

The expense of these prosecutions amounted to $78.20, for detective work, and under our law, which gives one-third of the fine to the complainant, we are entitled to recover $66.66 from the two indictments. Half of this, or the amount of the indictment to which the party plead guilty, has been paid. The other will be paid as soon as the matter is finally adjusted.

CORRESPONDENCE.

The correspondence of the office is continually increasing, many people writing for information on various matters; and it is our purpose to answer all of these letters of whatever nature at the earliest possible opportunity. A copy of all letters written has been kept, and they are fully indexed. This correspondence, of course, is entirely exclusive of that in connection with the bulletins, which of itself calls for the stamping, filling and directing of about 9,000 envelopes each month.

AGRICULTURAL SOCIETIES.

The year has been one of more than average prosperity for the most of our agricultural societies. The weather, as a rule, was favorable, and the increased interest which manifested itself in 1897 was fully maintained during the fair season of 1898. There appears to be a genuine desire on the part of the officers of our societies to fully comply with the State law regarding gambling and games of chance. As far as I was able to learn from personal observation and from other people, I believe that the county fairs of 1898 were particularly clean in every respect. Of course objectionable features will occasionally work themselves into fairs, no matter how vigilant the officers may be, but no intentional violation of the law has come to my notice during the past year. I wish to again repeat that those societies which stick the most closely to the real intent of an agricultural society, are, as a rule, the most successful. I believe it is well for the members of this Board to keep as closely in touch with the agricultural societies of their counties as they possibly can, and am inclined to the opinion that more time might be spent by them to good advantage in inspecting the fairs and the general management of these societies.

I append a summary of the business of the societies.

Number of horses and colts exhibited	1,390
Number of neat cattle exhibited	6,283
Number of sheep exhibited	1,532
Number of swine exhibited	580
Number of poultry (coops) exhibited	1,434

ANALYSIS OF AWARDS.

Total amount of premiums and gratuities paid	$17,257 71
Amount of trotting purses	19,714 75
Amount of entry fees for trotting purses	7,818 19

Actual cost of trotting purses....................	11,896 56
Per cent of premiums and gratuities to total awards,	46
Per cent of entry fees..........................	39
Per cent of stipend.............................	38.3
Per cent of increase in awards..................	4
Number of societies receiving stipend............	43
Decrease from 1897............................	2

THE PRESS.

The Board is still under great obligations to the press for extended notices of our meetings, for general coöperation 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 New York Produce Review and American Creamery, as well as several local papers, come regularly to the office and are kept on file for reference.

FARM PROSPERITY.

The study into the condition of our farmers begun in 1896 has been continued, and it is a pleasure to again note that there appears to be a continuance of prosperity. I am firmly of the opinion that the farmers of our State, as a rule, are prosperous. Certainly there have not been, since I have begun to observe conditions, so many visible evidences of wealth upon our farms and in our farm homes as there are to-day, and believing, as I do, that our farmers as a rule are not improvident but are economical and are living strictly within their means, it must necessarily follow that they are prosperous.

Respectfully submitted,

B. WALKER McKEEN,

Secretary.

This report was referred to a committee of three, appointed by the Chair, as follows: Nahum Hinckley, T. E. Skolfield, Joseph Ellis.

REPORT OF THE EXECUTIVE COMMITTEE.

It was planned for the executive committee to meet at Lewiston during the State Fair, but on account of the rush of work there it was suggested by the President of the Board, Mr. Moody, that the meeting be deferred until a later date, and that it be held in Portland in connection with the member from Cumberland County.

A meeting of the committee was called to be held in Portland Monday, October 24th. Mr. Moody and Sec. McKeen were the only members of the committee present. Met in consultation with Mr. J. J. Frye, the member of the Board from Cumberland County. Matters relating to the dairy conference were fully discussed, and steps were taken in relation to securing hall, hotel rates, music, etc. The opinion was expressed at this time that the general details of the meeting should be left in the hands of the member from Cumberland County.

W. H. MOODY.
E. E. LIGHT.
W. G. HUNTON.
B. WALKER McKEEN.

This report was accepted and placed on file.

REPORT OF THE LEGISLATIVE COMMITTEE.

At a meeting of the legislative committee of the Board, held in the office of the Board, Tuesday, January 3,—present, Mr. Farnsworth, Mr. Talbot, Mr. Winslow and Prof. Woods,—Mr. Farnsworth was appointed chairman and Mr. McKeen secretary.

On motion by Mr. Winslow, the following amendment to the seed law, which was adopted by the Board at the Portland meeting, was placed in Mr. Farnsworth's hands, to be presented to the legislature at the earliest possible moment:

"Section one of chapter three hundred and thirteen of Public Laws for eighteen hundred and ninety-seven is hereby amended by striking out the words "freedom from foreign matter" and inserting the words 'the percentage of inert matter and the names of all noxious weed seeds,' so that said section when amended shall read as follows:

"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, the percentage of inert matter and the names of all noxious weed seeds; provided, that mixtures may be sold as such when the percentages of the various constituents are stated."

The above amendment was introduced into the House by Mr. Farnsworth, referred to the committee on agriculture, and there will be a public hearing in the rooms of the Board, January 25th.

On motion by Mr. Winslow, voted, that it is recommended to the Board that they obtain legislation whereby the feeding stuff law shall be amended as follows:

Section 2, the last sentence, which reads: "Neither shall it include wheat, rye and buckwheat brans or middlings, not mixed with other substances, but sold separately as distant articles of commerce, nor pure grains ground together," shall be striken out, so that the section as amended shall read as follows: 'The term concentrated commercial feeding stuff, as here used, shall not include hays and straws, the whole seeds nor the unmixed meals made directly from the entire grains of wheat, rye, barley, oats, Indian corn, buckwheat, and broom corn.'

And in section 8 the following clauses shall be striken out:

"But is shall be the duty of said secretary, upon thus ascertaining any violation of this act, to forthwith notify the manufacturer, importer or dealer in writing, and give him not less than thirty days thereafter in which to comply with the requirements of this act, but there shall be no prosecution in relation to the quality of any concentrated commercial feeding stuff if the same shall be found substantially equivalent to the certified statement named in section four of this act," so that the section as amended shall read: 'Whenever the director 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.'

Adjourned to Tuesday, January 17, at 2 o'clock P. M.

Tuesday, January 17. Committee met according to adjournment.

The attention of the committee was called by several different persons to the need of legislative action on the suppression of injurious insects and dangerous weeds. This subject was discussed by your committee, and while they have no definite recommendations to make in the way of legislation, they believe the matter to be of great importance, and one to which the Board should give careful consideration.

On motion by Mr. Winslow, the committee voted to present a pure food bill, as previously outlined by them, and recommend that the Board adopt it and ask the legislature to enact it.

As Prof. Woods is to present a paper before the Board this evening on "The Adulteration of Foods," the committee will hold, unless the Board wishes otherwise, the text of the proposed law until the Thursday morning meeting of the Board.

Respectfully submitted,

A. S. FARNSWORTH,
JOHN F. TALBOT,
JOHN M. WINSLOW,
Committee.

On motion by Mr. Holland, voted, that that part of the report of the legislative committee which refers to pure food be laid upon the table until Thursday morning.

On motion by Mr. Skolfield, voted, that the report of the committee relating to the proposed amendment to the law regulating the sale of agricultural seeds be accepted.

Mr. SKOLFIELD—I move that the report of the committee in regard to the feeding stuff law be accepted.

Mr. TALBOT—I would like very much to have Prof. Woods state to the Board the reasons for presenting the amendments to this law.

Prof. WOODS—Mr. President: When the feeding stuff law was passed two years ago wheat bran and middlings, buckwheat bran and middlings, and rye bran and middlings were omitted from its provisions. They are the only offals that are sold in the State for feeding stuffs that are not included under the feeding stuff inspection law. These were omitted for two reasons: We did not have very much data in regard to the way in which these goods were running, and the law being so new it was feared that it would be difficult to extend its provisions to this particular class of refuse products. As a part of the work of the Experiment Station investigation, I asked the feeding stuff inspectors last spring, and again in November, to collect samples of all the brans and middlings which bore distinctive names, and the results of the analyses of these samples were put into a bulletin which was issued in December and has just been mailed. We examined 150 samples of these wheat offals, which were probably the best of these goods being sold in the State, as we did not take any samples of goods that were not branded. Goods upon which the men were ashamed to put their names were omitted. We determined only the per cent of protein in most of the samples, and the protein is all that we have returned, because protein and mineral matter are the chief substances for which brans are purchased. We buy bran to get phosphoric acid to build up the bone and for the nitrogenous constituents which it carries. If you will turn to page 7 of the bulletin, you will notice that these are graded simply in accordance with their distinctive brands. For instance, there is a Stott's Bran which runs from 14.6 to 15.1, according to the four samples examined. The Pillsbury Bran runs from 15.1 to 15.9, and Stock's from 14.8 to 15.4. You will see that the brans from one distinct mill seem to run pretty uniform in their composition. There were nine samples of bran that were labelled winter wheat that ran from 13.6 to 15.7; and there were 42 samples of bran which were not marked winter wheat brans, running from 13.9 to 17.9, a variation of four per cent. The point is this: When you and I go to buy bran we cannot tell what we shall get unless we know the particular brand. It would not be any particular hardship for Mr. Stock to say how much protein his goods are carrying, because the individual brands are running uniform, as these analyses show. The samples were taken from different lots, one in the late winter of 1898 and one in the fall. This shows that brans from the same mills are running quite uniform, but there is quite a difference between the brans from different mills. The mixed feeds, so called, we found to be practically all good grade brans. That is about all that mixed feed seems to mean at the present time. Whether it means a mixture of spring and winter wheat, I do not know, but in most instances the mixed feeds are bran of pretty good composition. These run a little higher in protein for the most part, than the brans, so called.

Mr. LIGHT—Do you know how the prices run?

Prof. WOODS—There is no relation between price and composition. These samples were taken from all over the State, and the price in one place would differ from that in another place, so that I could not answer that question satisfactorily.

We found middlings to be a very deceptive class of goods. I would like to have you notice, in the next to the bottom group on page 7, that there are 26 samples of middlings, which run from 12.4 to 21.5, as bad a case as we found in any cottonseed meals which we were talking about two years ago. One feed may be nearly twice as good as another feed, and there is no relation between the price asked and this difference in composition. Anything that may be swept into a bag, from the lowest grade up to a feed that is as good as the very best of feed flours, seems to be classed under the head of middlings. When I was talking to the Board at Portland, I had examined only the brans, and it seemed to me that a variation of 25 per cent was not a particularly serious matter. But I see no other way, in order to protect ourselves and the dealers as well, than to include all these goods under the law.

Perhaps you did not get the force of the law from the reading. When we passed this concentrated commercial feeding stuff law there were two sections, one of which named the things that should be exempt from the law, and the other named some of the things which should be included in the law, and then said, all others not named in section 2, among the things exempt. It is this paragraph, "neither shall it include wheat, rye and buckwheat brans or middlings, etc.," that in our judgment should be stricken out, and your committee recommend the Board to ask for legislation so that the law shall be changed in that particular.

Mr. LIGHT—Bran which contains from 15 to 16 per cent of protein is fairly good, is it not?

Prof. WOODS—The brans that we found in the State were fairly good, but there is a variation of about 25 per cent, from the lowest to the highest. If the lowest grade bran is worth 100, the best bran is worth 125. If there were a way in which we could strike middlings without striking brans it might be well, but I do not see any way in which you can draw the line between the two.

Mr. ELLIS—You mean that virtually there are no exceptions?

Prof. WOODS—All exceptions to be made are these: "The term concentrated feeding stuff, as here used, shall not include hays and straws, the whole seeds nor the unmixed meals made directly from the entire grains of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn."

Mr. SKOLFIELD—I find there is a general misunderstanding in regard to this law. The people think that these articles must be made right up to the standards, whereas they should simply print on the bag what is included.

Prof. WOODS—We have goods that are sold as low as 8 per cent, guaranteed, and other goods guaranteed as high as 48 per cent. I think it is pretty well understood by the manufacturers that they must fix their guarantee and live up to it, and the people will come to understand it. You cannot expect them to understand everything in two years. The way they have learned has been astonishing. When we were talking about the matter two years ago I did not believe that in ten years we would get to the point where we are now. People generally understand the law, and for the most part it is being well observed. I have had considerable to do with the men who are handling the goods, and have found no serious friction of any kind. The farmers seemed to understand the law very readily. The dealers were somewhat slow, but they are comprehending it now.

Ques. Do your agents, who have taken samples of these goods and observed the various amounts of different goods sold throughout the State, believe that this law is necessary,

Ans. I think they do. I do not see any other way in which you can know what your wheat offals are. If you ever went into a place where they were loading these goods, you have seen how they will sweep anything into a bag, and do not put their names on to it. These figures represent the best goods being sold in the State, and examined under the microscope we found only a small amount of oat hull. But if I had asked the inspectors to take samples of all brans I think we should have found brans loaded with those hulls. I have heard of goods of that kind, but we did not try to get samples of those. We tried to get samples of the reputable goods. In mill sweepings that are called brans we are liable now and then to get a sack of almost anything.

Ques. Would the saving in dollars and cents be as great as that on cottonseed?

Ans. It is difficult to answer that kind of a question. I do not see why it should not be. Of course the inspection is costing very little. That this law is being respected by some of the large houses, I know. In the feeding stuff bulletin which we have just printed, I quote from a letter which came to me from one of the largest manufacturers that are selling in this State, representing the largest syndicate on cottonseed. They sent a letter asking us to please ship to a mill town in Mississippi tags branded in a certain way as soon as we could. Very soon I received a telegram saying, "Do not send tags." In the letter which followed they said, "We thought such and such a mill was making high grade goods, but we find that the goods they are manufacturing are not up to the requirements of the law, so please do not ship the tags." If it had not been for our law we should have had the output of that West Point mill. I believe that it will work the same way in the case of brans, and I do not believe there are any greater hardships imposed on the manufacturers and dealers than in the case of the cottonseeds.

L. O. STRAW—You state that this gentleman said he could not send the goods because they were not up to the requirements. Does the law specify any limit?

Prof. WOODS—No; but that particular concern has been selling all of their goods on a guarantee of 43 per cent of protein and 9 per cent of fat, and they were not going to have goods come into the State under their name containing only 30 per cent of protein. If it had not been for our law they probably never would have made the discovery that the goods were of lower quality, and the goods would have come into the State.

J. M. WINSLOW—I was in a store in Wiscasset the other day, and found that an agent of F. W. Stock, who sells these goods, had been there and the dealer had told him that samples of these goods had been taken and sent to Orono. He was very much pleased, and was very anxious to get hold of one of the bulletins when printed, and wanted the dealer to make it a point to get one of these and see the quality of their goods. They are willing to stand behind them. You see that we must certainly get better goods in that way, when the wholesale dealers will talk to the retailers and refer them to the analyses of their goods.

E. E. LIGHT—This matter is covered in two sections, one in regard to striking out the part relating to bran and middlings, and the other relating to the duties of the secretary in regard to the enforcement of the law. Perhaps we had better dispose of the first section before discussing the other.

On motion, voted, to accept and adopt the recommendations of the committee on the section relating to brans and middlings.

Prof. WOODS—When our feeding stuff law was adopted last year we framed it along the line of our fertilizer law, in all its particulars. The section relating to the duty of prosecution read as follows: "Whenever the director 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; but it shall be the duty of said secretary, upon thus ascertaining any violation of this act, to forthwith notify the manufacturer, importer or dealer in writing, and give him not less than thirty days thereafter in which to comply with the requirements of this act, but there shall be no prosecution in relation to the quality of any concentrated commercial feeding stuff if the same shall be found substantially equivalent to the certified statement named in section four of this act." In the case of fertilizers, a company comes into the State, takes out a license and pays a license fee, and if they do not live up to the requirements of the law you can afford to give them the thirty days, because we discover the fact always weeks before, and frequently months before, these goods are actually offered for sale in the State. I then usually write them directly, and if they do not pay any attention to me I write to the secretary of the Board of Agriculture and he writes them a formal letter. With the feeding stuffs, it is not so. A man runs in a car-load of cottonseed meal, and before the thirty days are over, which is required for the notice, that cottonseed meal is fed out. When this law first went into effect it was well for a man to have this thirty days leeway in which to clear himself, but now it is in the way of bringing to terms a man who runs in only one car-load of cottonseed, etc., and it seems to me to be no longer desirable. And so, after consultation with the secretary, and with legal advice, your committee recommend that this be stricken out.

And as far as the part of the section which reads: "But there shall be no prosecution in relation to the quality of any concentrated commercial feeding stuff if the same shall be found substantially equivalent to the certified statement named in section four of this act" is concerned, that is provided for in section 6. It is only a repetition, and so the committee recommend that it be stricken out entirely, so that the law shall read just as it does in relation to seeds,—"Whenever the director 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." This merely simplifies the execution of the law, and if it had occurred to us two years ago, that clause would never have been put into the law. It is not something that was put in because of objections, but simply from the fact that we had it in the fertilizer law.

On motion, voted, to adopt the recommendation of the legislative committee in relation to section 8 of the feeding stuff law.

The matter of the suppression of injurious insects and dangerous weeds, which was called to the attention of the Board by the legislative committee, was now taken up, and the chairman of the committee, Mr. Talbot, was called upon for remarks.

JOHN F. TALBOT—Mr. President; Members of the Board: As I understand this matter, there has been a complaint in some sections of our State in regard to injurious weeds. For instance, the orange hawkweed is increasing in some sections, and in the bulletins which were sent out some time ago it was considered a very dangerous weed, and parties where this weed is making quite a growth are desirous that we should do something towards suppressing it. There are other places where fungi are attacking trees, and those sections are anxious to get at that matter. We did not know just how to present this matter, just how to frame a bill, but we all understand that there are certain things that come on to our farms, like foreign seeds or other matters, that are injurious, and we would like some way to get rid of them without a great expense.

Mr. LIGHT—I would like to ask in regard to the localities where this orange hawkweed is abundant?

Mr. TALBOT—I do not know where it is abundant. In our section I have knowledge of a small piece.

Mr. WINSLOW—In Lincoln county, in Bristol, there are large patches that run all through a man's field and into his pasture. It was brought there by a woman who planted the seed in her garden, years ago.

Mr. TALBOT—It first came to my attention through the Board Bulletin. I was away picking berries and found this flower. It is a very pretty flower, and I picked quite a bunch of it and carried it home and put it on the mantel piece, and showed it to quite a number of people. A short time after that I happened to be turning over the bulletin and found the description of the orange hawkweed. I compared this with it and found it was the same thing that I was treasuring up.

Mr. LIGHT—I know that there are many patches of it in the town of Union, and it seems to be spreading rapidly.

Mr. HOLLAND—In Penobscot county I think it is spreading very rapidly. In my field three years ago there was a very small patch. I rooted it, as I supposed, entirely out. The next year there was a much larger patch. I cut it early and tried to get rid of it, but this year I find that it has spread for thirty or forty rods.

Ques. In regard to orange hawkweed, how does it grow, and how difficult is it to eradicate?

Prof. WOODS. The orange hawkweed is the worst weed we have. There are half a dozen weeds of a little different color, which are about the same. It makes a fluffy seed, which will be carried by the wind as far as thistle down can go, so that it will be spread widely in that way; and it sends out a runner just as the strawberry plant does, and has an underground root stalk which branches and grows as witch grass grows. It can propagate in the manner of the thistle, the strawberry, and the witch grass. It has three modes of locomotion and uses them most industriously, and when a man tries to get rid of it without taking up every plant, he has propagated it so that he has twenty plants where he had one before. The seed will go miles, no one knows how far. It has gone pretty well over Penobscot county, in the vicinity of East Eddington, where there are farms that are running out. I see no way in which it can ever be rooted out in those places, until they are allowed to grow up to forests.

Ques. How was it brought here first?

Ans. It probably came as flower seeds. The orange hawkweed has a very pretty flower. I never saw the orange hawkweed until two years ago, when I first came into the State. As I was driving I saw a flower that was new and pretty, and got out and picked it. I saw that it was not a nice thing in the field, as the field was covered with it and everything else was gone.

Ques. I would like to inquire what the cost would be to the people of the State of Maine to exterminate the orange hawkweed?

Ans. I think it would be hardly possible to do this. It is claimed, and the experiments of the Vermont Experiment Station would seem to bear it out pretty well, that salt applied at the rate of between 1½ to 2½ tons to the acre will kill the orange hawkweed without killing the grass. In a field in front of the farm house of the College, we are trying two things. One-half of it we plowed up and planted with corn, keeping it thoroughly cultivated, by hand, and are trying to see if the dense shade of the heavy growth of corn will not kill out the hawkweed. The other half we have treated the same as we would witch grass, by summer fallow. We have kept it dry and pulverized. We are trying to see which of these experiments will succeed.

A farmer at the Pomona Grange at Exeter made a suggestion which, if I had heard it in time, I should have tried. He said that he had a little piece of orange hawkweed, and he applied salt to it. His sheep were running there, and the sheep were so fond of the salt that they had eaten the orange hawkweed. It is possible that by salting patches and keeping sheep on them, it can be exterminated. If we have orange hawkweed break out in any other place, in small clumps, we shall try it. I do not believe that it will be practicable or possible to form a law which shall look to the stamping out of that pest or any other, the State is so large. I think we can only do it by localities.

Mr. BENN—I should think that sowing the ground, if it is fairly rich, with buckwheat, would eradicate it.

Mr. GOODWIN—At the grange meeting which Prof. Woods speaks of this question was most thoroughly discussed, and I must say that I never have seen any subject at any grange meeting excite so much attention as this. Somerset and Piscataquis counties were represented in part, as well as many towns in that county, and I have no doubt that had the outline of a law similar to what has been suggested by the Professor been presented there, we could easily have gotten two or three hundred petitioners. But in many localities they do not appreciate the difficulty and the danger of this orange hawkweed. It seems to me that it might be well for this Board to instruct the legislative committee to formulate a law, perhaps for orange hawkweed alone, along the line suggested by Prof. Woods, leaving such towns as desired to take action in the matter free to do so, and thus make a start in the right direction, and not attempt too much. The impression I have is that orange hawkweed is worse than any other half dozen weeds. Perhaps I am wrong, but I judge from the description of the weed, the way it is propagated, and from the testimony of men who have been trying for ten or a dozen years to stamp it out that it is very difficult to get rid of. Some weeds the stock will eat; whiteweed we call a bad weed, but the stock will eat it. Even wild mustard the sheep will eat. But this I consider a very vile weed, and believe that we might make a move in the direction of exterminating it which would be a benefit.

Mr. ROLLINS—The only specimens of the orange hawkweed that I have observed in Franklin county I saw by the roadside of the Farmington cemetery last year. I called the attention of the first selectman to the matter, and informed him that it was a very dangerous weed and would certainly spread, and I hoped that he would take measures to exterminate it. I do not know whether he did or not. In such localities quite likely a law, and also agitation, to bring the matter to the minds of the people, would be of benefit. In localities where the weed has only recently been introduced, it might be kept out by a law as outlined by Prof. Woods.

Mr. TALBOT—It seems to me that while we are framing this law we had better not confine it to one pest. In localities where they do not have the orange hawkweed they might be able to suppress some other weed or insect that would be liable to spread. My idea would be not to confine it to orange hawkweed, but to include other pests.

On motion, voted, that the matter be assigned for discussion Thursday morning, following the discussion of the pure food bill.

Adjourned to Thursday morning.

Wednesday Evening.

LECTURE ON "THE ADULTERATION OF FOODS."

Delivered in Representative Hall, State House, by Chas. D. Woods, Director Maine Agricultural Experiment Station.

It is said that in a down town grocery store in a certain city many rats used to dwell and at night they would hold high carnival. One old rat, more sagacious than the rest, avoided the more badly adulterated classes of foods, and while he saw his companions, one by one, pass away as the result of the lead in the canned meats, the tin salts in the molasses, the copper in the canned beans and peas, the dyes and preservatives in the catsups and condimental sauces, and in the jellies and marmalades, he grew more careful and abstemious. And, lo, one day he alone, of all the band, was left. Wearied with life and its unbearable loneliness, he thought to end it, and boldly attacked the package labelled "rat poison." He was, however, doomed to disappointment. This had not escaped sophistication and its wheat middlings and gypsum proved far less deadly than the so-called foods.

Grossly exaggerated as this story is, there is a shadow of foundation for it to rest upon. It is my purpose to call attention to a few of the more common adulterations, and in so doing, I do not claim to present anything original. I have freely taken without credit, from the publications of the Chemistry Division of the U. S. Department of Agriculture, and the Ohio, New Jersey and Connecticut pure food reports.

The spices present an inviting field for the exercise of fraudulent arts. They are almost universally sold in the form of fine powder and in opaque packages, which do not admit of easy examination on the part of the purchaser. Consequently any cheap substance which may be easily pulverized to a similar degree of fineness, and which possesses little distinctive taste or odor of its own, answers the purpose; so that the list of adulterants for this class of articles is naturally very large, but may be classed into four groups. First, integuments of grains or seeds, such as bran of wheat and buckwheat, hulls of mustard seed, flax seed, etc. Second, farinaceous substances of low price, such as are damaged by the accidents of transportation or long storage—such as middlings of various kinds, corn meal, and stale ship's bread. Third, leguminous seeds, as peas and beans, which contribute largely to the profit of the spice mixer. Fourth, various articles chosen with reference to their suitableness for bringing up the mixture as nearly as possible to the required standard of color of the genuine article. Various shades, from light colors to dark browns, may be obtained by the skillful roasting of farinaceous and leguminous substances. A little turmeric goes a great way in imparting the rich yellow hue of real mustard to a pale counterfeit of wheat flour and terra alba, or the defective paleness of artificial black pepper is brought up to the desired tone by the judicious sifting in of a little finely pulverized charcoal. The field for sophistications of this sort is a wide one, and offers large scope for the development of inventive genius; so that each manufacturer of articles of this class would be likely to possess his own trade secrets. It will be observed that the adulterating materials just mentioned all belong to the class claimed to be harmless. In few instances has any poisonous substance been discovered. The proportion of foreign and genuine substances in the spices varies between wide limits, in some instances the former being slight; in others, the latter seemingly present in just sufficient quantity to impart faintly the requisite taste or odor. Even this small proportion of the professed article is occasionally diminished by the substitution of other substances; as, for example, in imparting to corn meal finely ground a pungency suggested by real ginger by the addition of a little salt and red pepper.

It is probably not so widely known as it should be that the demand for the materials for adulteration has called into existence a branch of manufacturing industry of no insignificant magnitude, having for its sole object the production of articles known as "spice mixtures" or "pepper dust." The use of "pepper dust" or, as the article is commonly designated in the technical language of the trade by its abbreviation "P. D.," is a venerable fraud.

The manufacture of "P. D." is now a regular branch of business, and the original and specific term "pepper dust" has expanded with the progress of inventive art to generic proportions, until now we have as well known articles sold by the barrel "P. D. pepper," "P. D. ginger," "P. D. cloves" and so on through the whole aromatic list. When it is considered that these imitations, lacking only such flavoring with the genuine article as the dealer thinks necessary to make his goods sell, are sold at from three to four cents a pound, and the retail price paid by the consumer is compared with it, the strength of the temptation to engage in such practices is clearly seen. When manufacturers openly advertise themselves as assorters and renovators of merchandise, and openly propose to cleanse musty and damaged beans by a new and patented process, it is full time that its significance should be considered by the public.

From the investigations it appears that the adulterants which are met with in this country are very numerous. Under the head of spice mixtures or "P. D.," much refuse of all descriptions is used up, and there are such changes in the character of the material from time to time as the sources of damaged material or refuse at hand may suggest. The diluents used in Baltimore and in the District of Columbia seem to be different from those in New York, and, in consequence, some of the adulterants which are mentioned most commonlv in the reports from the north, are not found in the spices of southern millers. While it is possible, therefore, to give a list of substances which have been used as adulterants, it is quite out of the question to say in what directions the ingenuity of spice-mixers will extend in the future. The following contaminations in the various spices have been already noted in this country:

Spices.	Adulterants.
Allspice	Spent cloves, clove stems, cracker dust, ground shells or charcoal, mineral color, yellow corn.
Cayenne	Rice flour, salt and ship-stuff, yellow corn, turmeric, and mineral red.
Cassia	Ground shells and crackers, turmeric, minerals.
Cinnamon	Cassia, peas, starch, mustard hulls, turmeric, minerals, cracker dust, burnt shells or charcoal.
Cloves	Spent cloves, clove stems, minerals, allspice, roasted shells, wheat flour, peas.
Ginger........	Cereals, turmeric, mustard hulls, cayenne, peas.
Mace..........	Cereals or starch, buckwheat or wild mace.
Nutmeg......	Cereals or starch, wild nutmeg.
Pepper	Refuse of all sorts, pepper dust, ground crackers, or ship stuff; rice, mustard hulls, charcoal, cocoanut shells, cayenne, beans, bran, yellow corn.
Mustard	Cereals and starch, turmeric, peas, yellow corn meal, ginger, gypsum.

BAKING POWDERS.

Baking powders may be conveniently classified according to the nature of the acid constituent they contain. Three principal kinds may be recognized as follows:

(1.) Tartrate powders, in which the acid constituent is tartaric acid in some form.

(2.) Phosphate powders, in which the acid constituent is phosphoric acid.

(3.) Alum powders, in which the acid constituent is furnished by the sulphuric acid contained in some form of alum salt.

All powders sold at present will come under some one of these heads, although there are many powders which are mixtures of at least two different classes.

CONCLUSIONS.

Investigations show that while especially the higher grades of cream of tartar and acid phosphate of lime powders are maintained at a quite uniform standard of excellence, the country is flooded, also, with many baking powders of very poor quality—cheap goods, poorly made.

Out of thirty-nine brands examined, twenty-five contain alum or its equivalent, in the shape of some soluble aluminous compound; eight are cream of tartar powders, with small quantities of other ingredients in several cases; four are acid phosphate of lime powders; two belong properly under none of the above classes.

With one exception, the powders containing alum all fall below the average strength of the cream of tarter powders, and in the majority of cases they fall much below the better grades of the cream of tartar powders.

In the cream of tartar and the acid phosphate of lime powders, no indications of substances likely to be injurious to health, in the quantities used, have been found. The presence of alum in baking powders is objectionable, since, under certain conditions, it may exert an injurious effect on the digestion. The effects may not be very marked in the case of any individual consumer, but that they can be induced to a greater or less extent seems to be well established.

There appears to be ample ground for requiring that the makers of baking powders should publish the ingredients used in their powders, in order that the consumer, who may justly have doubts of the desirability of using certain kinds, may be protected. At present the only guaranty of an undoubtedly wholesome and efficient article appears to be the name of the brand.

Moreover, since it is quite possible to put up the baking powders in such a way as to preserve their strength very thoroughly, and since it is evident that many makers fail in this respect, it would not seem unreasonable to require that baking powders should not be sold unless they will yield a certain percentage of carbonic-acid gas. The bad effects of the "heavy" food prepared with some of the baking powders among our samples must certainly be felt by those who use them, and who are yet too ignorant to know where the trouble lies. It is for this class especially that nearly all legislation relating to securing good food and drugs is enacted.

REGULATION OF THE SALE OF BAKING POWDERS.

According to the chief chemist of the U. S. Department of Agriculture, the best plan for the regulation by law of the sale of baking powders in the present condition of our knowledge of their effect upon the system is to require the manufacturer to use a label giving approximately the composition, or analysis, of the powder sold. This is recommended by Prof. Cornwall, and it appears to offer the best solution of the whole problem. The testimony that has been adduced is hardly sufficient to justify the prohibition of the sale of the cheaper kinds of powders as being injurious to health, but if they were required to be sold with a label giving their true composition it would soon lead to investigations upon this point. This is in harmony, also, with modern ideas in regard to legal regulation of the sale of foodstuffs, the tendency nowadays being to allow the sale of cheap substitutes for any article of food so long as they are not injurious to health, but to make all possible provision to insure that the purchaser should know exactly what he is getting, and that the substitute shall not be palmed off on him as the genuine article. In the case of baking powders it is manifestly unjust to the public to allow the sale of a first-class tartrate powder and an alum powder as the same article, and it is equally unjust to the manufacturer of the higher-priced article. The nature of the substance is such that the purchaser has no means of ascertaining by any simple or easy means the character of the article he buys, to say nothing of its relative quality. Such a regulation should meet with the approbation of all concerned in the manufacture of baking powders. The manufacture of high-grade powders, such as tartrate or phosphate powders, would certainly not object to it, and it would ultimately be to the advantage also of the cheaper sorts, such as alum powders, provided they could succeed in proving that such powders produced little or no injury to the health of the consumer.

The housewife surely deserves protection against swindling as much as the farmer, and she has no better means for ascertaining the strength and quality of the baking powder she buys than the latter has for learning the strength of his fertilizer. The verity and accuracy of the analysis stated on the label should be insured as in the case of the fertilizer, by its being performed by sworn analysts. If such a regulation were enforced, people would soon inform themselves of the respective merits of different varieties, and the further requirement of a certain standard of strength would be unnecessary, as they would learn to interpret the analysis, and a powder made up with fifty per cent of starch, for instance, would have to be sold cheaper than one made with ten per cent, or not sold at all.

SUGAR, SIRUP AND MOLASSES.

The total absence of any added matters to the high-grade sugars of commerce is plainly shown by the five hundred analyses of samples purchased in open market in different parts of the country.

The low price of cane sugar, however, has heretofore prevented the profitable adulteration of cane sugar with any article made from starch. It is also gratifying to know that the powdered sugars of commerce were not found adulterated with starch or terra alba; at least, in so far as the limited examination of them extended.

The chief adulterant of low-grade sugars, if it can properly be so called, is water. By modern methods of sugar-boiling a great deal of low-grade sugar and water can be incorporated in low-priced sugars, which still show an almost white color. This is due to the combined influence of bone black, and low temperature in the vacuum pan. By means of bone black the sirups are nearly or quite decolorized; and by boiling at a low temperature (115° to 120° F.) a soft crystal of sugar is formed which is capable of holding a large percentage of water. The resulting sugar, nevertheless, is almost white, and finds a ready sale for many culinary operations.

The question of the use of these sugars is one of economy only, for they are certainly not injurious to health. In general, it may be said that for a given sum a greater quantity of saccharine matter can be purchased by taking the high-grade sugars.

In respect to maple sugar there is a general impression that it is largely adulterated with cheaper varieties. At the present time the resources of chemistry are powerless to detect such an adulteration. The sugar of the maple sap is identical in composition with that of the sugar cane, sorghum and sugar beet. No discrimination in such cases can be made by analysis. If the ethereal substance which gives to maple sugar its peculiar flavor could be detected and quantitatively determined, then adulteration with a sugar containing none of this substance might be detected.

Perhaps the best distinction to be made between the term molasses and the term sirup, is this:

Molasses is the natural product of the manufacture of sugar cane, sorghum, or maple sap, or any product from which a part of the sugar has been removed. Sirup is the product of the refining of these articles or the mixing of various other articles together.

It has long been known that a large part of the maple sirup sold in the market is made from glucose. It is also well known that large quantities of maple sirups are sold on the market which are fabrications made up of other sweets, to which a little maple is added for the purpose of giving it flavor, or, as is often the case, being entirely free from any addition of maple product whatever. The maple flavor is imparted to sirups by mixing with them an extract of hickory bark, and this product has been made and sold under the term of mapleine. It is safe to say that perhaps the greater quantity of maple sirup sold on the market is an adulteration in the true sense of the word. These definitions, however, are only of popular nature, and the sirup could not be said to be adulterated, legally, unless some statute is enacted establishing a standard by which these products could be judged.

In regard to glucose it may be said that its presence in molasses or sirup is an adulteration unless the article containing it is distinctly so marked. A few years ago, when sugars and molasses were higher priced than they are now, the manufacture of sirups from glucose was very profitable. The price of genuine molasses, rowever, has at the present day fallen so low as to make the manufacture of glucose for the above purpose much less profitable than before. The advantage of using glucose, nevertheless, is very great aside from its cheapness. It gives to a sirup a fine body and a light color. A molasses or sirup, therefore, made chiefly of glucose and flavored with the refuse molasses of a refinery, makes a very attractive article for table use, in so far as appearance goes. In regard to wholesomeness also, it is not possible to condemn glucose. When properly made it is apparently as wholesome an article of diet as cane sugar. In fact the starches which are consumed in our foods are all converted into glucose during the process of digestion. A glucose food, therefore, is a starch food already partially digested. The fraud is one of misbranding.

TEA AND COFFEE ADULTERANTS.

The adulterants of teas, as a rule, are not such as may be considered prejudicial to the health. The mineral matters employed in facing, etc., with the exception of salts of iron or copper, are insoluble in water, hence would not be present in the infusion. Copper, which is probably very rarely present, would be very objectionable even in very small quantities. Sulphate of iron is a powerful astringent. In the small quantities used in increasing the astringency of teas it would possibly not be seriously objectionable. It may also be said of sulphate of iron that this substance was not detected in a very large number of samples examined by Hassall nor in the Department's samples.

Facing, if excessive, increases the weight of the tea, but there is no evidence of its being prejudicial to the health.

From these statements we see that the adulterations of teas are intended more especially to enhance the value of inferior grades, except in the case of "lie tea" or the addition of foreign or exhausted leaves. In the latter cases, a spurious article, which is not justified by any quality or principle which it contains, is foisted upon the market.

The evidence of authorities upon food adulteration confirms the statement that the addition of foreign leaves is now but little practiced. The general freedom of the teas of the markets of the United States from adulteration is largely due to the enforcement of the United States tea-adulteration law. Dr. Jesse P. Battershall, under whose direction a very large number of samples of teas were examined in connection with this law, notes a very perceptible improvement in the quality of teas imported under its provisions.

The examination of the coffees and coffee preparations on our markets shows that the consumers, and especially the poor, are being grossly deceived. Very little pure ground coffee is sold, and even whole coffee does not escape sophistication. The purchase of green coffee for home roasting does not insure a pure product, since even the green coffee is imitated. Stringent laws are certainly needed to suppress these frauds.

That there is a large demand for imitation coffee is evidenced by the fact of its importation from Germany. The manufacture of these coffees in imitation of the form of the genuine bean should be interdicted, even if the product is to be sold as a substitute.

CANNED VEGETABLES AND FRUITS.

Canned vegetables are not much subject to adulteration in the restricted sense of the word, which implies the addition of foreign substances to food for the purpose of increasing its quantity. The only practice in vogue which can properly come under this head is the addition of undue amounts of water during the canning process. This often occurs. Additions of salt might be regarded in this way, but this substance is added primarily as a condiment. Of adulteration in the more modern sense, that which includes sophistication, there is a great deal, and indeed it may be said to be almost universal. There are few canners who do not use salicylic acid or other preservatives, and the trade in coppered vegetables has grown to enormous proportions. Besides these wilful additions there is a class of what may be called unintentional sophistications, such as the presence of lead, tin, or zinc in these foods. These substances are often present, but are never, except occasionally in the case of zinc, added intentionally.

Ptomaines are often said to be present in canned foods, and this may sometimes be the case, but their occurrence in canned vegetables must be extremely rare. Ptomaines are by definition the result of bacterial action, and where this action does not occur they must of necessity be absent. Vegetables are usually canned in the fresh state, and if they are in any degree spoiled at the time, the fact is usually conspicuously evident to the taste, so that the canner cannot afford to use them. Bacterial action seldom occurs in the can without bursting it or rendering it unsalable. Ptomaines may, however, develop where the canned food is allowed to stand for some time after opening, though even this is unlikely in the case of preserved vegetables.

It may be said, therefore, that the principle risks to health which may arise from the use of canned goods are those due to the use of preservatives, or to the presence of the heavy metals, copper, tin, lead, and zinc. Iron, though often taken up by the food in considerable quantities from badly tinned cans, may be disregarded in this case, since it is not only a normal constituent of food, though hardly in the forms which it assumes in canned goods, but is not poisonous. Its desirability as an addition to food may be questionable, but it can not be called materially deleterious. In regard to the other substances mentioned, the case is different.

Lead is extremely poisonous, and tin is also poisonous, though in a much less degree. As to the preservatives in common use, of which salicylic acid may be taken as a type, their toxic action is not yet definitely known. This much is certain, however, that they have a marked physiological action and are all of them more or less potent medically. In large quantities they create very evident symptoms of poisoning, though this is usually only temporary. In the quantities in which they are liable to occur in canned foods, their action is at the best uncertain. They may be harmless—they may not be. Much evidence can be collected to prove either side of the question. It is a question which science is not yet prepared to settle. Pending that settlement, however, it may be said that their use is to be reprobated, inasmuch as any benefit which may be derived by the canner from their presence he can secure in other and less dubious ways. At the very least any food which contains them should be clearly and distinctly labeled, with the fact expressed in direct language. Where this is not done, their presence should be considered to be an adulteration and punished as such.

If there is any fact which is clearer than another, it is that no man or set of men has any right to administer surreptitiously to any other man a more or less potent drug. Every man has a right to a knowledge of the fact of being drugged, unless he expressly waives this right in favor of a physician. Even here the law steps in and prescribes that this physician shall be a member of a recognized school. Salicylic acid, which may be taken as a type of these additions, is a valued medicine in many cases, is in fact one of the best known remedies for rheumatism, and is believed never to have caused death in any dose. But this is no justification for its use. It is certain that it disturbs the normal course of the bodily functions—it must of necessity do so to have medicinal value—and this fact is alone enough to demand its exclusion from any food intended for general use, unless the food be so labeled.

There is another thing which may be said on this point. Were it as harmless as distilled water, there would be no excuse for its addition to food without notification to the consumer. Salicylic acid is not a normal constituent of any common food, and its addition to such foods for any purpose and in any quantity, without due notice to the consumer, is plainly adulteration. If any man desires to have salicylic acid in his food there is no doubt of his right to have it, since it is not a sufficiently violent poison to warrant the Government's forbidding him. But there is also no doubt of the fact that the canner has no right to admix it surreptitiously. In any case there can no possible harm result from labeling.

The same arguments may be repeated almost word for word in the case of copper.

Lead, tin and zinc are not usually added intentionally, but are often present, and can not be otherwise described than as dangerous to health. Zinc is sometimes used as a substitute for copper in greening peas, but it comes into canned goods accidentally as a rule. Lead comes from the lavish use of solder rich in lead and from the use of low grades of tin plate. As to its dangerous nature there can be no question. Tin in many instances is almost unavoidably a constituent of canned goods where the common unvarnished cans are used. There are few samples of these goods in which it cannot be detected.

Little as has been done in the study of adulterated foods in America, it would be possible to extend the list of known adulterants and the class of foods thereby effected very greatly. Within the last year wheat flour has been adulterated with corn flour and corn starch to such an extent as to cause United States legislation and a special revenue tax to be placed upon these adulterated flours. During the last summer a company very extensively advertised under the name of "Mineraline," ground soapstone to be used as an adulterant of flour.

A large amount of the fruit jams sold in the market consist of glucose, colored with a coal tar dye and preserved with salicylic acid, or they may consist, as a sample of currant jelly did, of a starch paste flavored with glucose, colored with coal tar dye and preserved with salicylic acid.

Adulteration and sophistication are attracting wide attention in our country. Several states have good laws on the subject which are well enforced. There is a bill before the National Government being pushed by the Pure Food Congress which, if it becomes a law, will do much toward improving the character of the foods now most adulterated.

Legislation based upon the experience gained in such states as Massachusetts, Connecticut, New Jersey, New York and Ohio, would not be experimental. A law wisely framed and intelligently executed would do much for the protection of the public against the fraudulently branded and adulterated goods now sold in the State.

FORENOON—THURSDAY, JANUARY 19.

Records of Wednesday's meeting read and approved. The report of the committee on pay roll was presented by the chairman, J. J. Frye, and the same was accepted. The committee to consider the report of the secretary recommended that it be accepted, and on motion by Mr. Hinckley, voted to accept the same.

The pure food bill presented by the legislative committee was now taken up for consideration, and the bill was read by Mr. Talbot.

Prof. WOODS—Before we go farther I would like to say that this is no experiment in legislation. This is founded on the best law that is known, that which has been adopted by the State of Connecticut, and that law was made up from the food laws of Ohio, New York and New Jersey, and the national bill. While, two years ago, we were making experimental legislation on seeds, this is in no sense experimental legislation. It has been thoroughly tried, and where it has been found wanting we have profited by the experience.

The bill was now taken up and acted upon by sections, after which it was voted that the entire bill be accepted and adopted.

On motion by Mr. Skolfield, voted, that the executive committee of the Board constitute a new legislative committee, and that the pure food bill be referred to them, for presentation to the legislature.

The matter of the suppression of injurious insects and dangerous weeds was now brought up for discussion.

Prof. WOODS—How would it do to put on record that we, as a Board, are in favor of doing all that can be done for the suppression of injurious insects and dangerous weeds; that we think it should be done largely by educational methods, but that if it seems wise to the legislative committee to introduce a bill into the legislature at this time, we would be in favor of supporting a law which tended to suppress these pests.

Mr. WINSLOW—I think that would be as well and as far as we can safely go.

Mr. HOLLAND—Mr. President, Members of the Board: It seems to me that the people of the State of Maine have had plenty of chance to be educated in regard to these matters, and the fact remains that many farmers are negligent in the matter of eradicating weeds. A man may undertake to farm and keep weeds from his premises, but if his neighbor is careless, shiftless, or indifferent in regard to the matter, it is utterly impossible for him to keep his farm clear of the weeds. For one, I never have thought that it was profitable to raise weeds, and I do not now, and I wish there could be some law passed whereby towns might be able to do something to compel people to take care of the weeds and injurious insects on their farms and in their orchards. I think that such a thing as that would open the eyes of the careless and indifferent, and they would perhaps do more than they would otherwise; and then it would help those who want to keep their premises free from these things.

We have been discussing the matter of the orange hawkweed. I have told you what it is doing on my place, and we have seen how rapidly it has extended for the last few years. That is only one of the many pests that have come under my observation. One which I would like to speak of is the tent caterpillar, that is allowed by some careless farmers to infest their orchards; and another is the black knot, or fungus on fruit trees. Of course we know that this fungus will attach itself during the year, going from one tree to another. Here is a man setting out an orchard of plum trees, for instance, and it is impossible for him to keep them clear of this fungus on account of the carelessness of his neighbors. If we should have a law that would stir up those parties to try to keep their trees clear of that fungus, I think it would be a good plan. I wish the Board would take some action in regard to it.

Mr. TALBOT—The reason that I agree with Prof. Woods in his suggestion is simply this: We are considering the matter experimentally. We do not, any of us, know what we want to frame as a law. We are not asking for any appropriation. We are going to make ourselves a committee, and try to interest towns to do something for themselves. We must educate the people up to the idea that they need a law before we ask for it, and I think the suggestion of the Professor is just right. We want to get the education started, and then we can put some teeth into the law.

Mr. ROLLINS—I endorse the first part of what Prof. Woods said, but I am in favor of saying that we would endorse a bill

Residence of W. P. Atherton, Hallowell, Me. Erected by Jonathan Haines of Hallowell in 1806.

of this kind if the legislative committee should see fit to present one. I think it might be carried too far, farther than we can begin to enforce. Laws that are not enforced, are a detriment rather than a benefit.

Mr. TALBOT—It seems to me a good deal like the law in regard to shade trées on highways. People who wanted to set out shade trees were allowed so much on their highway tax, and if you go through the country you will see places where the towns did this. Why would not this apply to weeds? One town may be full of a bad weed, and in another town you would scarcely see a bit of it. If you get up a little rivalry, people will say, What is the reason that the roads in one town are not as good as those in another, or that the shade trees are better in one town than another? It is because the people are educated up to their needs in one town better than another. This suggestion is simply to awaken an interest in the matter.

Mr. GOODWIN—The point seems to be whether we will, as a Board, recommend that a bill of this nature be framed, and also to what extent we will attempt to carry it, that is, how far in the suppression of insects and the destruction of weeds. It would rather seem to me that it might be well to instruct our legislative committee, in connection with Prof. Woods, to draft such a bill if they think proper. If the Board believes that now is the proper time to commence, I presume the committee would be glad to know it, and if the Board believes that it is not an opportune time, they would be glad to know that. I have no doubt in my mind that this is an important subject, and I think this is a good time to take it up. This orange hawkweed grows fast, and taking the State of Maine as a whole, I do not know that it is a very wide estimate to say that it might be spread over 100 acres.

Mr. FRYE—I do not think we can act too quickly on this question. It is a subject that is troubling every farmer through the country, and if this Board can do anything I think now is a proper time to do it. I would approve the suggestion that we empower the committee to frame a bill.

Mr. LIGHT—It seems to me that there is a growing public opinion in relation to the matter, and that the people are looking somewhat for legislation.

Mr. ROLLINS—Would it not be better to narrow the scope of the proposed bill somewhat, and only include the family of the orange hawkweed, and perhaps the different varieties of caterpillar, the forest and tent, instead of taking all noxious weeds and insects?

Mr. ELLIS—My idea is that the scope of the bill cannot be too wide. Although the hawkweed does not trouble us at all in our section, we have other weeds, and the different kinds of insects on the trees are very troublesome.

Mr. TALBOT—As a member of the executive committee I want to move that there be a committee of three appointed by the chair to draft some bill and present it to us during the afternoon session. Then this matter can come up again for discussion. We have discussed it enough to get an idea of what kind of a law we need, and now I move that a committee be appointed to frame the bill, and then it can be presented to the legislature if the Board sees fit.

This motion was carried, and John J. Frye, Joseph Ellis, and S. H. Goodwin were appointed as that committee.

Representatives from the State Dairymen's Association now appeared before the Board, and asked for their co-operation and assistance.

Mr. STRAW—Brother R. W. Ellis took an extended tour some two years ago through Connecticut, New Hampshire, and Massachusetts, and I would like to inquire if he found any marked difference in the character of the dairy herds in those states.

R. W. ELLIS—I did go through Massachusetts, New Hampshire and Vermont three years ago, and travelled through the best dairy sections in those states, and I am free to say that, taking all the surroundings together, Maine is fully abreast of New Hampshire or Vermont. They do not take any better care of their animals. The barns, on the average, in New Hampshire, Vermont, and Massachusetts, are not nearly up to the Maine barns, although there are a few nice ones. The cows are crowded into smaller quarters, and are not provided for as comfortably as they are in the State of Maine. In that respect I think we are fully abreast of any of the other states, and I believe, and have believed all along, that when we come into fair contest with those states, our dairy butter will be fully up to theirs. But they have a reputation, and that is worth something to them, it is real estate to them. They have gained this reputation through their creamery butter, and the creamery butter of Maine is not up to that of other states, and the object of this Dairymen's Association is to bring the mass of Maine butter up so that it shall have an equal standing in the markets of the world with the butter from these other states. The creameries in the State of Maine have to send their teams over large areas. They do not churn more than twice or three times a week, and their cream is not in shape to make first-class butter. Up and down the Connecticut Valley, in New Hampshire and Vermont, there are creameries that do not cover an area of more than three or four miles. Their patrons keep from 20 to 50 cows. They carry their milk to the factory in the morning, and it is immediately made into butter, and in 60 hours from the time the milk is drawn from the cow, the butter is in Boston. The milk is run through the separator, and the butter is manufactured every day. The farmer delivers his milk on one side of the factory and drives around to the other side and takes the skim-milk. You cannot expect a factory that churns only twice or three times a week to compete with those factories. If the dairymen of Maine had the confidence in one another and the faith in their business which they ought to have, so that, in localities where there are creameries they would stock their farms to the fullest capacity, we could do just as good business as is done on the Connecticut River.

Mr. LIGHT—Is there enough in the dairy business at the prices of butter to warrant the farmers in stocking up with cows enough to make the conditions equal to those in the Connecticut Valley?

Mr. ELLIS—I think there is; but let me qualify that. I think if they would do that thing they would increase the price so that the business would be more profitable. But at present prices I do believe it is the most profitable business in which the farmer can engage, if he is situated so that he can properly engage in it. I would not advocate that in every locality, but in certain localities where there are butter factories and the surroundings are favorable I believe it should be done; in other localities where they are better qualified for something else they should go into some other business.

Mr. STRAW—I am thoroughly interested in the dairy industry of this State. I believe it is the profitable business in the State, and I have believed for a long time that the prime trouble lay with the dairymen, but I must confess that I am somewhat confused since this discussion began. I find that our sanitary conditions in Maine are equal to, if not better than those in New Hampshire and Vermont; so that destroys the idea that I had that the fault lay with the dairyman. We say again that our dairy butter is equal to that of the other states but our creamery butter is not so good, but at the same time we say, or have been saying, that the fault lies with the people who keep the dairies, that the sanitary condition has much to do with it. Now I have changed my idea. I am firm in the belief that the trouble does not lie with the dairymen, but it actually lies with the creamery men. They do not gather their cream often enough, they are not careful enough in looking after their creamery interests, as found at the dairyman's house. For instance, my creamery man comes around part of the year twice a week and another part of the year once a week. I claim that my cream is not as good when it is held a whole week as it would be if collected every two days, and I do believe that the reason that our butter is marked so low in flavor at our Dairy Conferences is that the cream is not in the proper condition to be churned; that the creamery man had better be talked to, rather than the dairyman, and if we send out some one I think we had better send him to look after the creamery men as well as the dairymen.

On motion of Prof. Woods, voted, that the executive committee of this Board be instructed to co-operate with the Dairymen's Association during the coming year just as far and in just such ways as will seem to them to be for the best interests of the dairy business of the State.

On motion of Mr. Skolfield, voted, that the Five-Minutes Talks by Members, now in order upon the program, be laid upon the table and that the Board now listen to the address by Hon. Chas. J. Gilman of Brunswick.

PAST AND PRESENT METHODS OF AGRICULTURE.

By Hon. C. J. Gilman, Brunswick.

Mr. President: I wish for the Board of Agriculture to distinctly understand that I am not here to illuminate or to illustrate any great problem in agricultural science. I received a very pleasant notice from Secretary McKeen of the request from Brother Skolfield that I should be visible at this time, more, if I understand it aright, that they might see one of the prehistoric members of the Board of Agriculture, a connecting link with the past, than for any other reason. I wish to say to the members of the Board that I appear here not in the attitude of an orator, if it were in my power so to do, but to express my very great gratification and pleasure that we have a Board constituted as this is, and so fully and completely commensurate with the responsibility involved in the case.

Perhaps a slight allusion to the past may not be out of place. I was a member of this Board under the auspices of Mr. Goodale, now passed away. He was a very accomplished man, and his contributions were, in his day, deemed to be of very great value, and would naturally be preserved in the archives of your association. A pioneer, you might almost call him, in the department of agriculture. My relations with him were cordial and intimate, and the kindliness of his manner and the refinement pervading his nature were most agreeable. It is a pleasure to me, even after this lapse of half a century, to pay this tribute to the character of that man.

It would hardly be fitting or proper for me to enter upon any extended comparison of the present modes of agriculture with the past modes. Of course I could say, what is patent to every member of this Board, that my recollection—and it is a very vivid recollection—runs back to the use of the scythe rather than the mowing machine. My early experience in the field was with a large crew of men swinging their scythes, beginning work between four and five o'clock in the morning. That was a mechanical contrivance not entirely lost now.

There has been a radical change in the condition of the plows in this lapse of time, and yet we have not reached a perfect result

I think the day is not remote when the spading machine may in part supplant the plow. But, at all events, the plow is in far better shape than it was a half century ago.

The matter of barn construction has been alluded to here, and I wish to say to the members of the Board of Agriculture that at some opportune time I want to have a talk with Secretary McKeen upon that subject. I hardly think there is time to go into details this morning, but my mind has undergone a radical change in regard to our modes of procedure in connection with barn construction. It is my deliberate opinion that the whole system should be modified, and that our stock should be placed under different and improved conditions.

There is one other point which I will mention here, in a very quiet manner. I had the very great pleasure not long since of having an interview with the superintendent of the school system of this State. We all know, gentlemen, that the inclinations of the human mind in any direction can be intensified and enlarged, by attrition, by intense application, by all the moral forces of our nature, so that it does seem to me that a text-book, or text-books, properly constructed, directly to the point, simple in the make-up, might be a very valuable adjunct in our common school system and in our graded school system. We want to hold the minds of our young people to the questions relating to the soil. We are expending a vast amount of money here in Maine for the education of the human mind. Let us be careful that we do not educate these young people beyond the idea of labor. I have a great admiration for a cultivated man or a cultivated woman, but I like to encounter a man who can carve a turkey or drive a nail, or who has some conception, or perception, of the use of the hoe or of the axe; who has that knowledge of chemistry in its elementary forms which enables him to make use of its results. As far as chemistry is concerned, we have that in our colleges and our academies. We have departments of chemistry, mineralogy and geology in all of our colleges, I assume. But my idea is to have a simple work, properly constituted, adapted to the minds of the youth of Maine, so that they may be induced to abandon that idea which has been of so much injury to the State of Maine, that there is nothing to be gained by farming. They turn away from the old homestead and go to the ribbon shop of the city, or wander off into some pursuit in the remote part of this country, turning their backs upon this magnificent State with all its resources, a proper arena for the human mind in any department of industry or in any department of science.

Now, Mr. President, the discussion that has obtained here just previous to these remarks of mine, it seems to me is a very interesting one—in regard to the dairy system of Maine. Gentlemen, half a century ago, there was no dairy system in Maine; and while you are discussing whether one pound of butter can be made to be worth two cents more, a vital point of to-day, just hold up the standard of the dairy department of to-day and compare it with the condition of things half a century ago. At that time not a pound of butter crossed the boundary line of this State moving westward. Now we all know, as Mr. Ellis has indicated here to-day, that we have the qualifications, the soil, the climate, the intelligence, all the forces that are essential to place upon the market as perfect and complete an article as can be produced in Franklin County, Vermont, or in any county in the State of New Hampshire. Half a century ago, there was hardly a Jersey cow in the State of Maine. I remember well the interviews that I had with Dr. Holmes. I remember well the first purchase I made from his herd.

The Jersey cow was ridiculed, considered not entitled to consideration, totally unfit for anything but a plaything on the farm, but she was the basis, the foundation, of the great dairy system of the United States; and yet I must say here to-day, gentlemen, that because of the peculiar organism of that animal, we should not overlook the qualities of the beef animal. And I was delighted to hear the allusion made here to-day, by the gentleman from Somerset county in regard to the sheep industry. I, myself, have been greatly discouraged in that direction. I well remember when, in conjunction with my brothers on a farm not within the corporate limits of this State, I had 100 thoroughbred Southdown ewes, choice animals, torn to pieces, scattered, by the dogs. Now I want my friend from Somerset, or the gentlemen from any other part of this State, to give us a solution of that problem. I consider to-day, that, with hay in the market from four to eight dollars a ton, we have a product by which we can build up the beef industry and the sheep industry of this State, and I have been delighted with some intimations that have been made to me lately that there are indications of a revival of the sheep industry. I hear gentlemen say to me that there is a demoralization, a weakness, in the great woolen manufacturing interests of the American continent. That is true; that experience is incident to all departments of industry, it is inevitable in the course of human nature. Our cotton industry in New England has had a cloud impending over it, but still the energy and the enterprise of New England brought to bear in the right direction will rescue those industries and place them upon a firm foundation. Let me cherish the hope here to-day, that this Board of Agriculture, by such means as you can conceive of, through your associations, your men of experience, will see to it that every honorable and reasonable step is taken to develop the sheep industry of the State of Maine. It does not matter so much with me whether the wool is worth 14 cents a pound or 25 cents, although that is an important difference, the more the better for the farmer and for all concerned, but I am looking largely and mainly, except in the case of fine wool sheep, to the product of meat. A mutton is the creature of a year; a lamb is the creature of six months. It is a germ to-day, it is a perfectly developed organism within a year, ready for the market, and there is always a demand, and always a fair price.

Now, Mr. President, not to hold this Board in durance vile here very much longer, or to harass you with any rhetoric of mine, I will simply call your attention to one point which may be a slight excursion of the imagination, and yet it may not be inappropriate to allude to it. It was years ago, I should say nearly twenty years, that Prof. Brackett was at the head of the chemical department of Bowdoin College. I asked him at one time this question: I said, if I understand it aright, the feldspar rocks of the State of Maine are permeated to a greater or less extent with potassium, potash combined with soda or with some other element. Cannot that be extracted, and cannot we get the benefit of it in manure for our land? Right over here on the other side of the Androscoggin there is enough locked up to manure the whole of Cumberland county. He said, "It is a hard puzzle, Mr. Gilman. There must be some pretty violent action in order to accomplish that." I told him he had better give it consideration, and while they were at work upon that problem there was developed in Germany what is called the German salt, which, as Prof. Woods and the rest of you may understand, now enters largely into what we call our commercial fertilizers. That is found in such a way, under such conditions, that to get at it, and to make it marketable, fit for transportation, is a matter involving far less expense than the other problem that Mr. Brackett and Mr. Goodale were at work upon. The point that I am after is this: it is my judgment here to-day, and I do not wish to indulge in any very loud or boisterous assertions, that the day is not remote when these ledges that we look upon as useless, that contain those elements of fertilization, will be broken down and made available for the agricultural interests of this country. It may not be in my day, because I have not very many years in reserve, but the younger gentlemen of this Board may live to see that day. Certain things have arrested my attention and induced me to indulge in this line of thought. I have seen the dust of granite applied to the soil, containing, in percentage of potassium, far less than you would find in feldspar rocks in many parts of the Valley of the Androscoggin, with most decisive results. I have seen the growth of the grass as the result. Now I am not here this morning to advise the farmers of the State of Maine at once to attack these granite ledges, these feldspar rocks, but to indicate to you what they may be in the future, as a reliance of this State for the elements of fertilization. How the result is to be accomplished I will not attempt to say.

Now, gentlemen, finally, there is one topic which you may not think is germane to vegetation, and yet it has a bearing upon the industrial interests of this State, a very decisive one, and that is a topographic survey of Maine. And what is a topographic survey? It is an outward expression of the State, indicating the altitude, the lacustrine system, the pond system, the elevations, the depressions, the roads, etc. And that topographic survey is issued in sheets, in maps struck from electrotypes. Suppose my friend from Somerset proposes to construct water works, or a sewerage system, or proposes to build an electric railroad or a steam railroad, and wants to know the altitude of a certain piece of ground; he immediately refers to the sheet. He does not go to a man with instruments and pay him thirty or forty dollars—there it is before him. A portion of that work has been done by the Government of the United States. I have a chart here showing the extent of that work already accomplished in Maine, largely in York county, Cumberland county and on the Kennebec. It remains to complete that work.

Now, gentlemen, what is our great danger in Maine? What effect has the denuding of the territory of Maine, of these great and magnificent forests, on the water systems of the State? We know how it has diminished the water flow in Massachusetts, we know its effect in the older portions of the State of Maine and in Connecticut and Rhode Island. What we are in pursuit of, and are contemplating in the future, is the enlargement of the storage capacity of our rivers, and lakes and ponds. The topographic survey, therefore, is the basis of a hydrographic survey. In the town of Brunswick the power that impels the cars from Bath to Brunswick and Brunswick to Lewiston, a distance of sixty miles, is water power, the cheapest of all powers. Gentlemen of the Board of Agriculture, the state that can furnish power, whether it is intellectual or physical or water power, and in abundance, without restraint, under admirable conditions, has a position that no other state in the Union can hold. In talking with the Governor on this question, to-day, he said, "Mr. Gilman, I have thought upon this subject seriously." I said, "Governor, you know what has been whispered in my ear. I have been told that men, largely in the wild landed interests of the State of Maine, would oppose this firmly." He said, "I am not one of them. If I owned a town in Aroostook county or in any other part of this country I should want to know the physical facts, whether above ground or under ground, relating to that town."

Now what bearing has this upon the department of industry that you so ably represent? Power and manufactures are two things that we place in juxtaposition. Now, then, a manufacturing town is a consuming town, and a consuming town has a direct bearing upon the productions of the soil. The farmer within ten, fifteen, twenty or thirty miles of Lewiston and Auburn of course feels the effect of the growth and the development and the advance in those communities. Therefore I want the Board of Agriculture, so far as it can consistently and with propriety, to cherish this purpose and plan of a topographic survey of the State of Maine. I want this Board of Agriculture to remember that we have some fifty or sixty thousand farms in the State of Maine, and the legislature of the State had better look carefully to this great interest. The grange is on the alert, the Board of Agriculture is not indifferent; but if there are any resources in the treasury of Maine unexpended, I want the yeoman of the State to get the benefit of it as far as he can.

Mr. President, I thank you most kindly and cordially for this opportunity which you have given me, and again express my very great gratification in meeting this Board. It awakens pleasing recollections. I was thinking the other day who might be living among those with whom I was once associated on another arena in the city of Washington, before the breaking out of the rebellion. All that I could bring to mind were John Sherman in his decadence, Galusha Grow of Pennsylvania, and, lately passed away, Justin Morrill of Vermont. When you turn from your Board of Agriculture to-day to the Board of Agriculture with which I was associated, there has been a harvest of death. It becomes those of us who are living not to look back to the past but to look forward to the future; and so may this Board of Agriculture be what it should be, a factor of usefulness and an instrumentality of advantage to the State of Maine.

On motion by Dr. Harris, a rising vote of thanks was extended to Mr. Gilman for his interesting address.

FIVE-MINUTE TALKS BY MEMBERS.

SECRETARY McKEEN—I would like to say that, as I understand it, these five-minute talks are to be devoted largely to suggestions in relation to institute work and the general work of the Board. I hope every member will feel perfectly free to state his ideas very fully, and will consider that this is a matter which concerns him in his county, and the State at large. I say this largely for the benefit of those who have not been associated with me previously on the Board. It has been my effort, ever since I have been the executive officer of the Board, to see to it that the Board was not a nonentity, that the Board of Agriculture as an organization amounted to something, and to that end I have on every possible opportunity consulted the members as to the time, manner and place of holding their institutes, as to the speakers they wanted, the subjects they wished discussed, and in a general way, in regard to all matters relating to institute work or to the other business of the Board. I have been very much pleased at the active coöperation that I have received from the members, and the apparent freedom and ease with which these matters have been discussed, both in this office and when we have been holding our meetings in the various counties. I hope this freedom will continue, and that nothing will occur in any way to break up the confidence that has apparently existed between the members of the Board and myself all of this year, and that it may continue during the year to come.

CUMBERLAND COUNTY.

JOHN J. FRYE—Mr. President; Gentlemen: I am in hearty sympathy with this work. I believe it has done a great deal of good. When I first became a member of the Board it was almost impossible to create any interest among our people. It seemed to be almost impossible to get together a dozen people, but I am happy to say, to-day, that there is a wonderful change, and especially so since our Dairy Meeting. Whereas I used to have to go after the people and call together a meeting, to-day they are running after me, and asking for meetings. I think the institutes have been the means of doing a great deal of good. I hope they will be followed up, and that all the assistance will be rendered to our secretary that is necessary.

OXFORD COUNTY.

JOHN F. TALBOT—Mr. President; Members of the Board: A short time ago I received through the mail a marked copy of a paper with the question in it, "What is the duty of the Maine Board of Agriculture?" I do not think that I could answer that question in five minutes, for I realize that the importance of the Maine Board of Agriculture is such that the question could not be answered in five minutes. I think it is a very important factor in the State of Maine, and one that is growing more and more important every year. Since my connection with the Board I know of no meeting so interesting as this one that we are having at the present time. The interest in our county in the institute work is increasing every year, and I am continually receiving invitations from various places to hold institutes. I was sorry to have to write to many last year that we had held all of our institutes and should have to put them off, for it only increases the number of demands, the more they are put off.

I like the suggestion of the secretary that we endeavor to hold all the meetings we can, and divide up the speakers so that one speaker need not necessarily sit and listen to another, but when he has finished he can go to another town or district and entertain the people that may be assembled there. I am going to try to carry this out in our county. The institute work, I believe, is one that is demanding more intelligent speakers every year. We have had some grand good speakers, but the people are educating themselves up to the point where they demand a little more, and consequently we must supply that demand if we are to have an interest in this work. Our meetings are composed of ladies as well as gentlemen, and I believe in having subjects that will interest not only the farmer but also the farmer's wife and the farmer's children. I am not one of those who feel so very bad to think that all the boys are leaving the farms. I am proud that so many boys have left the farms and have made their mark in the world in other lines. They were not adapted to farming. We should not have had our Dingleys if we had kept them all on the farm. We should not have had the eminent doctors and scientific men, if they had been continually on the farm and had not had an opportunity to develop those ideas that were born in them and wanted a chance to find expression along other lines. I am glad that we have enough left on the farm so that the cause of agriculture has not suffered, but we have been able to meet the demand, and not only to feed ourselves but to send large quantities of food into other parts of the world. It was with pride that we listened the other evening to the testimony of some of these men who spoke here, when they said they lived upon the farms which their grandfathers cleared. Their fathers had died upon them and they expected to die upon them. No doubt they had made a mark in the world as farmers. And I believe if we could have heard the testimony of the numbers that had gone into other lines we should have found that they also had made a mark in their lines; and that Maine in this way has sent out a great many able men. It has been with great pleasure that I have listened to-day to this able discourse from this old gentleman who has addressed us on the past and the present; and I believe that through the united efforts of the Board of Agriculture we can create a larger interest, and keep the good old State of Maine up to her standard. I hope that everything will be harmonious and pleasant between the members of this Board, and that we can coöperate to further the interests of agriculture in all ways possible.

YORK COUNTY.

L. O. STRAW—I haven't anything new to suggest for York county. Our lines of work there have been extensively portrayed in years past. Our industries are the same, and I do not know that we could introduce any new industries in York county. In the lower part of the county we have our manufacturing interests, and those have no particular connection with the farming industry of the county. The only subjects that we can advance are the dairy interest, the stock interest and the fruit interest. I think we are sadly neglecting our fruit industry. I think it is true that not only in my county but in other counties as well, the small fruit industry is sadly neglected. I do not know how long it may be before we can awaken our people to the fact that every farmer is neglecting himself and his family by neglecting that industry. There is scarcely a farmer who can present to you a respectable garden in the line of small fruits; scarcely a farmer who raises a strawberry for his table, a currant for his table, or, in fact, any of the small fruits which are luxuries, and which every farmer should raise to a certain extent. We have tried to develop our dairy interest, and I think that interest is the most important of all the interests in York county. I have simply to say that whoever may follow me should give especial attention to this industry.

SAGADAHOC COUNTY.

T. E. SKOLFIELD—I represent one of the smallest counties in the State, and yet we have all of the larger industries. I do not know that there are any new lines that I would suggest. Last year I thought the dairy interest and been talked about enough, but I believe there is a chance for more light on dairying, and in the northern part of the county there are fine towns for the dairy interest. In the southern towns, the towns along the sea shore, the sheep industry or poultry growing might be carried on to better advantage than dairying. Bath, we all know, is one of the largest ship-building towns in the United States, and it makes a fine market. I think the work in Sagadahoc county the present year should be largely along the lines of the dairy interest and the production of crops on the farm.

HANCOCK COUNTY.

NAHUM HINCKLEY—The needs of our county are transportation, as well as an improvement in dairying and farm products. It is a good county for small fruits, but our transportation in the western part of the county is very imperfect, and until that can be improved, I do not know what can be done unless it is in the line of creameries or cheese factories. The farmers are very much interested in the lines laid down by the secretary and other speakers at the institutes. They are much interested in the work, and are willing to adapt themselves to all of the features they possibly can to improve their circumstances. It is a very good hay country and I regret to say that they have been selling off quite a lot of stock this fall. Hay is very cheap and they certainly have made a mistake in selling their stock; their farms will be impoverished under that plan, and I think that with the institute work they can be induced to see it in the proper light. We have had some fine speakers at our institutes and they have done us lots of good, and I think if the work is followed up Hancock county will average very well with the rest of the counties in the State.

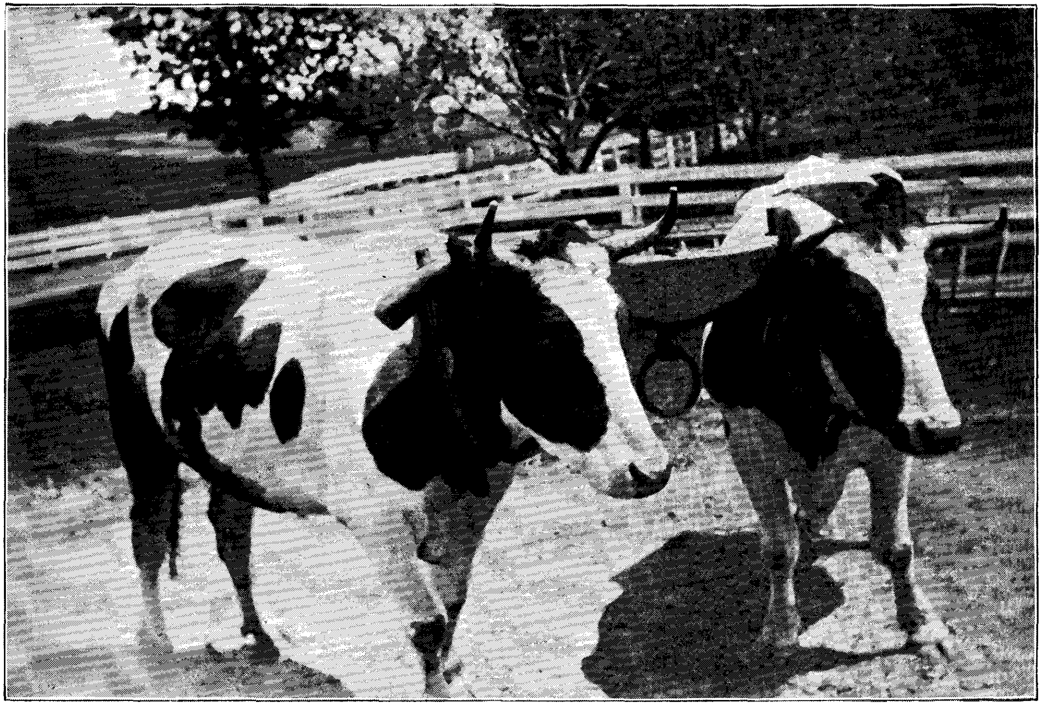
AROOSTOOK COUNTY.

JONATHAN BENN—I do not know as I have anything new to say in this line. I do not think it a good plan to keep changing from one industry to another. We have one good industry, potato raising, and I think others ought to be encouraged to go along with that. I think we ought to raise more good beef stock, as well as dairy stock, and I think Aroostook county is a grand field for the sheep industry, and that ought to be encouraged in our institutes. And there is another industry that I think ought to be talked for perhaps an hour at each institute, the poultry industry. Up there in the winter it is almost impossible to get what eggs are wanted. There seems to be a lack in that industry, and I think it should be encouraged. As our territory is quite large, we have to scatter our institutes considerably. I think we can take up the same subjects as last year, and still have new audiences. Our hay is abundant, and the market is very low for it, and I think we ought to have encouragement to raise stock and feed it. It is quite a good county in which to raise wheat. I have raised wheat for a number of years, and I think it pays. But we are lacking in good milling industries. We would like to have a new mill in the upper part of the county and in the southern part.

FRANKLIN COUNTY.

F. H. ROLLINS—In arranging the institute work for the coming year our own home markets should receive attention, especially for our beef and mutton products. Our markets all over the State are filled with western beef, preserved or embalmed by the use of boracic and salicylic acids, that must be very injurious to health of our people. I am informed that it is injected into the veins of the animal when slaughtered and permeates every particle of the flesh. A statement was made a short time ago by an army surgeon before the government commission on the conduct of the war that some of this beef destined for the use of the army in Cuba was exposed in the hot sunshine for sixty hours without any perceptible change. It is not to be wondered at that the marketmen prefer such beef that can be kept almost forever to our more perishable, but more palatable and wholesome product. I think the investigation and agitation of this subject should be a feature of our institute work for the coming year. When we consider the large sum of money annually appropriated by the legislature for protecting the wild animals of the forest from our own people so that others might come and shoot them, it would seem that the sum of three thousand dollars allowed the Board of Agriculture for institute work should be increased to at least five thousand dollars.

This sum should be divided among the several counties as equitably as may be, the expenditure to be under the direct



Thoroughbred Holstein Steers, owned by Hon. John M. Deering, Saco; five years of age, girt 8 feet, weight, 4500 pounds.

supervision of the member for each county. With this sum more practical methods could be undertaken; such, for instance, as a dairy school to continue for a week or more under the direction of our honored secretary with the assistance of some of the professors of the University of Maine, where all of the latest methods in use, in the making of fine butter and cheese, could be practically demonstrated, such as separating the cream from the milk, pasteurizing and ripening the cream, churning it, and finishing and packing the product for market in the best manner to please the eye of the buyer and the taste of the consumer.

A school of this kind in each county in the State in a few years would improve the average quality of our dairy products to such an extent that the markets would be ample for all that we could produce, at good prices.

At an institute of this kind the dairy work could probably all be done in the morning, and the afternoon and evening could be devoted to giving lectures to the class and others who might come in, on other topics closely connected with the farming business, such as the care of the orchard, small fruit, the care and management of the flocks, the poultry and other subjects of interest. Another subject that should receive the attention of the Board is the advocating of the practical coöperation of farmers, to this extent at least, that farmers in each neighborhood where conditions are similar should engage in the same lines of work. Wherever we find a number of manufacturers of the same kind of goods in one town, there we find the quality of the goods brought nearest to perfection, the cost reduced to the lowest point, and the producers making the most money. The same principle would hold good in farming. For instance, some neighborhoods are better adapted to keeping sheep than anything else. If the farmers would all make the sheep industry their principal business and would select one of the leading breeds as their standard, they would soon have the best sheep in their region. This would attract buyers who would pay better prices. Therefore the farmers would be more prosperous than they would be if each was engaged in a separate line of work. A more fraternal spirit among farmers would add to their prosperity. Men in other lines of business form societies to protect their members and are quick to resent any injustice done them. Farmers should stand together in the same manner, and assist each other in getting the best prices for their products and defend each other from frauds and impositions of all kinds.

Voted, to adjourn, suspending the program until afternoon.

Adjourned.

AFTERNOON—FIVE-MINUTE TALKS BY MEMBERS.

PENOBSCOT COUNTY.

GEO. N. HOLLAND—Mr. President and Members of the Board: In suggesting institute work for the county of Penobscot I should recommend that it be somewhat diversified. When we consider the extent of the county we can easily see that what would be for the interest of one portion would not be for that of another. The distance from Boston to the western limit of the state of Massachusetts would but little exceed the length of our county, while its extreme width and length is about equal to the state of Connecticut, and we could enclose within our limits more than two such states as Rhode Island. With this large extent of territory we find the inhabitants engaged in very dissimilar agricultural pursuits.

In the northern section, with good pasture, abundance of hay and fodder and cheap lands, we would suggest the raising of stock, largely for beef, and the establishing of herds of pure bred animals.

The sheep industry should not be overlooked, but carefully presented at the institutes; while in the southern portion of the county with a good home market for garden truck, and small fruits, and an increasing market at Bar Harbor, it would seem advisable to bring the raising of those products into notice at the meetings in that section of the county. The many creameries in this locality would demand that the dairy herd be closely looked after, as well as the poultry business, which is reaching such large proportions and attracting so much attention.

Whatever line of work may be adopted the coming season, we are sure of the hearty coöperation of the secretary of the Board, who in all our relations for the past four years has given his best efforts to make the institute work successful.

PISCATAQUIS COUNTY.

W. H. SNOW—I do not know as I can suggest any particular lines of work more than were carried on last year. In our county in the last few years dairying has received the most attention, but there is a tendency now to go into other kinds of stock husbandry,—beef raising and sheep raising. I find that in the county each year after we have our institutes there is a greater amount of interest, and a desire on the part of more of our people to make their farms self-supporting. And while a few years ago I almost had to carry the reports around and urge people to take them, now I have calls for them continually, and there is much more interest taken. We have had some very good meetings there, we have been furnished with extra speakers. One man came to me who had attended an institute at Brownville, and very much regretted that his boys were not there. He said he was well paid, and wished his boys had been there, and wanted me to be sure to remember him next year. I find the same interest all over the county. One thing has been spoken of here which I think should be largely encouraged, and that is the raising of small fruits. I think that should receive a little more attention. I do not think there is anything more that I can say in regard to the institutes. If everything has not been just right it is wholly my fault.

WALDO COUNTY.

JOSEPH ELLIS—Mr. President; Members of the Board: I will say to you that I am a new member and I do not propose in any way to advise as to what lines should be pursued in institute work. I have been somewhat acquainted with the institute work in our county. I have attended many of the institutes, and I will say in regard to the speakers, that I have always been well satisfied with them, and well satisfied with the management. It used to be hard work to get the people out in our county, so that there would be a good audience, but recently we congratulate ourselves that we have patronized the institutes pretty well, and the people are growing more and more in favor of the institutes and the institute work. The particular line of work for our county I hardly know. The county is a large hay raising county. We sell a great deal of hay, but that part of our business has dropped off, consequently our people would like very much to take up the dairy business. We have done this considerably, but would like to do it more. I think perhaps some institute work on that line would be of benefit. At the institute at our place a separator was exhibited and worked, and a few of our people bought separators right away; either the institute or something else brought this about. So that the use of the separator in connection with the institute seemed to be very satisfactory to the people.

LINCOLN COUNTY.

JOHN M. WINSLOW—Mr. President; Gentlemen of the Board: I do not know that I have anything to suggest for institute work for the coming year. I can simply say that the institute work has been highly satisfactory in my county the past year, and in all probability the same lines will be pursued the coming year that have been pursued in the past. It has been a rule to consult the parties where we concluded to hold an institute in regard to the subjects they wanted discussed, and to carry out their wishes, and when we have had good weather the institutes have been very well attended, and the speaking has been well received, and I believe that the farmers have profited by the institute work in my county. The great benefit which I see from the institute work, which is more marked than when I was first a member of the Board, is that the farmers talk about the lectures among themselves after the meeting, and follow it up for months, bringing up points that were brought out, and discussing them. I cannot suggest anything new for the coming year. I shall consult my constituents, and whatever they want I shall provide.

WASHINGTON COUNTY.

E. F. ALLEN—I am not old enough in this work to suggest anything new. The needs of our county are very much the same as those of Hancock county. We have great privileges for hay, and we need more flocks and more herds. We need to raise stock and sheep to eat up the hay that is now a drug on the market. This last year we have had a small army down there building a railroad, so that we have used up the hay, but this is only for one year. Next year the hay crop will be on our hands, and we want to educate the farmers to raise more stock. They are beginning to talk something about a creamery, and that is one of the needs down there.

Prof. C. D. Woods—Mr. President; Gentlemen of the Board: I do not know that there are any suggestions that I need to make about institute work. Of course it would hardly do for me to say that I have been displeased with the speakers at the institutes which I have attended. The subject of institutes I believe to be a very important one, and I think the Board is doing exceedingly good work along those lines, and has to congratulate itself, through its secretary, that it has been able to increase the number of these institutes so materially. I think the number of institutes has been increased nearly four fold since the present secretary came into office, with the same appropriation, so that I believe the institutes are being run much more economically, and, from all that I can learn, exceedingly satisfactorily. I believe if you work along the same lines in the year to come that you have been working upon in the past, you will continue to accomplish much good.

KNOX COUNTY.

E. E. Light—Gentlemen of the Board: I haven't anything new to suggest. The institute work in Knox county has been satisfactory. I think I said a year ago that in some places in Knox county it was well to have small meetings, perhaps to divide the speakers up and have more meetings. And then I think, too, that the best results will come from a two-days' meeting. We have held one two-days' meeting in Knox county since I have been a member of the Board, and I regard it as one of the most profitable institutes ever held in the county. I think a two-days' meeting in Knox county (and perhaps it would apply equally well to some localities in other counties) is wise. In regard to the subjects that had best be considered at these institutes, dairying is always a subject in which there is a good deal of interest, and it is a profitable subject. Knox county has some sections that are noted for their fruit interests, and I think the subject of fruit, especially the culture of winter varieties of fruit, and that part of the industry that relates to the depredations of insects, should receive considerable attention. Also the sheep industry is an industry that is receiving more attention; and there is an increasing interest in the beef industry, and I think that subject should receive more attention than it has in the past, along the line of better breeding and better winter feeding.

SOMERSET COUNTY.

S. H. GOODWIN—Two years ago it seemed wise to recommend that the matter of the sheep industry be taken up in institute work in some counties of the State to a greater extent than it had been. At that time I must say that I did not have very many enthusiastic supporters; but as time has developed, not only Somerset county and Franklin county, but others as well, would be glad to have that subject receive attention. This past fall Secretary McKeen was very fortunate in securing the services of a speaker from outside of the State. While the secretary is sometimes criticized for importing speakers, I think I can safely say that this money was well spent. I think the member from Franklin county will bear me out in that statement. I think we got an inspiration from the speaker that will be of advantage.

A point which I wish to emphasize is that the success of our institutes is due largely to the work of the secretary. It was my experience last fall to have a rainy season for the institutes, and I had an exceedingly good opportunity to see how loyal and how devoted he is to the cause. I think it is that devotion and that untiring industry in the work which have brought up this institute work to the point where it is. Secretary McKeen has followed in the line of very able secretaries, but notwithstanding that, there never was a time in the history of this Board of Agriculture when the common people were so thoroughly in sympathy with the work of the Board, and the work was so well received, as at present. This work has been done by the secretary, and I think we ought to give him our loyal support, and I think we do, unanimously. I have felt that, so far as the work in our county was concerned, the question of the extirpation of weeds should receive attention; and there is one other subject which is near my heart. It is a subject which came up here two years ago in a peculiar way. I do not bring it up for any discussion whatever, but I do say that, as I understand the present law, at some time, perhaps in the coming season, there will be a fund accumulated which will be expended through our secretary in the direction of the education of the people in the matter of roads. And I wish to put myself on record here as saying that I believe there is no one subject that is before the people of Maine to-day that demands their study and attention to such an extent, and that the farmers should look into as closely, as this question of roads. I am not speaking of any system, but simply say that I think the farmers are vitally interested in this subject, and it should receive very careful attention. If this fund which is accumulating should ever get to that size that any portion of it can be expended in this direction, I would like to have some of it in Somerset county. The time is coming when the Board of Agriculture undoubtedly will have to take hold of this question, and I think we ought to encourage the study of it in our meetings and keep it before the people as much as we can. Under whatever system we work, I think we should try to interest our people in giving more attention to the subject of good roads.

TEN-MINUTE TALKS BY MEMBERS.

THE ADVANTAGES AND NEEDS OF AROOSTOOK COUNTY.

By Jonathan Benn, Hodgdon.

Gentlemen: I am to present to you some of the advantages and needs of Aroostook county.

Its advantages for agricultural purposes have never been fully realized by the people of our State. It is a vast territory, only about one-fourth under cultivation, the remainder divided into virgin soil, unbroken forests, lakes of beauty and rivers of immense waterpower; a climate temperate, snow remaining upon the ground during the winter season, enriching the soil and protecting vegetation. The growth of vegetable matter during the summer season is marvelous. The surface of this county is broken by hills covered with vast forests which form a natural wind-break and prevent violent storms, heavy freshets and long droughts.

Aroostook is truly the farming section of our State. The soil is deep and rich. The slate formation is largely lime and is a source of fertility to the soil. Its grass lands are unsurpassed. All kinds of hardy fruits and vegetables are there grown to perfection. It has been truly called, "the garden of Maine."

What are the needs of this county?

First: Aroostook needs, not educated farmers, but farmers with a practical knowledge of its soil, its needs and the latest and best methods of cultivation; men who take advantage of the helps given by the best agricultural papers, experimental stations, the keeping of farm accounts, and business methods generally in the running of the farm.

Second: More home-made manures and less of commercial fertilizers. The home manures have been neglected and wasted. The hay grown has been exported, but little has been returned to feed the exhausted soil save the annual application of temporary fertilizers to the potato field.

Third: More variety in crops grown; less of potatoes and more of wheat; the establishing of flouring mills with the latest improvements. More wheat can be grown to the acre in Aroostook than in any other section of the Union; and if it could be ground by western methods there would be no flour imported into that county.

Fourth: More stock-raising, dairying, canning, growing of hardy small fruits, and particularly those things that supply the farmer's table and make him independent of foreign markets. Above all, modern methods in production, and old-fashioned methods of economy in the financial management of the farm.

Fifth: A more attractive home life to the boys and girls on the farm; less hours of manual labor and more plans and methods in the work; more efforts to keep the boys and girls from early drifting from the farm to the large cities, which are already overcrowded by those who seek to escape the old life of routine drudgery, where there is work all the time and no play.

Finally: The Aroostook farmer can truthfully say in the words of Pope, "If vain our toil, we ought to blame the culture, not the soil."

THE MARKET OUTLOOK FOR MAINE CROPS.

By JOHN J. FRYE, Portland.

Mr. President and Gentlemen: Another year its course has run, and finds us still working on nearly the same lines, with a steady improvement. This thought often comes to me. Are we doing our best? Are we lending a helping hand to the farmers? Are we doing for them all the good we can? In looking over our loved State we have need to feel proud of her and of our representative men who have helped make the laws of our United States and to-day are foremost in guiding the important questions of our country. While as a State we are not increasing in population as fast as some of the western states, yet I believe we are enough better in quality to make up for the difference. At our last dairymen's meeting Maine proved herself to be among the foremost states in her products of butter. How has it come about? It has not been the work of a day, it has been the persistent work of years. I was pleased at some of the questions asked by the butter makers, especially by one young lady. She asked the judge, "Will you please tell me what is the trouble with my butter?" He looked up with a smile and said, "How many cows have you?" "Two," was her reply. "How often do you churn?" "Once a week," was her answer. "Madam," he said, "the cream that was six or seven days old gave the off flavor to your butter, but let them give you fresh cream so you can churn once a day or every other day and you will make as good butter as there is here." A ray of joy shone over her face. She had received the encouraging word. Gentlemen, I believe that there is many a wife, mother, and perhaps daughter that rises early in the morning and toils hard all day, that never gets the encouraging word that makes life's work easy and brings sunshine to the home. I believe that many of our boys and girls that have left and gone to the city would be on the farm to-day if a little more pains had been taken to fix up the home, and make it attractive.

But what is the market outlook? We visit the market and find potatoes selling for 60 cents per bushel by the carload, a price probably never before realized with so large a crop.

Onions, $2.00 per barrel; yellow eyed beans, $1.60 per bushel; pea beans, $1.40 per bushel; eggs, 30 to 32 cents a dozen; apples, 3 to 4 dollars per barrel; butter, fancy, 28 and 30 cents, common, 18 to 25; cabbage, $12 per ton; squash, $25 per ton; turkeys, 15 to 18 cents; chickens, 12 to 14 cents; hay, $8 to $10 per ton, a very low price, but there are indications that quite a tonnage will be shipped out during the remainder of the winter and spring. They tell us that the most of the poultry is shipped in from the West, and the beans nearly all from New York. Gentlemen, this should not be. I believe we can produce these in our own State and at a profit, and keep our money at home. It is also true of grain. We want to raise it and when the farmer goes to market with his butter, eggs, apples and other products, he can take the money home and distribute some of it among the family and make them feel there is something to live for. The Grand Trunk Railroad tell us that they have brought to our markets 64,216 barrels of flour, 2,322,832 bushels of corn (1,322,000 distributed in Maine), 4,658,059 bushels oats (1,000,-000 sold in Maine) 3,181,713 bushels of wheat, and 149,462 bushels of barley, nearly double that of last year; also 167,728 bushels of buckwheat; 309,926 bushels rye; 1,109,127 bushels peas. The barley has been shipped to New Hampshire and Massachusetts.

What are our own railroads doing for us, the Maine Central, the B. & A., and their branches? They have stimulated the agricultural interests, the lumber trade, and manufacturing, and have given us first-class passenger accommodations.

We have in Aroostook county alone 4,400,000 acres, and it is a question whether to-day there are 800,000 acres taken up by farmers, probably not over 400,000 acres cleared. This leaves nine-tenths of the county uncleared. The population of the county in 1890 was less than 50,000. The growth by decades is as follows: Beginning at 1830, 4,000; 1840, 9,000; 1850, 12,000; 1860, 19,000; 1870, 29,000; 1880, 42,000; 1890, 49,500, and it is now estimated at 63,000 and good judges say 65,000. The crop of potatoes in 1897 was about 9,000,000 bushels, 2,100,000 bushels made into 8,000 tons of starch, 1,500,000 consumed in the county and reserved for seed, 5,400,000 bushels shipped out of the State. Farmers are producing more wheat than in years gone by. We have several rolling-mills that are doing a good business and turning out good flour. Other mills are talked of and will probably be built. There is an increased demand for cedar in various forms, for ties, posts and poles, and at firmer prices. There is an increased demand for pulp wood. There are indications that stock raising is on the increase. Canada ships to New York market 250,000 sheep annually in the face of a high duty. It would seem that Maine, with no duty, could and should compete for this trade.

Altogether, the signs of prosperity for Maine are very satisfactory. We need not overlook the new Washington County Railroad, another line that will bring to our markets gold, silver and brass with her other products. I am glad for her. She has worked hard for twenty years in the interest of her people, and to-day they can ride in a palace car from her sea coast to the far West.

TILLAGE AS A PRODUCER OF CROPS.

By JOHN M. WINSLOW, Nobleboro.

While tillage alone will not go very far towards producing crops, without some stimulus, yet it is of great importance to thoroughly till the soil that we undertake to bring into better condition, as the tillage is worth as much as the dressing we use. I am convinced of this from observations on my own farm. I have in mind a piece of land of about two acres, that I plowed, dressed heavily, and with but little harrowing laid down to grass. The result was that I did not get a crop of grass to amount to anything until I plowed and cultivated it thoroughly.

Tillage may be made a great producer of crops if we use in connection therewith the means we have at hand. After having tilled and dressed a piece of land (I mean, of course, thorough tillage), if we sow clover and then do not let our land lay too long before we plow it again, we may get good crops with less dressing than we do when we crop the land too many years before breaking, as the tillage we give the land, together with the decaying sod, will add much available plant food for our crops. The tillage we may do this year will not answer three or four years hence.

I believe that cutting two crops of clover hay and then plowing and thoroughly tilling and reseeding is one of the best ways to increase the production of the farm. We are not apt to follow this, I have not strictly, myself, yet I do believe it the proper thing to do, from my own observations. We do not like to plow a piece of land that is bearing a good crop of hay, when we have land much poorer. The inclination is to plow the poorest every time. I believe as a rule farmers do not harrow their land enough, more especially for hoed crops. It is of great importance that the land be thoroughly pulverized, as in so doing you break up the lumps and liberate much plant food, which would not otherwise be available, and so we should not feel it a waste of time to thoroughly harrow our land before planting, but feel it to be economy to do so. Economy is not in hoarding up money. It is, as has been said many times, the wise expenditure of money, and a farmer's time is money and it is not enough to know and to say "I work all the time," but we must see to it that our time as money is wisely expended in our farm labor.

Governor Hoard has said that agriculture is one of the mighty forces of this great national life; its prosperity means community, state and national health; its decay means community, state and national ill health and degeneracy, therefore the highest patriotism is involved in every effort from the farmer to the National Congress that shall promote and improve the condition of our agriculture and enrich our understanding of farm problems and principles. The problem of tillage is easily worked out by any farmer if he will try. It will take but a few years to show the advantage of thorough tillage on any farm if the farmer will but note the difference between good and thorough cultivation and poor or but little cultivation. Farming is a business that ought to grow like any other business if well managed. If a farmer passes from one decade to another and keeps the same amount of stock or less he is not managing the business rightly unless his farm is up to the limit of cultivation. Stir the ground thoroughly and stir often, is one of the things for us to keep in mind.

I might dwell at length on the clover plant as our stronghold, together with thorough cultivation, but there is no need of my talking on this matter when you have in the Maine report of 1897, page 246, the able lecture of Mr. Terry on clover growing. I would recommend to the farmers of the State to read his lecture at least every spring. We do not always get clover here in this State but with me it is as safe as any crop I plant.

OUR LIVE STOCK AND ITS VALUE TO THE STATE.

By John F. Talbot, Andover.

Mr. President; Gentlemen: The subject which has been given me by the secretary, "Our Live Stock and Its Value to the State," is one that deals largely with statistics, which, on almost any subject under discussion, are not easily remembered and consequently are uninteresting to the average listener. However true this may be, by the farmers of Maine this subject may well be considered and carefully studied, in relation to the facts these figures suggest, because it comes so close to their interests as farmers. I hope to present these figures (which I have obtained from the reports of the assessors of the different towns to the State assessors) in such a way that they will at least arouse interest enough to cause more or less personal study of this matter.

The total number of farm animals, or rather beef animals, as given by the assessors, is 255,859. Of this number 137,444, or 53 per cent are cows, 8,898, or 3 per cent, are oxen, 26,642, or 10 per cent, are three-year-olds, 40,621, or 15 per cent, are two-year-olds, and 42,254, or 16 per cent, are one-year-olds. I have not carried this out very closely as to fractions. While these figures indicate a gain as compared with the previous year, still in each succeeding class the number is less. For instance, there are not so many two-year-olds this year as there were yearlings last year, by 2,973; not so many three-year-olds as two-year-olds last year, by 11,588; not so many oxen by 1,425; and not so many cows by 4,078.

We also find that the counties making gains in the number of beef animals are as follows:

Androscoggin	383
Hancock	87
Kennebec	219
Knox	10
Lincoln	225
Oxford	93
Sagadahoc	283

Waldo	370
York	770
Total gain	2,440

COUNTIES LOSING.

Aroostook	118
Cumberland	325
Franklin	159
Penobscot	28
Piscataquis	30
Washington	134
Somerset	227
Total loss	1,021

Three counties have gained in the number of cows,—Hancock, 94, Lincoln, 143, and York, 15; two counties in oxen, Androscoggin, 28, and Sagadahoc, 7. All the counties except Washington have gained in three-year-olds. The counties losing in two-year-olds are Aroostook, Hancock, Lincoln, Piscataquis, Somerset, and Washington. Those losing in one-year-olds are Kennebec, Knox, Lincoln, Oxford, Penobscot, Piscataquis, Somerset and Waldo.

Now there are questions that naturally arise from these figures. First, in regard to cows: Do the facts go to prove that by the aid of science, in the way of the Babcock test, discussions at the farmers' institutes, and through the press and the monthly bulletins, the farmer is weeding out the poor cows, and keeping a much better quality of animals, and thereby keeping up the products of the dairy, perhaps exceeding them?

As regards oxen, farmers have found it more agreeable, at least, to work with horses, and for this reason horses have superseded oxen. As to whether it is profitable in all locations, is a question requiring much thought. It is rather surprising to notice the counties that are gaining or losing in numbers of young stock. We have considered such counties as Franklin, Somerset, Penobscot, Piscataquis and Oxford good grazing land, and yet these counties have lost in numbers while some nearer the coast have gained. Why is this change? Have the pastures been allowed to grow up to bushes because of the scarcity of sheep to keep the sprouts down, and the clearing of new land gone out of fashion?

The summing up of all these facts goes to show that there were not as many head of cattle upon the farms in 1898 as there were in 1880, by 78,562. This is partly counterbalanced by the excess of horses, there being 44,744 more horses in 1898 than in 1880. Still, with these added, there is a loss of 33,818 from the year 1880, or 10 per cent. We find, further, that the average number of neat cattle on the 65,000 farms in Maine is a little less than four. It is well, perhaps, to inquire if the same facts exist in other states. The report of the secretary of agriculture at Washington shows that in the United States there are seven and one-half millions less than in 1890.

Coming in close connection with this subject is the keeping up of the fertility of the soil; the converting of those coarse fodders and less marketable grasses into cash or its equivalent; and, what is another important matter, the question of whether the average farmer can purchase commercial fertilizers at a profit, in place of keeping young stock. Science has stepped in to assist the farmer in his endeavor to make a living upon the farm. The Experiment Station in our own State is doing a good work along the line of advising farmers in regard to the value of the different feeding stuffs, and what is considered a balanced ration for animals designed for the dairy or for beef. No farmer need go by guess if he will use these prescriptions, coupled with common sense and good judgment. Animals can be matured earlier by breeding and feeding along scientific lines, and thus give to the farmer quicker returns for his labor. In this way, as along other lines, our live stock is of great value to the State, in a financial point of view. We find that there is a constant demand for our best cows and heifers to supply the demands of the markets of other states; and whereas the score of our dairy products is not as high as is that of other states, it is a fact that the milk from the cows raised in our State, produced in other states, helps in a large measure to keep the standard of those states up to its level.

Again, our experiment stations have been of great help to the farmer, in regard to the value of stock, for we find that the average price of cows has increased from $22.14 in 1890 to $27.45, and that of other cattle from $15.21 to $20.92, a difference of $5.71. We do not apprehend that this was brought about because of scarcity in supply, but because of excellence of product, through more intellectual breeding and feeding. While the report shows that we have imported many cattle,—$2,589,857 worth, we have exported $36,357,451 worth, a difference of $33,767,594 in favor of our export trade. If we take all the animals fed by the farmers we find a balance in exports of $41,283,006.

As another benefit to the farmer in the raising of stock to keep up the fertility of his farm, we have the silo, as a preservative of food. In this State of long winters, while formerly the young stock just barely held their own, or, we might say, barely lived through the winter, now they have a more succulent food, or summer condition, and return to the farmer a good market for his corn stover, which used to adorn his fields and manure piles in the winter, unfit for food, and a source of trouble to the plow and cultivator.

We consider the live stock interests of the State of such importance that the Board of Agriculture should try to impress upon the farmers through the bulletins and institutes the benefits to be derived from an increased attention to this industry; for those who are so situated as to engage in dairying to good advantage, the raising of stock for the dairy; for those who are not so situated, other lines of stock raising.

DEVELOPING HOME MARKETS.

By W. H. Snow, Milo.

In the matter of seeking his fortune, or bettering his condition financially, man has, as a rule, been a rover. Distance lends enchantment to the view, and man is apt, in the struggle for wealth, to take long distance chances. This spirit of adventure has, no doubt, led in many instances to success, and as often to failure. The reality is seldom the equal of what fancy has painted it, and hence failure sits in the seat where success was to have been crowned. Such has been the history of many who went to the gold fields in the years when rumor painted her most fanciful pictures of fortunes to be gained in a day. Not only is man as a rule more or less adventurous, but at the same time he is averse to patient plodding to secure his desire in life. We as a rule try to cover distances by a single bound, that should require a somewhat protracted effort of locomotion, and so when chance holds out to us rosy inducements we are apt to take it, rather than go slower and surer. I am here reminded of the Irishman who had heard in his country, that fortunes could be picked up in this country easily, and that money was strewed around on the bosom of Mother Earth, and who on landing discovered lying on the ground a silver half dollar. Pat. looked at it for a moment, and only for a moment, and said, "I'll not bother to pick you up, but will go where they're thicker." A great many of us are like Pat. and neglect the small opportunities lying within our reach, and are searching for the place where they lie thicker. One difficulty to-day with the small farmer is, that having been driven out of the general markets by the large producers of the West, he has not tried to create or open up a market for the products of his labor at home. In every large village there are hundreds of consumers, who will buy products of the farm and dairy, and prefer to buy them fresh from the hand of the raiser, rather than at second-hand, from the local marketman. I know a man who a short time ago lived in my town, and who possessed a little house and two acres of sandy land, which formerly was a part of a farm that for years had not been self-supporting, and yet, with patient toil and industry, although a man of seventy years, he made enough from early gardening to support himself and a small family, one item of his products being thirty bushels of green peas which he sold at his door for one dollar per bushel. I know men who live near large towns who have turned a neat amount in the sale of pure spring water, to the residents thereof. To be sure everybody doesn't possess a spring of water, the contents of which may be sold, but I speak of it to call attention to the variety of ways open to the industrious by which he may travel toward the goal of his desire, to wit, an honorable living.

I call to mind at this time a man who has made a failure in a large business venture where success seemed fairly certain, so much so that he left his farm to engage in it, but is now making a success in supplying the home market with milk. By dint of energy and hard work he has opened up a good market and has made a milkman so necessary in that town that should he go out of the business his route would be quickly covered.

Some less than a year ago I was induced to furnish milk for quite a large number of families in a new town which had grown up at the foot of Schoodic lake in my county and about six miles from my place. I went there with a few gallons at first, but soon found that I needed more cows to furnish all that I had a market for. I added several cows to my small herd, and still sell all the milk we have to spare. I visit the town daily and my patrons now ask me to furnish them with butter, fresh eggs, poultry and vegetables, which I have done to a limited extent, and shall do another season more fully.

Now, then, this market has been there for several years and nobody seemed to care to make the effort to furnish it, and I was in doubt about success when I began.

Most men proportion success according to the size of their accumulations, but my idea of real success in life is to live well but economically, be endowed with good health, and a disposition to work, accumulate sufficient to meet my obligations, and owe no man, and to educate my children. If opportunity, aided by thrift, shall win for us a large fortune, well and good; but at all events we may win certain success, and the one idea I wish to suggest, if no more, is that lying all about us are the opportunities to succeed if we will but lay hold of them.

SMALL FRUITS.

By T. E. Skolfield.

The subject of small fruits for my vicinity is an important one, and it seems as though something should be said or done to encourage us to grow more of them. Summer people coming to our town demand a large lot of fresh summer fruits,—strawberries, raspberries and blackberries. With the exception of strawberries, I do not know that a single quart of berries is raised especially for them. Our fruit is a little later than the western fruit, and can be taken from the vines and delivered to them fresh at good prices. I was talking with Mr. Luce on the subject of strawberries, and he told me what he got a box, and it was just about half what they are worth in my town. In regard to varieties of strawberries, I notice the seedsmen are propagating a late variety which I think will be very profitable. I do not remember the name. The most of our strawberries come a little early. It is very difficult in many sections to raise strawberries. It needs a deep, mellow soil, and it should be a soil that will not dry up in these short droughts which we have in summer. Last summer one of my neighbors had about a quarter of an acre, and the first of June he never had a better looking lot. One year he took $250 worth from a piece no larger, but this year it became dry about the first of July and he did not get one-fourth as many. One man who is very successful sets them out in grain. He sows the grain and then sets out the strawberry vines and lets them go, does not do anything more to them. The next year he picks the berries and he hardly ever fails to get a crop. But his ground is rather moist, and that is the reason, perhaps, why he is so successful. He gets from twelve to fifteen cents a box for all the strawberries he raises. I do not know of any one who raises raspberries and blackberries, but we have an excellent market for them. There is a kind of raspberry called the red cap that grows very rapidly, and is an excellent variety.

SHEEP HUSBANDRY, AND ITS IMPORTANCE TO THE FARMERS OF MAINE.

By S. H. Goodwin.

Mr. President; Gentlemen of the Board: In the limited time which I have had since I received notice that I was desired to say something on this subject, I have had no time for the preparation of a paper, much as I regret it. I also regret that at this late hour I shall not be able to present this great question to you in the manner in which it should be presented, and which its importance demands. Perhaps the importance of sheep husbandry to the farmers of Maine can be illustrated very briefly by reference to some statistics which I have found this morning. I find that in 1820, in what was termed the "Survey of Maine" the sheep were not enumerated. The first census which we have was in 1840, at which time there were 649,261 sheep in the State, or 129 sheep to each 100 inhabitants. If I mistake not, that is the largest number of sheep that has ever been in the State. In 1850 Somerset county had 60,024, the largest number in any county, which position she has since maintained. The State had 451,577, or 77 sheep to each 100 inhabitants. In 1860 there were 76,001 sheep in Somerset county, and 452,472 in the State, or 72 to each 100 inhabitants. In 1870, 78,400 in Somerset county and 434,666 in the State, or 69 to each 100 inhabitants. A conservative estimate of the number of sheep in Somerset county in 1880 would be 100,000. At that time the State had in round numbers 500,000, the census showing 565,918. The number of sheep to each 100 inhabitants was 87. From 1880 to 1897 there was a steady decrease, and in 1897 Somerset county had only 37,243, and the State 227,178, or 34 to each 100 inhabitants. The loss to Somerset county from 1880 to 1897 was 62,757, which, at $3.00 a head, which perhaps would be a fair estimate, would amount to nearly $200,000, a loss which that county could not well sustain, and which, in my judgment, never has been retrieved by any other business. The men who went out of that business have never gone into any other business to get that money back, to any great extent. The State had 500,000 sheep in 1880 and 227,178 in 1897, the loss in that time amounting to 272,822 sheep, which at $3.00 a head would be worth $818,466. Thus we see that the approximate loss in that period of years to the State was $800,000, and to Somerset county, $200,000. I am aware that some of the men who went out of the sheep business engaged in other industries, in other lines of farming, which may have brought a part of this money back, but it is my belief that quite a large percentage of that was a total loss to the State. The question comes up whether it would not be wise and beneficial to try to get back a part of the loss which we have sustained. I will say that there was a gain from 1897 to 1898, according to the assessors' reports, of 11,000 in the State and about 1,000 in our county, showing, as I believe, a move in the right direction, and bearing out the statement which I made two years ago that I thought the sheep industry was, or would be, on the increase. I will try to give you some of the reasons why I believe that we might engage in that industry at this time. A point was brought to my attention by the brother from Cumberland, in regard to the number of sheep taken to the New York market from Canada, on which the duty must be paid; and it does seem as though we ought to be able, at least, to compete with Canada, they having to pay the duty.

Stock husbandry in some form must be the basis of our agriculture. That has been so well brought out by Secretary McKeen that I will not dwell upon it. And I believe that in certain portions of the State sheep husbandry should be encouraged by this Board, and that the farmers should take hold of it, because all sections of the State are not so situated that they can go into the business of dairying with profit. In a hilly town, and where there are abandoned farms, the lands are cheap and they are well adapted to the raising of sheep, and I know of no reason why, with hay at the low price which prevails now, and with the fact that you can produce upon the farm all that the sheep need, you could not make as much money, relatively, as compared with other lines of stock husbandry, as was made back in 1880 when we had our large flocks. I believe that the farms should produce the feed for the animals, just as far as possible; in other words, they should be self-sustaining. Of course there are exceptions. Mr. Ellis has alluded to a practice in our county. He says he raises sweet corn, and with the cash which he receives for that he buys other feeds, but I fear that there are many men in Maine who are buying the western feeds and have no definite idea as to where the money is to come from with which to buy them. In other words, they are not producing the crops for their animals which they should. Now sheep can be cheaply kept. That is to say, there are certain kinds of produce which are not so useful for other stock which make the best of feed for sheep. There are hundreds, and I might almost say thousands, of tons of hay which would make an excellent feed for sheep that would not be fit to feed to dairy cows. In the institutes which were held in our county the lecturer told us that, in feeding his flocks of sheep for mutton, where he fed especially for flavor, the weeds, especially pig weeds, produced the most delightful flavor, though it was not profitable for him to raise them as he could do better with turnips. Now we might rid the roadsides, fields and pastures of many of these worthless weeds by cutting them early and feeding them to sheep, and it would be money a great deal better expended, in my judgment, than in the purchase of western feeds. I would say that clover makes one of the very best of feeds for sheep, as you all know, and the growing of clover should be encouraged. Sheep will eat kale or wild mustard gladly, and golden-rod makes an excellent feed if it is cut early, as well as many other weeds, and small bushes. In fact, the best hay for the Boston market, herdsgrass, is the poorest hay for sheep. Turnips make an important article of food for sheep in England, and, as we have been assured by the lecturer in our county, and others, they are an ideal feed for sheep. Certainly they can be raised cheaply here. Rape is another valuable food for sheep. I am informed by Mr. Adams of Bowdoin that he has recently been in the town of Brooks, and that Mr. Reynolds of that town is practicing the feeding of rape. I think we ought to look into this matter of feeding rape. It is a very cheap food for sheep from October 1st to December 15th, and it is said that they will actually gain faster upon that than upon any grain food. So that in feeding sheep we are not obliged to depend upon grain, although if we choose to raise grain there is no animal that we can feed it to with greater profit. We can thresh it or feed it unthreshed, with good results.

The buildings for housing sheep cost but a trifle. We do not need expensive buildings. These old barns on the abandoned farms are all right. Give them plenty of air, and a good dry place, and it is all right. They do not require that steady, persistent, unremitting care that cows do, or even poultry. They must have care, and of course the more you give them the greater will be the profit, but it is not necessary to give them that unremitting care that dairy cows need.

There is another reason why this industry is important. The lambs and the wool are cash products anywhere and everywhere. They will always sell at a fair price. We understand that wool is low, comparatively, and yet I noticed in the paper that one of our merchants in Skowhegan took an order for a number of pounds to go to Boston at 20 cents, and with mutton or lamb selling at the price which it brings, it seems to me that the cash net income from sheep now is sufficient to induce our young men, and our older ones, to go into the business. I think that the business could be enlarged in the counties where these abandoned farms are, especially the hilly counties which are at quite a distance from butter factories. Also a small flock of sheep could be kept to advantage, many times, in connection with the dairy.

I ask you to carry home with you the ideas expressed by the speaker of the forenoon, and let his eloquence ring in your ears rather than any broken, imperfect remarks of mine. Certainly he told a great deal of truth in a short time. He asks the question as to what we should do with the dog. My answer to that is that I think the present law is working fairly well. It certainly is a great improvement over the old one, and in many cases where the dogs have destroyed the flocks, or partially destroyed them, I have heard the law commended by those who owned the sheep. We are not obliged to look to the owners of the dogs to get a recompense for the sheep, and hence we are able to get pay for the sheep injured by dogs when formerly it was very difficult, because the owners might be without means. The fence question is not a difficult one to solve. I will not go into it at this time.

The raising of sheep to be sold as mutton at three years of age has probably gone by never to return in this State, but the raising of what some term hot-house lambs is being carried on to good advantage. Perhaps the term hot-house lambs, strictly applied, would not be so applicable as early lambs. Mr. Reynolds of Brooks, was selling his lambs last spring at from $5 to $8 a head in April, and was feeling fairly well satisfied.

It seems to me that this question is one to which we should turn our attention, and that we should give it encouragement, as far as the funds of the Board can be used for that purpose.

Mr. Chas. Hichborn of Augusta, President of the Board of Trade, was now presented to the Board, and extended an invitation for the next dairy conference to be held in Augusta.

On motion, voted, that this invitation be referred to the executive committee for their consideration in determining the location of the next dairy conference.

ECONOMIC STOCK FEEDING.

By L. O. Straw, Newfield.

Mr. President, and Gentlemen of the Board:

To produce the most for the least invested is the avenue to economical stock feeding, and when produced, to feed the same so that we may get in return the best possible financial result. In our own State, as in others, the same rule will not apply to crop-raising on all farms, some of our farms being distinctly hay farms, while others are suited to both hay and other crops, and a fair interpretation of the subject assigned me would be: obtaining the most satisfactory results with the least possible expenditure.

This, as it seems to me, does not confine itself wholly to a consideration of the dealing out of foods when stored and ready for use, but relates to economy in raising them as well. To produce stock fodders at a minimum cost is an all important factor, that the balance may be on the right side of the ledger at the closing of the feeding period. And I find it more of a study how to produce cheaply than how to feed my products economically.

I believe there is more loss with many farmers by poor selection in adapting soil to crop, and the care of same, than in any other way. To continue the cropping of a piece of land in the light of repeated failures should awaken the farmer to his folly and be a sign-board to those spots where, with a few days with spade and axe, the land under his footsteps will blossom as the rose.

The best trees in the forest, the most productive fruit trees on the farm and the most desirable vegetables in the garden are found in the richest soil, made fertile by care, and fertilization, showing the wisdom in selecting such lands upon which to raise a crop rather than soils upon which would not grow the value of the seed used in planting it. This is a very important item in the production of profitable crops.

No farm practice yields more beneficial results than the careful and intelligent selection of seed for sowing. Judicious planters look carefully at the quality of their seed, paying a high price for the best obtainable article.

The complete failure in my locality of the sweet corn crop for two consecutive years is sufficient to awaken one to the folly of using poor seed. Buy early, buy the best, and test its germinating powers before risking the year's crop. Select large, plump seeds, and a correspondingly large stalk and ear will be the outgrowth.

Thorough cultivation, the best seed obtainable, planted in good and well prepared soil, and the details which follow carefully looked after to the time of harvesting, are but the beginning of economic stock feeding.

A light, warm and well ventilated stable, with proper sanitary arrangements, coupled with the free use of card and brush, are all important in the saving of feed, and lessen the cost of stock supplies.

More thought and scientific investigation should be given and practiced in the feeding of farm animals. And the meadow or fresh hay condemned by so many is to-day, in many parts of the State, an indispensable ingredient in the line of stock fodder, and when used with corn stover and fed to milch cows, the output at the pail will equal that when the best timothy hay is fed; and when the cost of the hay is only for the cutting, producing the same yearly without expense, much of our land now bearing a thrifty growth of alders could be made to produce annually a valuable crop.

Corn stover, the companion of meadow hay in the coarse fodder ration, is that part of the corn plant remaining after the mature ears have been removed, including the entire stock, leaves and husks. In 1895, the farmers of the United States planted about eighty-two millions acres of land with Indian corn, which would yield about ninety millions tons of field-cured corn stover. Allowing this stover to have the average feeding value, and to be properly cured and housed, it would feed all the milch cows, oxen and other cattle for approximately one-fourth to one-third of a year. It is, therefore, of the utmost importance that the farmer should have a thorough knowledge of the composition and practical feeding value of this prime fodder stuff. And yet, in view of the fact that the analysis of corn stover is within a point or two in all its component parts of the best timothy hay, farmers let acres of this valuable feeding material remain in the field and waste. And when, too, this same stock so valuable as a fodder plant is only one-half of the ultimate value of the kernel planted in good soil, certainly it seems the grossest error for the farmers in Maine to raise so little of this valuable plant and buy so much in the West.

So slight is the difference in the money obtained from the feeding of many of the leading concentrated feeding stuffs, such as the glutens, cottonseed meal and the like, that the age of the oldest inhabitant would be too few in years to notice any great difference in his bank account. A ten days' experiment in this line just completed, first with bran and cob meal, then bran, gluten and cob meal, then bran, cottonseed meal and cob meal, showed the slightest difference in favor of the gluten mixture, and that cob meal and bran, pound for pound, gave better results than the cottonseed ration.

No matter what science may proclaim, the only question for the farmers to consider is, How can I conduct my farming interests so that I may secure the most profit for the labor bestowed? If a herd of dairy cows will produce as much cream by feeding a ration of cob meal and bran, as a ration of cottonseed meal and bran, pound for pound, then certainly it behooves us all to double the corn acreage and save the money paid for western grains and add it more judiciously to the fertility of the farm. In an experiment with the so-called balanced ration of cottonseed meal and bran, and sweet corn, ground cob and corn together, fed pound for pound, the latter proved practically as beneficial as the former, and it is my opinion and experience that as good results can be obtained from the feeding of bran and cob meal as a grain ration, with sweet corn fodder, meadow and timothy hay, in equal parts, as coarse fodder, as from others more highly concentrated. All of these feeds can be raised on the farm at minimum cost.

Extended experiments by Prof. Robertson have conclusively proven that silage can be substituted in part for the grain ration of milch cows without causing loss of flesh or lessening the production of milk, fifteen pounds of the silage to equal four pounds of the grain mixture.

In the light of repeated scientific experiments (and practical as well) in relation to feeding farm stock for profit, we can but conclude that nearly all the practically useful concentrated foods are raised on the farm, and come to us at the lowest possible cost.

A clear conception of whether we are feeding for cream, milk, or butter fat, is an important matter to be considered in feeding farm stock for profit. What would be an economical ration for putting fat on the back of an animal would not satisfy at the milkpail.

With my limited experience with the small profits realized from the farm, I firmly believe there is no royal road to wealth, and what little surplus there may be in the main comes from a saving of the odds and ends in the line of production. Not that we condemn the science of farming, for a wide-awake farmer can leave more to show to others that he has once lived than many in other walks of life. "Adorn and beautify the dwellings, surround them with twining vines or graceful plants, for there is no spot on earth so rude as not to be refined by their presence and none so adorned as not to be graced by their beauty and fragrance."

Bye and bye, when little by little he has arranged to his fancy, he can sit in the shade of his own vine and fig tree and rejoice that he lived to enjoy it. Not only will it be a comfort to him and his family, but those who pass that way will say he is a thrifty farmer, one that makes farming pay; an economical farmer, one that has "Diligently driven the plowshare of thought through the heavy soil of ignorance and thus prepared the mind for the growth of knowledge and wisdom, knowing full well that if he fail to sow he cannot reap."

THE FARMER AND EDUCATION.

By Dr. A. W. Harris.

Mr. President One gentleman who preceded me spoke of potato-raising as the most important agricultural pursuit; another seemed to value the breeding of sheep rather more highly; and several others would give dairying the first place. You will pardon me, then, in this body of specialists, if I decline to agree with any of these speakers, and claim that the most important product of the farm is the great body of bright boys and girls raised there. This conviction is my excuse for appearing before you again to talk about education. I have some fear that you may tire of hearing me again, on my old subject, but I shall present a phase of it, on which I have not spoken before. I need not say that I lay the greatest stress upon a technical education—agricultural education for the farmer, medical education for the doctor, legal education for the lawyer. The value of agricultural education for the farmer has been well illustrated in the discussions of to-day. It would seem that this value has been so often asserted, that no further need of assertion exists, but this is not so. One speaker said, he was talking about a very old subject when he talked of tillage, but that it was pertinent to talk of tillage until the land was tilled. It is allowable to talk of agricultural education, until the agriculturists are educated. I expected when we were lamenting the condition of Maine dairying, as compared with that of Vermont, that some one would remember that there are only seven students in the short course at Orono, while in the smaller State of Vermont there are fifty. If we believe that education is an important element of success in any pursuit; that, indeed, it is the greatest foundation of success, we will agree that a part of our trouble in butter making comes because we have not learned to value properly education for that business. When we come to value such education, it will be time to stop preaching technical education, but not before.

But technical education is not my theme. I wish to talk of the relation of the farmer to general education—the education, begun in the common school, carried farther in the high school, and completed in the college. In the first place, the farmer, more than most men, ought to have an especial interest in education, and in all its forms—in the education that the press brings, in the education that the school gives, in education as books furnish it—and for the reason that the farmer is to a great extent set off by himself in life. The business man, with his work in the city, is continually brought face to face with new problems, and whether he desires to think or not. his business forces him to deal with problems, the solution of which is in itself an education. But, though the farmer does not have education forced upon him, he still has the advantage of unusual opportunities for gaining it. He has time and leisure that seldom come to the business man. If he will keep abreast of the time, he must use his leisure in three ways: First, he must see to it that the agricultural population has the best possible schools; second, he must read papers, magazines, and books; third, he must make opportunities to meet, as often as may be, his fellow men. In other words, the farmer needs the best schools, the best publications, and the best societies, and among the last, I include religious societies, secret societies, and all others that stir up thought.

If this be true, one of the most important things in the farmer's life is the little red schoolhouse, which, although it has lost its color, still holds its name. The primary school in one sense is the most important part of the whole school system. It is important because it teaches the greatest number of pupils. A great many children never get beyond it. It needs careful attention more than any other school, for it is, ordinarily, in charge of the lowest paid teachers. I have a little boy in the primary school, and it is my observation that I am almost the only parent who is carefully watching the work of that school. I have discovered what seem to me defects, though I may be wrong in my judgment. One is this: pupils are promoted once a year. I wonder how many schools have the same rule. Perhaps this does not seem very important, but it may have this result. A boy who just fails to gain promotion must spend a whole year grinding over the same course. If promotion were made oftener perhaps he had lost only one-third or half of a year. A year out of a boy's life does not amount to much, we say, but in the end it is a year out of a man's life. I think it all important that the parents watch the primary school. There, more than anywhere else, there is danger that the work of the teachers may not have the most intelligent supervision and direction. If I only had the mothers here, I would like to say to them that they have no more important duty to their family than that of caring for the early education of the child. As the twig is bent so the tree is inclined. If a boy learns to hate school at the beginning, there is little chance that he will ever learn to love it. On the other hand if he lays a careful, thorough foundation in his first school days, he is very likely to go on making conquests, often way beyond the promise of his early achievements.

In most communities the child has a good chance, after getting out of the primary school, of enjoying the advantages of the secondary school. Parents do not question the advisability of allowing the child the secondary education, but it is worthy of note that a very large percentage never get into the high school. Those of you who see how, year by year, more education is demanded for success in life, can do nothing better in your own communities than to preach, in season and out of season, the advisability of boys sticking to the high school. Many a boy gets in a hurry, and leaves school to get into what he calls active life. In my opinion no greater mistake can be made than to hurry boys into money-making before they are ready for it; setting them to the use of the tools, with which they must earn their own living through life, before those tools are perfected. Men of experience, looking back upon their own mistakes ought to impress it upon the young men and young women, that nothing is lost by making haste slowly; by getting ready before they begin to run, by obtaining training before they essay to fight.

Last, let me say a word about the higher education; so-called, because it is built upon that which goes before, and is in some senses more important, because out of it comes most of the inspiration for the lower work. I trust that the farmers generally, have observed the trend of the times, and appreciate the fact that in these times we cannot shut ourselves into our own narrow line, even if we would. It is continually true that things started in one direction take a turn and go in another direction. Discoveries made in one industry, are shedding light, and sometimes their greatest light, in other industries. I was interested, several years ago, in the outcome of an invention for shearing sheep, which made use of a flexible spring for transmitting power. The success was not sufficient to bring the machine into great use, but it came to the attention of a dentist, and resulted in the motor with which we are all familiar, and is said to have made the fortune of a great dental manufacturer. It has certainly added enormously to the comfort of suffering humanity. Steel, invented for a particular purpose, has gone into every industry, until the cheapening of steel is almost as important to the farmer as to the maker of the battleship. Air was first compressed for use in mining, but has found its use in many industries. Its latest use is in torpedo boats, and for the dynamite gun. Years ago one of the most intelligent men in one of the most progressive of Connecticut towns, failing to see the interdependence of industries, succeeded in getting his fellow citizens to forbid a railroad, running through the town, because, as he said, it would do away with the use of horses, lower the demand for oats, and ruin the farmers. He thought the interest of the farmer and the railroad entirely opposed. Since then that town has paid hundreds of thousands of dollars to obtain a railroad, and incidentally, to prove that the interests of the farmer and the interests of the railroad are one.

And this I have said, to strengthen the statement that the farmer ought to be interested not in agricultural education only, nor in technical education only, but in all higher education. I would appeal to the farmers to see to it that the boy, who has the capacity for higher education, of whatever kind, be sent to the place where he can best get it. When the farms contribute to the upbuilding of other professions or pursuits, they are helping in one way to serve the best interests of the farm. Suffer an illustration. Why is there no attempt to give instruction relating to agriculture in the lower schools? It is needed. Most of the future farmers of the State will never get beyond the common school, and what they are to know of the sciences which underlie the practice of agriculture, they must get in the common schools. This has long been understood by the farmers. Why, then, is there so little success in getting agriculture taught in the schools which are chiefly controlled by the farmers? I know the principal reason. Would you expect much success in the teaching of languages by teachers who had never seen them taught? Would you expect Latin to be well taught by men who had been brought up to believe that Latin ought not to be studied? Why, then, should we expect success to result from an attempt to introduce the study of the sciences, and the application of those sciences to agriculture, under the teaching of instructors who know little about the sciences, and nothing of their application to agriculture? The first step toward the teaching of agriculture in the common school, is the preparation of teachers for the work, the introduction of courses attractive to teachers, in the agricultural colleges. I expect that the introduction of the Classical Course and the Latin-Scientific Course at Orono, will be seen in due time to be in the interest of agriculture, and not against it as some of the critics believe.

I must say one thing more. We talk a great deal about making money. One man said a good thing to-day when he told you that real economy consisted, not so much in getting money, as in spending it in the right way. Has it ever occurred to you that the men make the money, but most of it is spent by the women. Until the woman is taught how best to spend money, we have only half done our duty. I would introduce into the schools not only instruction to help the farmers in making money, but to help the women in spending it. I would give them ideas of how to do their cooking, and manage their houses, and explain the reasons lying back of the best practice.

Let the farmer cultivate his interest, in education of all kinds, and all grades, as the most promising instrument for the upbuilding of his industry, and the most hopeful avenue open to success to his children, an avenue with many branches, each to be commended as it is best adapted to the tastes and ability of the traveller.

The committee to which was referred the matter of legislation for the suppression of injurious weeds and insects reported that they had formulated the outlines for a bill which they would present to the Board, and recommend that the matter be referred to the executive committee, with instructions to draft a bill and present it to the legislature unless circumstances should arise which would seem to make it unwise.

On motion, voted, to accept the report of the committee, and to refer the matter to the executive committee, in accordance with the recommendations in said report.

The report of the finance committee was presented and accepted, and the committee discharged.

On motion, voted, that the secretary be instructed to furnish each member with a proper amount of stationery as soon as reasonably convenient.

Mr. FRYE—It has been suggested that the date of holding the dairy meeting be changed, on account of the exhibit of poultry and eggs. The thought was that if it could be held a month or so earlier we could get better poultry, and our object is to make a success of everything we take hold of.

Mr. TALBOT—Down at Portland I had an opportunity to see the butter scored. There was a chance on the cards for remarks, and if the judges did not like the flavor, one would say to the other, "What would you call that?" They would set it down as a barny flavor. They could not tell whether it was because the cows had been eating frozen grass or moldy fodder, or because of the time of year, when they were changing from grass to hay. If the low scoring of our butter is on account of the time of year, it would be to our advantage to change the time of holding the meeting.

Mr. LIGHT—Allow me to say as a practical creamery man, who has to do with handling cream in all conditions, that about the time of the dairy conference is the very worst time I have.

Mr. SKOLFIELD—Last year the dairy meeting was held at Portland, and we had as good a dairy meeting as was ever held, and the people of Portland would like to have it there again.

They say they could have a much better one, and also, if it should be an interstate meeting, the same as last year, it would be a more central place and the express would be some cheaper. We want the executive committee to take into consideration whether it would not be better to hold the meeting there next year. The people of Portland would be very glad to invite you there again, and I presume they will do so.

Mr. FRYE—I was greatly pleased with the result of our meeting, for the very reason that there were so few people who seemed to know much about the Board of Agriculture. In talking, even with the reporters, it seemed almost impossible to interest them at first, but after a little they seemed to warm up, and began to say, "Come again! Have this meeting here next year and we will show you what Portland can do for you." I would heartily coincide with the remarks of Brother Skolfield, and would extend an invitation for the Board to come there another year.

Voted that the thanks of the Board be extended to the Maine Central Railroad for reduced rates.

Voted to adjourn. Adjourned.

Statistical Tables of Agricultural Societies.

OFFICERS OF AGRICULTURAL SOCIETIES.

Name of Society.	President.	P. O. Address.	Secretary.	P. O. Address.	Treasurer.	P. O. Address.
Maine State Agricultural	Isaiah Pompilley	Lewiston	George H. Clark.	North Anson	E. G. Eveleth	Auburn.
Eastern Maine Fair Association	F. O. Beal	Bangor	Ezra L. Sterns	Bangor	S. Dean Benson	Bangor.
Maine State Pomological	W. M. Munson	Orono	Elijah Cook	Vassalboro	Chas. S. Pope	Manchester.
Androscoggin County	Lincoln Morrison	East Livermore	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	Jonathan Benn	Hodgdon	Ira J. Porter	Houlton	Ira J. Porter	Houlton.
Aroostook, North	J. W. Dudley	Mapleton	E. T. McGlauflin	So. Presque Isle	A. E. Irving	Presque Isle.
Aroostook, South	T. B. Bradford	Golden Ridge	Isaac Cushman	Sherman Mills	B. H. Towle	Sherman Mills.
Cumberland County	Alonzo Libby	Westbrook	Chas. H. Leighton	Cumberland Mills	Fred D. Scammon	Gorham.
Cumberland, North	Q. M. Chute	Harrison	J. Orin Ross	Edes Falls	James Thomes	Harrison.
Cumberland Farmers' Club	M. W. Pearson	Cumberland Cen.	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' Club	Ed. C. Walker	Bridgton	Fred C. Knight	Bridgton	Chas. A. Scribner	Bridgton.
Cumberland, New Gloucester and Danville	A. J. Haskell	Danville Junc.	F. W. Berry	New Gloucester	George C. Jordan	Upper Gloucester
Cumberland, Lake View Park	Arthur Dyer	Sebago	J. P. Fitch	East Sebago	J. P. Fitch	East Sebago.
Franklin County	W. Thornton	Chesterville	Reuben Hatch	Farmington	Geo. M. Currier	Farmington.
Franklin, North	Wilson C. Beal	Phillips	M. Sewall Kelley	Phillips	Sumner H. Beal	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 County Fair Association	A. W. Ellis	Ellsworth	H. F. Whitcomb.	Ellsworth	Henry J. Joy	Ellsworth.
Hancock, Eden	Wm. L. Alley	Eden	F. 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	J. W. Britton	East Pittston.
Knox, North	Moses Bowes	Union	George C. Hawes	Union	W. A. Bessey	Union.
Lincoln County	A. M. Card	Alna	A. I. Phelps	Damariscotta	Chas. M. Jones	Damariscotta.
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	Dean A. Ballard	Fryeburg	T. L. Eastman	Fryeburg	W. R. Tarbox	Fryeburg.
Oxford, Androscoggin Valley	J. W. Thompson.	Canton	H. T. Tirrell	Canton	D. W. Goding	East Peru.
Oxford, North	George O. Huse	Andover	John F. Talbot	Andover	Lewis C. Akers	Andover.
Penobscot County	Chas. E. Sutton	Stillwater	Geo. N. Holland	Hampden	H. W. Hammond.	Hampden.
Penobscot, Lee Union						
Penobscot, West.	Joel Richardson.	North Newport	F. E. Jewett	Exeter	F. E. Jewett	Exeter.
Penobscot, North	S. T. Mallett	South Springfield	D. B. Averill	Prentiss	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	J. F. Sprague	Monson	W. A. Bray	Monson	W. A. Bray	Monson.
Sagadahoc County	W. B. Kendall	Bowdoinham	W. S. Rogers	Topsham	L. E. Smith	Brunswick.
Sagahahoc, Richmond Farmers' and Mechanics' Club	S. E. Skillins	Richmond Corner	C. E. Dinslow	Richmond Corner	D. W. Alexander	Richmond.
Somerset County	Orlando Walker	Anson	J. F. Withee	Madison	C. A. Wilbur	Madison.
Somerset, East	S. H. Goodwin	St. Albans	J. A. Goodrich	W. Palmyra	Chas. Rowell	Hartland.
Somerset, Central	Warren Russell	Skowhegan	H. A. Archer	Skowhegan	A. R. Bixby	Skowhegan.
Somerset, New Portland	W. R. Richardson	N. New Portland	W. B. Clark	N. New Portland	Elmer Quint	N. New Portland.
Waldo and Penobscot	A. E. Nickerson	Swanville	E. H. Nealley	Monroe	F. L. Palmer	Monroe.
Waldo, West	L. C. Morse	Liberty	W. H. Moody	Liberty	L. F. Hurd	Liberty.
Waldo, North	Edwin Rand	Unity	E. B. Hunt	Unity	F. A. Bartlett	Unity.
Washington County	A. S. Farnsworth	West Pembroke	Sidney A. Wilder	West Pembroke	Clifton Laughlin	Pembroke.
Washington, North	Charles H. Yates	Princeton	Albert L. Jones	Princeton	Nathaniel Ripley	Princeton.
Washington, West	D. W. Campbell	Cherryfield	E. F. Allen	Columbia Falls	F. L. Allen	Columbia Falls.
Washington, Central	J. E. Vose	Machias	E. F. Barry	Machias	M. Gardner	Machias.
York County	Chas. Moses	Saco	S. S. Andrews	Biddeford	Geo. H. Boothby	Saco.
York, Buxton and Hollis	Alonzo Roberts	Buxton Center	A. J. Carll	Saco	F. J. Leavitt	Hollis.
York, Ramshackle Park	Leroy O. Straw	Newfield	Geo. E. Mitchell	West Newfield	David W. Libby	West Newfield.
York, Shapleigh and Acton	S. R. Thyng	Ross Corner	Fred K. Bodwell	Acton	Wm. P. Ferguson	Springvale.
York, Ossipee Valley Union	R. G. Pease	Cornish	H. Lorin Merrill	East Parsonsfield	Otis B. Churchill	N. Parsonsfield.
York, Springvale Agricultural and Mechanical Association	E. E. Goodwin	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.	Number of sheep.	Number of swine.	Number of poultry, (coops).
Androscoggin County	86	20	48	-	73	96	22	36	295	42	18	93
Androscoggin, Durham	15	1	7	-	11	22	6	4	51	20	-	13
Aroostook County	-	-	-	-	-	-	-	-	-	-	-	-
Aroostook, North	48	5	8	8	21	14	-	12	68	25	5	26
Aroostook, South	-	-	-	-	-	-	-	-	-	-	-	-
Cumberland County	47	21	44	2	40	125	14	25	271	36	40	184
Cumberland, North	17	-	-	5	16	34	4	30	89	13	15	8
Cumberland Farmers' Club	18	6	34	2	20	38	6	21	110	10	32	28
Cumberland, Gray Park Association	20	7	29	3	26	24	4	-	93	1	20	7
Cumberland, Bridgton Farmers' and Mechanics' Asso.	30	4	7	3	15	48	2	-	77	-	1	11
Cumberland, New Gloucester and Danville	42	2	-	11	71	10	2	19	115	25	10	8
Cumberland, Lake View Park	21	-	-	5	39	30	-	-	74	-	6	4
Franklin County	51	14	45	24	107	156	7	81	434	283	40	78
Franklin, North	46	9	17	9	42	180	8	30	295	102	21	4
Hancock County	25	2	2	4	69	22	-	-	99	17	23	7
Hancock, North	23	1	9	2	17	6	-	-	35	4	-	14
Hancock Fair Association	16	10	8	2	30	20	-	-	70	26	10	105
Hancock, Eden	-	2	3	1	2	-	-	-	8	-	11	9
Kennebec County	59	12	24	-	66	136	26	42	306	70	8	50
Kennebec, South	27	9	21	8	28	170	5	20	261	26	12	8
Kennebec, Pittston Agricultural & Trotting Park Asso.	29	11	11	6	21	102	6	40	197	29	21	33
Knox, North	26	2	10	7	36	82	7	17	147	30	4	22
Lincoln County	15	3	8	1	18	70	6	-	106	16	1	37
Oxford County	41	33	51	-	59	69	10	48	270	47	31	55
Oxford, Riverside Park Association	42	27	64	12	89	70	-	44	227	84	41	12
Oxford, West	70	8	22	4	19	92	8	25	178	23	32	117
Oxford, Androscoggin Valley	27	10	42	7	26	64	6	18	173	12	24	38
Oxford, North	21	9	12	-	20	20	6	18	85	41	20	26
Penobscot County	-	-	-	-	-	-	-	-	-	-	-	-

Penobscot, Lee Union	-	-	-	-	-	-	-	-	-	-	-	-
Penobscot, West	86	24	62	9	56	70	1	30	252	85	20	130
Penobscot, North	25	1	5	7	30	25	8	4	80	24	10	7
Penobscot, East Eddington Farmers' Club	22	2	-	4	30	6	-	4	46	32	-	12
Penobscot, Orrington	15	-	-	1	8	-	2	-	11	7	-	26
Piscataquis, East	-	-	-	-	-	-	-	-	-	-	-	-
Piscataquis, West	20	-	-	1	13	-	-	-	14	19	2	1
Sagadahoc County	24	29	104	-	101	92	4	75	405	57	39	20
Sagadahoc, Richmond Farmers' and Mechanics' Club	13	6	25	-	39	31	2	78	103	22	-	23
Somerset County	16	5	11	5	61	62	10	-	154	115	-	23
Somerset, East	-	-	-	-	-	-	-	-	-	-	-	-
Somerset, Central	-	-	-	-	-	-	-	-	-	-	-	-
Somerset, New Portland	28	-	1	3	18	6	-	-	28	-	4	-
Waldo and Penobscot	36	18	16	3	43	53	14	48	195	52	6	51
Waldo, North	31	4	-	-	14	24	6	-	48	29	-	3
Waldo, West	-	-	-	-	-	-	-	-	-	-	-	-
Washington County	39	4	21	-	39	8	-	18	90	36	2	21
Washington, North	13	-	-	1	6	-	-	-	7	1	-	2
Washington, West	50	11	20	-	22	20	2	-	75	29	25	82
Washington, Central	-	-	-	-	-	-	-	-	-	-	-	-
York County	-	-	-	-		-	-	-	-	-	-	-
York, Buxton and Hollis	-	-	-	-	-	-	-	-	-	-	-	-
York, Ramshackle Park	21	1	2	2	8	46	6	8	73	-	-	-
York, Shapleigh and Acton	16	-	-	7	20	147	10	-	184	12	1	36
York, Ossipee Valley Union	24	10	24	5	23	172	4	-	238	31	3	31
York, Springvale Agricultural and Mechanical Asso.	13	12	24	-	10	130	14	-	190	-	-	-
York, North Berwick Agricultural Association	60	8	20	6	40	100	-	24	198	30	25	-

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	$20 00	$9 00	$10 00	$10 00	$9 00	$10 00	$12 00	$42 00	$27 00
Androscoggin, Durham	-	-	-	-	3 00	3 00	-	2 00	-
Aroostook County	-	-	-	-	-	-	-	-	-
Aroostook, North	-	3 25	1 50	3 25	-	1 75	-	15 00	13 00
Aroostook, South	-	-	-	-	-	-	-	-	-
Cumberland County	14 00	20 00	-	-	25 00	20 00	-	15 00	32 00
Cumberland, North	-	-	-	-	-	-	3 00	-	42 00
Cumberland Farmers' Club	5 00	3 00	-	-	-	5 00	-	14 50	-
Cumberland, Gray Park Association	-	3 00	-	-	5 00	15 00	8 00	1 00	8 00
Cumberland, Bridgton Farmers' and Mechanics' Association	-	-	-	-	6 00	5 00	5 00	3 00	28 00
Cumberland, New Gloucester and Danville	5 00	5 00	-	-	5 00	8 00	8 00	10 50	8 00
Cumberland, Lake View Park	-	3 00	-	-	3 00	6 00	3 00	8 00	19 00
Franklin County	16 50	6 00	4 00	3 50	6 00	15 00	10 00	21 50	15 00
Franklin, North	9 75	5 00	-	2 00	-	3 50	5 00	10 00	6 00
Hancock County	12 00	3 00	-	3 00	-	-	4 00	20 00	-
Hancock, North	-	1 50	-	1 50	-	2 25	-	3 25	11 50
Hancock Fair Association	15 50	3 50	-	-	-	-	-	13 00	20 00
Hancock, Eden	-	-	-	-	-	-	-	-	-
Kennebec County	45 00	34 00	-	8 00	10 00	10 00	6 00	11 50	18 00
Kennebec, South	7 00	3 75	2 50	-	1 50	3 50	3 75	5 50	5 25
Kennebec, Pittston Agricultural and Trotting Park Association	3 00	3 00	2 00	-	8 00	3 00	-	13 00	-
Knox, North	5 00	-	-	-	3 00	2 50	4 00	10 50	25 00
Lincoln County	3 00	4 50	-	3 00	-	11 00	-	6 75	-
Oxford County	38 00	27 00	-	-	-	35 00	-	54 00	69 00
Oxford, Riverside Park Association	6 00	6 00	-	-	-	25 00	-	13 92	38 00
Oxford, West	-	6 00	9 00	9 00	6 00	25 00	7 00	9 00	29 00
Oxford, Androscoggin Valley	17 00	7 00	-	-	-	8 00	6 00	11 00	6 90
Oxford, North	-	5 00	7 00	-	-	10 00	-	15 00	34 00
Penobscot County	-	-	-	-	-	-	-	-	-

Penobscot, Lee Union	-	-	-	-	-	-	-	-	-
Penobscot, West	15 00	11 00	4 00	3 00	5 00	10 00	10 00	14 00	25 00
Penobscot, North	-	-	-	3 50	-	7 00	-	13 00	4 50
Penobscot, East Eddington Farmers' Club	-	-	-	1 50	-	2 50	-	2 50	7 00
Penobscot, Orrington	-	-	-	2 00	-	3 00	-	4 50	8 00
Piscataquis, East	-	-	-	-	-	-	-	-	-
Piscataquis, West	-	-	-	-	1 00	1 50	1 00	50	16 00
Sagadahoc County	11 00	10 00	-	-	8 00	10 00	-	18 00	28 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	75	90	75	1 15	-	-	-	1 60	8 75
Somerset County	2 00	3 00	-	-	-	2 00	-	3 00	11 00
Somerset, East	-	-	-	-	-	-	-	-	-
Somerset, Central	-	-	-	-	-	-	-	-	-
Somerset, New Portland	-	1 50	-	-	2 50	2 50	-	3 00	6 00
Waldo and Penobscot	4 00	4 00	4 00	4 00	8 00	13 00	5 00	11 00	45 00
Waldo, North	12 00	6 00	-	-	4 50	6 00	6 00	7 00	6 00
Waldo, West	-	-	-	-	-	-	-	-	-
Washington County	-	12 00	-	5 00	-	-	9 00	37 00	9 00
Washington, North	3 00	3 00	-	3 00	-	-	-	3 00	2 00
Washington, West	36 00	7 00	-	-	-	50 00	4 00	62 C0	56 00
Washington, Central	-	-	-	-	-	-	-	-	-
York County	-	-	-	-	-	-	-	-	-
York, Buxton and Hollis	-	-	-	-	-	-	-	-	-
York, Ramshackle Park	-	-	-	-	9 00	14 00	9 00	13 00	9 00
York, Shapleigh and Acton	-	-	-	-	6 00	6 00	-	2 50	-
York, Ossipee Valley Union	-	-	-	-	-	-	-	-	4 00
York, Springvale Agricultural and Mechanical Association	-	-	-	2 50	3 00	3 00	1 50	-	-
York, North Berwick Agricultural Association	-	2 00	-	-	3 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	$48 00	$67 00	-	$86 00	$20 00	$7 00	$33 00	$6 00	$24 00	$74 00	$45 00
Androscoggin, Durham	2 00	6 00	-	12 00	4 00	-	6 00	2 00	5 00	6 00	9 00
Aroostook County	-	-	-	-	-	-	-	-	-	-	-
Aroostook, North	14 00	18 50	$8 75	18 25	11 00	11 50	-	4 00	-	-	-
Aroostook, South	-	-	-	-	-	-	-	-	-	-	-
Cumberland County	54 00	46 00	6 00	51 00	52 00	12 00	34 00	10 00	30 00	-	118 00
Cumberland, North	-	-	15 00	6 00	8 00	8 00	5 00	6 00	5 00	10 00	21 00
Cumberland Farmers' Club	11 00	12 75	1 00	12 50	42 00	7 00	7 00	3 00	9 00	28 00	29 00
Cumberland, Gray Park Association	7 00	16 50	5 00	23 50	10 00	5 00	3 50	-	5 00	25 00	16 00
Cumberland, Bridgton Farmers' and Mechanics' Asso.	11 00	18 00	8 00	22 00	-	21 00	16 00	3 00	3 00	16 00	6 00
Cumberland, New Gloucester and Danville	5 00	-	8 50	35 00	13 00	2 00	4 00	-	2 00	10 00	2 00
Cumberland, Lake View Park	-	-	5 00	24 50	-	12 50	2 00	-	2 00	-	10 00
Franklin County	32 50	47 00	28 00	64 75	31 00	11 00	45 00	2 00	8 00	71 50	34 00
Franklin, North	5 90	15 00	6 50	16 75	10 00	4 50	10 15	-	5 25	37 18	5 75
Hancock County	5 00	4 00	10 00	63 25	-	21 00	-	-	-	-	19 00
Hancock, North	50	5 00	2 00	6 00	-	-	-	1 50	-	-	4 50
Hancock Fair Association	22 50	18 00	-	43 25	-	29 20	-	-	-	-	28 00
Hancock, Eden	1 25	2 00	75	1 75	-	-	-	-	-	-	-
Kennebec County	25 50	30 00	-	31 75	24 00	31 50	18 00	7 50	19 50	69 00	30 00
Kennebec, South	12 00	25 50	9 00	20 80	13 00	15 25	16 90	3 25	4 00	53 02	16 50
Kennebec, Pittston Agricultural and Trotting Park Asso.	10 00	12 75	7 50	13 00	9 00	11 00	12 00	-	6 50	25 00	14 50
Knox, North	1 50	7 00	8 00	26 00	9 00	7 00	9 50	-	5 50	15 00	24 00
Lincoln County	6 50	10 50	50	17 00	-	9 00	19 00	20 00	9 00	22 00	20 00
Oxford County	173 00	141 00	-	144 00	42 00	124 00	44 00	-	17 00	61 00	47 00
Oxford, Riverside Park Association	134 75	84 00	7 00	58 00	8 00	38 25	9 37	3 00	-	24 00	47 62
Oxford, West	27 00	44 00	-	23 50	16 00	22 50	24 00	9 00	10 00	56 00	76 00
Oxford, Androscoggin Valley	30 00	22 00	16 00	43 50	14 00	26 00	31 00	6 00	6 00	22 00	38 00
Oxford, North	8 00	-	6 00	10 75	7 00	10 00	6 50	-	3 50	-	20 00
Penobscot County	-	-	-	-	-	-	-	-	-	-	-

Penobscot, Lee Union	-	-	-	-	-	-	-	-	-	-	-
Penobscot, West	48 00	68 35	5 00	69 25	20 00	29 00	17 00	3 00	2 00	-	12 00
Penobscot, North	3 00	12 00	11 00	48 50	10 00	-	-	-	-	-	-
Penobscot, East Eddington Farmers' Club	2 00	-	2 25	10 00	-	4 50	-	-	-	-	-
Penobscot, Orrington	-	-	1 00	5 50	-	-	-	-	1 00	8 00	-
Piscataquis, East	-	-	-	-	-	-	-	-	-	-	-
Piscataquis, West	-	-	75	2 00	-	-	-	-	-	-	-
Sagadahoc County	68 25	143 50	-	112 50	54 00	56 50	27 50	10 00	9 00	43 00	27 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	2 90	5 95	-	4 75	5 75	1 45	3 40	1 30	60	-	8 90
Somerset County	4 50	9 50	1 00	29 25	-	8 50	9 50	1 00	5 50	-	2 00
Somerset, East	-	-	-	-	-	-	-	-	-	-	-
Somerset, Central	-	-	-	-	-	-	-	-	-	-	-
Somerset, New Portland	-	-	1 00	11 50	-	-	1 50	-	-	-	-
Waldo and Penobscot	71 00	57 00	8 00	88 00	35 00	-	17 00	10 00	44 00	44 00	65 00
Waldo, North	14 00	-	-	18 00	-	22 50	-	-	9 00	-	-
Waldo, West	-	-	-	-	-	-	-	-	-	-	-
Washington County	12 00	24 00	-	22 00	22 00	12 00	-	-	-	-	-
Washington, North	-	-	2 00	10 00	-	-	-	-	-	-	-
Washington, West	54 00	66 00	-	33 00	-	46 00	-	-	5 00	-	-
Washington, Central	-	-	-	-	-	-	-	-	-	-	-
York County	-	-	-	-	-	-	-	-	-	-	-
York, Buxton and Hollis	-	-	-	-	-	-	-	-	-	-	-
York, Ramshackle Park	3 00	7 00	6 00	12 00	7 00	21 00	24 50	3 50	9 00	10 00	15 00
York, Shapleigh and Acton	-	-	4 50	14 25	-	6 00	31 50	-	6 00	45 00	11 00
York, Ossipee Valley Union	8 00	16 00	-	13 00	10 00	7 00	3 00	-	-	-	5 00
York, Springvale Agricultural and Mechanical Asso	20 00	30 00	-	7 50	-	16 00	6 00	1 50	6 00	30 00	15 50
York, North Berwick Agricultural Association	8 00	20 00	4 00	13 00	26 00	24 00	3 00	-	-	16 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	-	-	-	-	$244 25	-	-	-	-	-	$ 244 25
Androscoggin County	$30 00	$14 00	$75 00	$74 00	68 00	$34 00	$13 00	$5 00	$92 00	$152 00	1,116 00
Androscoggin, Durham	-	-	5 75	14 30	10 75	1 50	4 25	-	14 75	7 75	119 05
Aroostook County	-	-	-	-	-	-	-	-	-	-	-
Aroostook, North	11 00	9 75	23 00	55 10	46 55	10 55	6 00	-	21 70	42 47	349 87
Aroostook, South	-	-	-	-	-	-	-	-	-	-	-
Cumberland County	29 00	12 00	194 00	52 00	35 00	20 00	15 00	-	13 00	201 00	1,110 00
Cumberland, North	3 00	8 00	4 50	15 25	15 00	4 25	1 50	-	20 35	7 00	207 85
Cumberland Farmers' Club	6 00	3 00	8 50	21 50	21 70	9 45	-	-	20 70	1 75	282 35
Cumberland, Gray Park Association	1 00	4 00	3 50	13 00	9 25	9 90	50	-	16 45	28 00	242 10
Cumberland, Bridgton Farmers' & Mechanics' Club	-	3 00	8 00	11 75	14 00	13 75	-	2 00	30 00	23 00	276 50
Cumberland, New Gloucester and Danville	5 50	5 00	4 25	15 35	14 00	7 15	-	-	23 45	4 00	209 70
Cumberland, Lake View Park	-	4 00	4 00	8 00	7 25	4 25	-	-	6 75	-	132 25
Franklin County	140 50	10 50	47 25	12 20	45 60	11 05	5 15	23 00	23 80	17 95	809 25
Franklin, North	16 50	4 25	2 55	14 10	16 90	7 10	2 00	-	22 30	13 00	256 93
Hancock County	15 00	7 50	4 50	60 20	19 15	15 60	-	-	28 70	24 00	338 90
Hancock, North	2 00	-	4 10	32 80	18 20	9 75	1 00	-	21 70	13 50	142 55
Hancock Fair Association	21 00	5 00	49 25	40 00	31 50	13 50	5 00	-	80 85	-	439 05
Hancock, Eden	-	1 25	2 20	8 80	7 65	20	-	-	4 80	4 05	34 70
Kennebec County	25 50	4 00	36 00	85 00	89 75	40 75	9 00	-	40 25	1 55	761 05
Kennebec, South	5 00	3 00	4 55	13 25	18 45	13 35	50	-	54 00	-	334 07
Kennebec, Pittston Agr'lt'l & Trotting Park Ass'n	9 25	4 00	19 50	17 60	15 60	1 15	-	-	22 30	2 25	244 90
Knox, North	10 00	5 25	22 15	13 60	23 10	12 25	9 70	-	28 26	20 75	307 56
Lincoln County	7 00	2 00	19 75	60 60	16 40	17 00	3 25	-	47 50	13 25	348 50
Oxford County	31 00	30 00	12 70	46 50	57 00	60 50	16 75	56 50	47 60	232 00	1,606 55
Oxford, Riverside Park Association	12 00	11 00	4 50	11 57	20 00	8 50	-	-	-	66 75	637 23
Oxford, West	26 00	28 00	72 00	29 00	16 25	18 25	15 35	2 00	42 30	11 00	668 15
Oxford, Androscoggin Valley	5 00	11 00	35 00	15 65	28 65	14 50	3 50	3 50	18 65	22 25	468 10

Oxford, North	15 00	10 75	18 50	23 25	14 00	7 00	6 55	-	20 40	13 10	271 30
Penobscot County	-	-	-	-	-	-	-	-	-	-	-
Penobscot, Lee Union	-	-	-	-	-	-	-	-	-	-	-
Penobscot, West	23 00	20 00	77 80	23 00	45 95	28 75	3 50	-	92 15	36 78	721 53
Penobscot, North	4 75	3 00	3 00	7 35	8 00	8 00	2 50	-	28 25	-	177 35
Penobscot, East Eddington Farmers' Club	6 00	3 50	3 50	26 70	16 50	4 50	6 00	-	18 60	5 00	122 55
Penobscot, Orrington	3 00	-	11 25	22 40	19 55	1 50	5 30	-	24 15	5 50	125 65
Piscataquis, East	-	-	-	-	-	-	-	-	-	-	-
Piscataquis, West	2 50	75	50	1 60	2 75	75	-	-	2 10	4 00	37 70
Sagadahoc County	32 00	19 00	77 25	102 25	96 50	54 60	18 75	-	74 25	198 42	1,308 67
Sagadahoc, Richmond Farmers' & Mechanics' Club	3 60	-	4 05	16 40	6 05	1 35	25	-	8 35	4 10	93 05
Somerset County	30 75	-	4 10	5 25	3 75	1 60	75	-	14 85	-	152 80
Somerset, East	-	-	-	-	-	-	-	-	-	-	-
Somerset, Central	-	-	-	-	-	-	-	-	-	-	-
Somerset, New Portland	-	75	-	3 55	75	-	1 35	-	4 90	-	40 80
Waldo and Penobscot	48 00	21 00	26 25	46 05	46 00	20 50	6 50	-	142 35	16 70	910 35
Waldo, North	21 00	-	2 55	28 50	6 75	1 55	3 00	-	40 00	25 75	240 10
Waldo, West	-	-	-	-	-	-	-	-	-	-	-
Washington County	28 50	5 00	14 75	62 00	26 50	29 05	1 50	-	63 34	-	394 64
Washington, North	1 00	-	75	19 50	11 75	4 50	-	-	32 71	-	96 21
Washington, West	46 00	21 00	53 00	145 00	75 75	25 00	9 00	-	110 00	37 00	940 75
Washington, Central	-	-	-	-	-	-	-	-	-	-	-
York County	-	-	-	-	-	-	-	-	-	-	-
York, Buxton and Hollis	-	-	-	-	-	-	-	-	-	-	-
York, Ramshackle Park	-	-	-	9 00	6 00	-	4 00	-	18 00	-	209 00
York, Shapleigh and Acton	6 75	1 50	20 00	57 00	25 25	14 25	-	-	24 75	91 25	373 50
York, Ossipee Valley Union	2 00	-	3 50	8 00	1 90	4 10	1 50	-	34 45	85 00	206 45
York, Springvale Agricultural & Mechanical Ass'n	9 50	6 50	20 00	25 00	9 50	4 00	-	-	42 60	-	259 60
York, North Berwick Agricultural Association	10 50	7 00	-	15 00	7 25	3 10	-	-	54 50	33 00	249 35

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	$47 00	-	-	$ 20 00	$1,067 00	-	-	-	-	$1,090 63	*$1,530 00	-
Androscoggin County	464 63	39 00	$550 00	$351 50	1,048 25	2,453 38	-	$750 00	$581 33	-	2,447 33	600 00	$1,000 00
Androscoggin, Durham	76 10	-	-	83 75	571 45	731 30	$40 00	228 00	46 50	$262 83	696 38	2,000 00	1,500 00
Aroostook County	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroostook, North	152 45	52 06	-	198 75	903 85	1,307 05	-	475 00	197 86	146 05	1,168 78	4,000 00	3,000 00
Aroostook, South	-	-	-	-	-	-	-	-	-	-	-	-	-
Cumberland County	308 70	-	200 00	548 75	3,053 96	4,111 41	310 66	1,260 00	1,062 10	358 65	4,101 41	6,000 00	1,250 00
Cumberland, North	51 00	-	-	36 00	214 47	301 47	-	108 00	76 00	-	391 85	3,500 00	91 40
Cumberland Farmers' Club	33 10	9 00	-	142 50	781 98	966 58	43 71	312 50	330 45	-	969 01	2,500 00	275 00
Cumberland, Gray Park Association	94 64	-	-	335 00	1,106 30	1,535 94	-	650 00	625 00	2 90	1,520 00	9,000 00	200 00
Cumberland, Bridgton Farmers' and Mechanics' Association	83 32	-	-	322 50	1,515 96	1,921 78	308 00	700 00	102 00	-	1,386 50	2,500 00	-
Cumberland, New Gloucester and Danville	69 34	10 00	-	78 00	693 93	851 27	36 67	236 75	116 16	110 93	710 21	2,500 00	-
Cumberland, Lake View Park	47 39	-	-	64 00	426 15	537 54	80 00	248 50	85 00	24 00	569 75	1,000 00	115 00
Franklin County	280 90	647 00	-	125 00	2,828 96	3,881 86	498 80	447 50	532 96	283 71	2,572 22	5,000 00	18 00
Franklin, North	64 11	301 00	200 00	227 50	673 88	1,466 49	50 00	696 25	50 00	440 89	1,494 07	3,500 25	2,470 00
Hancock County	114 87	-	-	80 00	1,271 78	1,466 65	50 00	450 00	201 13	88 00	1,128 03	5,000 00	650 00
Hancock, North	51 85	10 00	1 82	-	481 84	545 51	-	-	284 08	118 88	545 51	-	1 82
Hancock Fair Association	122 35	-	-	47 00	2,036 90	2,206 25	-	391 00	1,086 97	289 23	2,206 25	11,500 00	200 00
Hancock, Eden	41 09	9 50	-	-	292 02	342 61	-	-	29 00	25 35	89 05	529 90	255 00
Kennebec County	316 72	-	304 50	263 50	1,381 10	2,265 82	408 60	618 75	332 11	308 17	2,428 68	3,300 00	862 05
Kennebec, South	102 35	-	-	118 00	1,738 68	1,959 03	683 85	356 25	258 94	332 68	1,965 79	1,850 00	-
Kennebec, Pittston Agricultural and Trotting Park Association	62 58	30 00	390 00	70 00	450 57	1,003 15	18 79	379 50	30 00	320 06	993 25	1,500 00	1,070 00
Knox, North	76 00	268 25	-	129 00	514 50	987 75	-	263 00	65 04	267 12	902 72	-	-
Lincoln County	104 21	15 00	150 00	51 75	1,018 43	1,339 39	87 00	195 00	389 40	309 18	1,329 08	1,000 00	150 00
Oxford County	528 20	22 00	-	523 00	4,880 53	5,953 73	908 23	1,197 00	334 86	1,411 32	5,457 96	10,000 00	54 43

Oxford, Riverside Park Association..	173 35	-	-	170 50	859 52	1,203 37	104 75	650 00	400 00	75 00	1,866 98	2,400 00	600 00
Oxford, West	200 18	40 00	-	435 00	2,289 82	2,965 00	308 50	900 00	237 75	936 10	3,050 50	7,800 00	1,000 00
Oxford, Androscoggin Valley	143 34	16 00	-	536 47	1,772 64	2,468 45	291 29	1,028 75	323 30	218 11	2,329 55	2,500 00	3,100 00
Oxford, North	74 44	10 00	-	141 22	769 32	994 98	50 00	373 50	75 00	40 00	809 80	1,400 00	-
Penobscot County	-	-	-	-	-	-	-	-	-	-	-	-	-
Penobscot, Lee Union	-	-	-	-	-	-	-	-	-	-	-	-	-
Penobscot, West	179 00	30 00	-	445 00	1,519 29	2,173 29	300 00	872 50	600 00	-	2,494 03	5,000 00	2,500 00
Penobscot, North	43 26	1 00	82 34	-	40 75	167 35	10 00	-	5 00	10 00	202 35	-	-
Penobscot, East Eddington Farmers' Club	47 23	-	-	-	205 80	253 03	-	-	51 53	34 00	208 08	1,000 00	-
Penobscot, Orrington	40 10	-	5 22	79 75	652 04	777 11	182 45	266 00	90 50	225 81	890 41	1,100 00	350 00
Piscataquis, East	-	-	-	-	-	-	-	-	-	-	-	-	-
Piscataquis, West	-	38 00	-	-	48 70	86 70	-	-	-	62 45	100 15	-	13 45
Sagadahoc County	453 72	539 00	1185 91	585 00	3,765 32	6,528 95	800 00	1,110 00	1,800 00	1,510 28	6,528 95	5,000 00	1,400 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	28 46	1 50	-	-	139 25	169 21	2 00	-	33 50	41 83	170 38	50 00	5 43
Somerset County	60 02	5 00	-	86 25	443 09	594 36	61 32	225 00	35 00	31 70	505 82	800 00	169 60
Somerset, East	-	-	-	-	-	-	-	-	-	-	-	-	-
Somerset, Central	-	-	-	-	-	-	35 00	-	-	-	-	2,500 00	640 00
Somerset, New Portland	-	-	175 00	118 00	378 14	671 14	253 88	300 00	31 75	34 36	660 79	800 00	185 60
Waldo County	-	-	-	-	-	-	-	-	-	-	-	-	-
Waldo and Penobscot	250 00	-	40 18	332 00	3,228 17	3,850 35	861 83	1,245 00	584 52	589 14	4,190 84	3,500 00	-
Waldo, North	79 19	-	-	165 00	657 50	901 69	-	400 00	150 55	-	790 65	-	-
Waldo, West	-	-	-	-	-	-	-	-	-	-	-	-	-
Washington County	130 04	27 00	-	146 25	871 22	1,174 51	-	382 50	117 00	78 32	972 46	1,700 00	1,000 00
Washington, North	34 89	-	-	156 00	507 70	698 59	-	360 00	105 50	146 47	708 18	3,000 00	2,000 00
Washington, West	316 87	2 00	-	70 00	2,058 15	2,447 02	-	284 75	345 25	784 96	2,355 71	2,218 31	1,170 07
Washington, Central	-	-	-	-	-	-	-	-	-	-	-	-	-
York County	-	-	-	-	-	-	-	-	-	-	-	-	-
York, Buxton and Hollis	-	-	-	-	-	-	-	-	-	-	-	-	-
York, Ramshackle Park	45 30	5 00	-	106 25	307 00	463 55	-	325 00	132 75	-	666 75	2,000 00	257 77
York, Shapleigh and Acton	141 88	219 00	60 00	-	3 77	424 65	-	-	16 00	28 60	418 10	2,000 00	-
York, Ossipee Valley Union	200 00	-	-	342 50	1,493 05	2,035 55	-	975 00	641 26	212 84	2,035 55	6,500 00	2,209 26
York, Springvale Agricultural and Mechanical Association	86 50	-	-	111 25	607 23	804 98	148 82	453 75	250 00	-	1,112 17	4,000 00	400 00
York, North Berwick Agricultural As.	93 26	-	-	338 75	1,635 52	2,067 53	-	575 00	839 97	554 10	2,218 42	8,000 00	5,311 50

* Other resources, $219.80.

REPORT OF PROCEEDINGS

OF

STATE DAIRY MEETING

Held at Portland, December 7th and 8th, 1898.

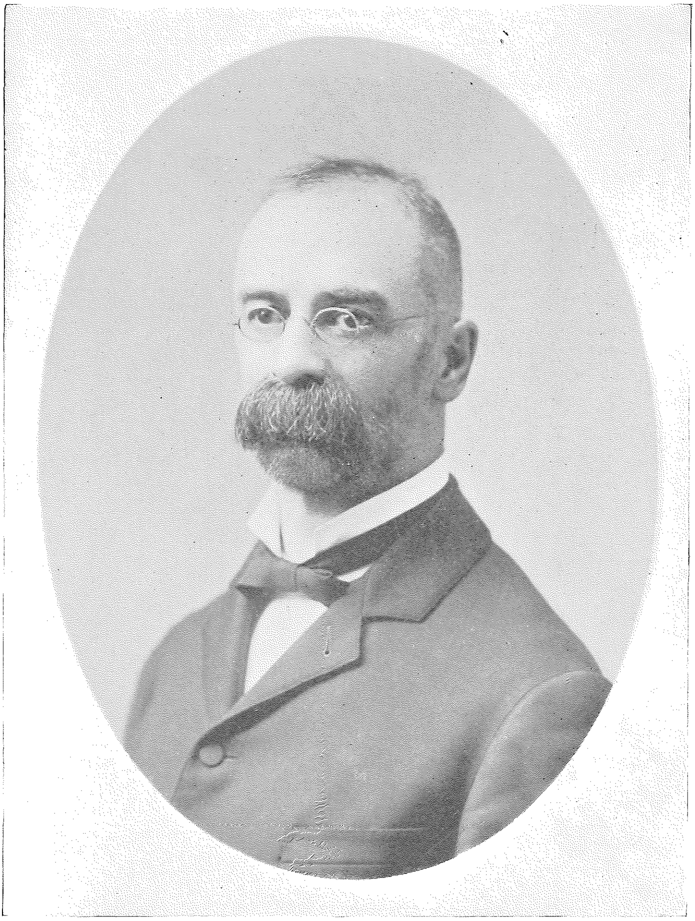
Wednesday, A. M. Meeting called to order by President W. H. Moody.

ADDRESS OF WELCOME.

By Mayor CHARLES F. RANDALL.

Mr. President; Ladies and Gentlemen: It affords me great pleasure to welcome to our city to-day the members of the Maine Board of Agriculture. We are always glad to welcome any association that is working for the benefit and the development of the grand old State of Maine. Only a few years ago they told us that we could not raise anything down here but granite, except, perhaps, noble men and women. But that has all been changed, and to-day no state in the Union has so many possibilities as the State of Maine, which are being largely developed. And I understand that in the matter of dairy products, which you exhibit here so finely to-day, you have made great strides, so that some of the finest butter and cheese in the country to-day comes from the State of Maine.

I understand, also, that this exhibition is open to people from all over New England, and I cordially welcome to our city our friends from other states in New England. I am always glad to take a good New Englander by the hand. Cold, Puritanical New England, if you please, but that New England which has done so much to develop this great country. I recognize the



PROF. SAMUEL M. BABCOCK,
MADISON, WIS.
Originator of the Babcock Milk Tester.

attainments of the West, the progress that has been made there, but I realize that had it not been for the pioneers of New England, and for New England money, much of the West would not have been developed.

I am glad to see you here. I cordially welcome you, and trust that your exhibition here will be of great advantage to your organization, and that you will so enjoy your meeting that when you depart for your homes you will feel like coming again. And I assure you that when you do you will always receive a hearty welcome from the citizens of Portland.

RESPONSE.

By Wm. H. Moody of Liberty, President of the Board.

Ladies and Gentlemen: In the absence of the gentleman whose duty, or privilege, it would be to answer the kind words of welcome to which we have listened, I will simply say that through me the Board extends its thanks to the city for the kind welcome that we have had. The City Government and the business men of Portland, as well as the Board of Trade, took hold of this matter with earnestness when we told them that we would like to come here, and have shown us every kindness and given us every facility possible to make our exhibit here a success.

The Board of Agriculture has been at work for half a century, and while I shall not take the time to review the work of the Board or to review the progress of the country during that time, I will simply say that the product of grain,—of corn for instance, has increased since that time more than 11,000,000 bushels, and the cost has been reduced by 66 per cent, in hand labor. We have been doing something in Maine. Three million five hundred thousand acres of land in the State of Maine are now under cultivation. Fifty years ago it is safe to say that it was hardly possible to run a machine over much of it. To-day, machines are run over practically all of it. This shows a great progress. Then out of the 65,000 farms in Maine, 63,000 are farmed by the owners, and that is another item of progress that is very gratifying. And in no branch, perhaps, has there been more progress than in this one that we are here to represent to-day, that of dairying. I earnestly believe that this is our stronghold, and I know that the people believe with me, too, because of the interest they take in it. When we first began to hold State Dairy Meetings, about ten years ago, it was difficult to get many people to attend, and there was no exhibit such as you see to-day; while for the last few years we have been welcomed by the cities and towns everywhere. The business men, as well as those engaged in agricultural pursuits, have turned out almost en masse, to hear the lectures that we have been able to give them, so that we are encouraged to-day.

I will not take your time, as there are gentlemen here who are prepared to talk to us and give us a great deal of information; but I would once more express the thanks of the Board to the city, and the business men, and the Board of Trade, for what they have done for us.

OUR DAIRY WORK FOR 1898.

By Prof. G. M. Gowell, Orono.

Mr. Chairman; Brother Dairymen and Creamery Men: Each year at these dairy conferences we have attempted to review the work and note the progress that has been made during the preceding year, and while necessarily what I may say this morning may seem to be a repetition of what I have said in the past, yet it is fresh data, and, of course, fresh matter. So far as our advance during the year is concerned, it is to a certain extent attributable to the season and to the markets outside of our State. We have been, this year, unusually favored in the season. Last spring being a mild spring, and there being an abundance of rain throughout the summer, the grass in the pastures has been good, and the conditions for grazing and for the growth of forage crops have been favorable. Therefore, so far as the welfare of the animals and the production of food for them are concerned, conditions have been favorable to dairying. Of course this does not imply that we depend upon grazing, because we have learned better than that. We have learned that the systems of soiling which we are following are the only ones that we can depend upon to secure results that are satisfactory.

The prices throughout the entire season have been well maintained. The markets outside have been satisfactory, and we have not touched the low point that we usually do. Prices recovered earlier this fall, after the depression of the spring which we always have, and are better maintained at the present time; so that on the whole we have had a favorable season.

CREAMERY WORK.

It has been necessary to accumulate a little data, to learn whether we are going ahead or falling back, and I have endeavored, as in previous years, to come in touch with those men that alone could give us data, the creamery operators, and through them I have obtained some figures relative to the work of this year. I told you two years ago that I was not going to depend upon the guess work of the creamery men, or the information as they secured it ordinarily. I was going to ask each creamery operator to ascertain through the cream gatherers from each patron the number of cows furnishing milk or cream, etc., so that he could make returns that were satisfactory, and almost invariably they have responded. Many of them have taken great pains to give me this data. One of the largest creameries, doing more work than almost all the others combined, went to the trouble of furnishing the cream gatherers with blanks, and in this way made a canvass of the patrons. It has always been an easy matter to get at the money paid the farmers, but not to get at the number of cows. But I believe that this year we have better returns than ever before. The returns from twenty of the largest creameries are complete; those from others are hardly satisfactory, because they are not filled completely and I fear are estimated. Those twenty creameries that have reported fully show that they have received the milk or cream from 22,680 cows, and that they have paid the farmers $682,000 for milk or cream, this being an average of about thirty dollars per cow. In some instances the returns have been as high as fifty dollars. Certain creameries have paid for every cow furnishing milk or cream, fifty dollars; others have paid as low as twenty dollars. Here is a very marked difference, and right here is an opportunity for that lesson that we ought to take home, every one of us. Some of those cows have furnished satisfactory returns; others, of course, have been heavy loads upon the men that owned and fed them, and we must look after that sharply. The returns from these same twenty creameries last year were $10,000 less than this year. While this is not a great amount when we compare it with the gross returns, it is enough to indicate to us that we have not lost ground, but we have advanced. Some of these twenty creameries have done more work than last year, others less. The larger creameries have done more work, and the smaller, weaker ones are the ones that have rather fallen back. We have three or four new creameries established this year that promise well, that are strong creameries. There are about as many old ones that have fallen out, the weaker ones that ought never to have been established. They were established where the cow population was sparse, the cost of collection too much, and the returns received by the farmers too small, so that they withdrew their patronage; a condition that we have always warred against.

PRVATE DAIRYING.

From data accumulated which is not sufficiently correct to be regarded as statistics and yet of sufficient value to indicate something, I conclude that we have in our associated dairying in the State not far from thirty thousand cows. We have about one hundred and thirty-five thousand cows in the State. These 30,000 cows that furnish their milk or cream to the creameries have returned about $900,000 to the men that owned them,—a little less than a million dollars. While we are apt to measure the work that we are doing by our associated system, it is by no means a just measure of what we are doing, because we have more than 100,000 cows whose milk is not being worked up in our creameries, but is worked up in some other way. Less than one-fourth of the total number of cows are furnishing their cream or milk to the creameries. The milk from the other three-fourths is being worked up in some other way. Probably we may say that the income from the cows of Maine is but little less than $4,000,000. The other 100,000 cows in the State (I was dependent on the assessors' returns for the figures and I presume they are correct) are doing a different kind of work. You know that our private dairying is a leading industry, because everywhere, in every neighborhood, even in the sections where the associations are doing their work, are men that are standing out because they are doing what they regard as a better quality of work. They are manufacturing their butter themselves and selling it to private customers at higher prices. There is a vast amount of this work being done in our State. At almost every railroad station every week little packages are being sent to the city markets, and returning to their owners quite satisfactory prices. This has become a large industry; we have no means of measuring its extent. Some of those men are receiving more than the $30, the average which the creamery men are receiving, because conditions are under their control. They are able to make a fine quality of butter and sell it to a class of consumers who are willing to pay for something that is good.

Again, about our cities and villages are men that are engaged in the wholesale and retail milk business, and of these 100,000 cows engaged in private work, a large number are furnishing milk for sale as whole milk; and you know very well that the returns from selling whole milk are much larger than those from selling milk or cream for butter-making purposes.

And there is another class of our cows that we never have taken into account, and that is the family cow. I do not know how far we are dependent on the cow for our living. We do know that the family cow is a luxury to those people who have means, and keep a cow, and with the poorer people, the mechanics and people who have but little means of support, the cow comes in and really supports the family. We have but to look over our State, and we hardly find a family so poor, except the very poor, but that they keep a cow; and that cow largely feeds the family, if it is a poor family without other means of support. How valuable these family cows are it is impossible to tell, or even conjecture, but I do say that I believe there is no place where the cow is paying so much as where her milk is consumed as whole milk, because here the entire product is consumed.

Regarding the machinery, the advance that we have made in methods of manufacture, there is not much to say. No new machines have been brought out in this country or any other country during the past year. The milking machines that we have been so much interested in, are slightly better than a year ago. The 400 machines that have been manufactured and are being experimented with in England have not been sufficiently perfected so that they have been put upon the market, but they are gradually being improved. How long it will be before the Maine dairyman uses the machine is a question. We have no new separators or extractors. The older ones have been improved and generally cheapened by lengthening the bowl and enabling them to do a little more work and to do it a little more thoroughly. There is no mistake in buying any of the standard machines at the present day.

One new scheme has been brought out, and that is the dilution method, with a view to raising the cream. It simply means the dilution of the milk with warm or cold water so as to cause it to yield its cream more readily, with a certain kind of cans. This is not a new idea. We have been at work on it in the Station, and have known its results, but we have not secured anything that we thought worth giving to the people. It is an aid in case there is no ice at hand and you have to depend upon conditions that are very inferior, but it is not worth adoption by the dairyman who wants to extract from his milk all the cream. The cream is too much diluted, and the work is not well enough done. This idea is not worth patenting.

The advance that we have made during the year in the legitimate work that we are doing has been gradual. We all recognize the necessity for improvement, and have recognized it all the way along. We know under what unfavorable conditions we are doing our work. I have referred to them so much that I am almost ashamed to do so at the present time. We are using gravity cream, and collecting it at infrequent intervals, and you know how responsible this partially ripened cream is for the poor quality of the butter. When I urged the matter of more frequent collections, and of putting each man's cream into a can by itself, four or five years ago, I was met by the creamery men, almost to a man, with the objection that it was not practical; so much labor, so much care and so much expense were involved that it could not be done. And yet, within the past two years, several of the largest creameries, two in Bangor which are next to the Turner Creamery in magnitude of business, have adopted this plan, and are bringing some of the cream thirty miles, each man's cream in a can of its own. It is hauled on spring wagons, and when it reaches the factory it is set into a warm room, and there is sampled and tested by a person who is competent. The butter-maker has the opportunity to select the good cream and throw out the poor. These creameries have been compelled to do this, perhaps, because they are selling sweet cream. They are compelled to have good cream, and therefore they are prompted to weed out the men who are furnishing them poor cream and dirty cream. In order to do the work that we ought to do, if we are bound to cling to the gravity system and not adopt the separators—and with our sparse cow population this may be the right thing to do—we must bring in the cream while it is new and fresh and must bring it in in such a way that our butter-makers may do a work with which they are satisfied.

As to the interest our people are taking in our dairy work, I think we at the Experiment Station are in a position to answer that question as well or better than any other parties, because of the numerous inquiries that are constantly coming to us and the samples of cream which are sent there by people who are not satisfied with the tests they are getting at the creameries.

TESTING STATION.

Our dairymen and creamery men are differing more in regard to the tests than in any other particular, and I do not think we have made much of an advance in this line during the past year. We never have had so many inquiries and so many samples sent for testing as in the past year, showing that the farmers are dissatisfied. I query how this matter of testing is to be done in the future. I am satisfied that the work of the creameries in the future will be the collecting of cream in individual cans, not farther apart than every other day (every day would be better), collecting it while it is sweet. I am sure that this is to be the future of our work, and the quickest way in which we can bring it about is by getting our creamery men together and inducing them to act in unison. The butter-makers, pressed with the work of keeping their cream clean, keeping their accounts, manufacturing the butter, etc., all the regular daily work, are confronted each two weeks or each month with the matter of testing the samples they have saved. In the majority of cases the creamery men regard this as additional work, and as a burden. They do not like to do it. With the establishment of some central plant, where all of the samples from the different creameries could be sent each month, and a man paid for doing the testing, I believe better testing would be done. All the testing would be done uniformly by a man who regarded it as his business, who was paid for doing it. I am not speaking for the Experiment Station, we do not want that job; but I believe that some man who is mechanical and careful can do this work and do it at a less expense than the butter-maker. You creamery men know very well that if you have 50 or 100 or 500 samples to test and sit down to work them through, if your acid is too strong or the conditions are not favorable, you are prone to guess at the test and call it something. You know this is not right, but it is only the man who has the patience and time to go over the work and make the test until it is clear who can do perfect work. The creamery man will not do this.

PASTEURIZATION OF CREAM.

There is another line of work that we can and should adopt, and have adopted to a certain extent, and that is the pasteurization of cream. I know of one creamery that is practicing this. We have been doing it for years at the Experiment Station, and studying the process closely. We have been studying the character of the butter made, and the waste in the skim-milk and buttermilk, and we have become convinced that it is the right thing to do, because pasteurization eliminates the undesirable features; I mean to say, if they are present as the result of odors from any source, or from the eating of vegetables or the condition of the cow, they are extracted by pasteurization. If any mixture has fallen into the milk and become absorbed there is no power on earth that can extract that. In pasteurization it is absolutely essential that the stock be sweet, and this will force the collection of cream while it is sweet, instead of the soured or half ripened cream. Pasteurized cream makes a denser butter, a finer grained butter, which would be lacking in flavor if this were not imparted to it by a starter which the creamery man makes for himself or purchases. If we can get every creamery man in Maine to adopt this system of collecting sweet stock, pasteurizing, and then using a starter which is from one source, we shall be able to accomplish what we have been striving for so long, the making of an article which shall be uniform in every creamery in our State, and I do not know of any other way to do this. We must have uniformity.

STATE DAIRY ASSOCIATION.

We have made another advance, and that is in our dairy association, the dairy association that is in process of formation, I might say, because we found we had to wait for certain forms of law before it could be established. It is something we have been talking about for quite a period of years, and this fall, recognizing the necessity for a means of bringing the creamery men and the farmers together, this association was formed. We have everything to hope for from this organization. Its work is to be particularly with reference to quality. We are not going to proclaim that we have something that is the very best, and then demand a right in the markets. We have no rights in the markets that are not respected. I believe we are getting as much for the butter we are sending to Boston as we ought to get. I believe we are getting paid for the quality. The lesson for us is to make a better quality, and thus get a better price. This is what the association is aiming at, and its work is to be somewhat through bringing our creamery men and our producers closer together, and getting the farmers to adopt certain rules that they shall recognize as the best for them. It has a cream producer as its president, its secretary is a private dairyman, and its trustee to associate with the president and secretary is a creamery man, a manufacturer. Thus we have brought together these three elements that ought to work in sympathy with each other. And in each county there is a corresponding secretary, who shall work in connection with this Board, and keep them appraised of the conditions in his locality.

There is another feature that is of a great deal of value. I have spoken of the returns from the cows in our State, but this does not mean all that we have been doing in the way of dairying, because we have been selling a vast number of cows this year. We have been shipping from almost every station large numbers of cows to the markets outside. I never have known a time when there has been such a canvass among the farmers for the best cows, the deepest milking cows. Every butcher has been a cow buyer, and they have been taking away the cows at good prices. It is a legitimate line of work, and one that we can well make the most of, and yet I question if it is the best thing for us to do. With the vast quantities of cheap hay and grain, had these cows been retained they might have furnished more money than was received by selling them. We are growing an immense number of heifers on the waste of the dairies, to take the place of these cows, and we are going to carry this work on to our advantage, very markedly. There never has been a time when so many inquiries have been made in regard to the matter of breeding, when there was such an evidence that we want to improve our animals, as during the past year. Further than this, we never have had so many inquiries from private dairymen, at our institutes and through correspondence, regarding the methods of manufacture. I believe the interest was never as lively as now, and the outlook never was better.

THE DAIRY OUTLOOK FOR 1899.

By Sec. B. W. McKeen.

As I look over the market conditions, and observe the increasing demand for dairy products, I am inclined to the opinion that there is still room for the progressive dairyman. I believe that never in the history of dairying in Maine has there been a brighter outlook, or more encouraging prospects for active, intelligent work, than at the present time. Ever since the first dairy conference was held in Maine, we have been continually met with the cry of a possible overproduction of dairy goods, and occasionally have been asked by conservative people to call a halt and to turn the attention of our farmers to some other lines of work rather than to an increased work along dairy lines. But, notwithstanding all of the work that has been done by the Board of Agriculture and by other institutions and organizations, the fact remains that the quantity of butter manufactured in Maine has not kept pace with the increased demand from our own people, so that to-day we find creameries in our own State buying butter from abroad, much of it coming from the extreme West, for distribution among their regular customers. Not only is this true, but in many cases there are direct shipments from the market centers to consumers in various sections of the State. I am informed that at one time during the latter part of the summer shipments were made by one party to one place in the central part of our State aggregating $1,500, and covering a period of only six weeks. At the same time this party was shipping butter to other sections, notably to the eastery part of the State, for consumption in boarding houses and hotels. I am fully impressed with the belief that until Maine can produce butter enough to supply her own wants at all seasons of the year, we should still consider seriously the question of increasing our dairy output.

We find by the late returns of the local assessors to the State assessors that there is a slight decrease in the number of cows upon our farms, but at the same time we find a very encouraging increase in the number of young cattle. This is particularly true in the case of one-year-olds and two-year-olds, showing that the attention of our farmers has been turned more to the necessity of raising their calves, instead of vealing them as they have done many times in the past. That there has been a decrease in the number of our dairy cows is not due, I believe, to any dissatisfaction with the business on the part of those who are engaged in it, but rather to the fact that there is a large and growing demand for cows, and that they have sold for exceptionally high prices the present season. This fact, taken together with the rise in the price of beef and the increasing interest in the production of steers, is responsible, in my judgment, for this decrease.

The dairymen of Maine are dependent upon the creameries to manufacture their goods and place them upon the market, and I believe that there is no one institution that has done more for the uplifting of Maine agriculture than have the creameries and butter factories of our State. I regret to note in some quarters a lack of confidence on the part of the farmers in the management of some of these creameries. In my judgment this is largely due to a lack of mutual understanding, which might be cultivated by the creamery managers as well as by the farmers. Quite a large proportion of the creameries in the State are cooperative, and are owned and controlled, either directly or indirectly, by those who furnish the milk or cream. In these creameries there can be no object whatever in reducing the test or in any way covering up any of the returns; and a somewhat careful investigation leads me to the belief that the cream tests in the proprietary creameries of the State will not fall below those made in the co-operative creameries where the only object of the managers is to distribute the money that they receive equitably among their patrons. This leads me to the conclusion that as a rule the work is being done fairly and well. I believe that before we look seriously into the future, however, the creameries of our State should come to some mutual understanding, by organization or otherwise, as to the condition the cream shall be in when it reaches the factory, and the times and methods of collecting. I recently took a short trip through the eastern section of the State, where farmers are patronizing the Maine Condensed Milk Company, doing business at Newport, and I find that this company has a set of rules in relation to the care of barns and tie-ups, the feeding and care of the animals, and the handling of the milk after it is drawn from the cow and until it reaches the factory. These rules are rigidly enforced, and have much to do in establishing the excellent quality of the goods which they manufacture. Farmers are required to whitewash their tie-ups at least twice a year, there are certain restrictions in relation to light and cleanliness in the barns, and it is necessary that the milk shall be cared for in a manner that is indicated by the managers of the factory. And as far as I was able to learn, no farmer considers these rules a hardship, but rather the reverse, and having once become accustomed to doing their work in this manner, I do not believe there is one farmer in twenty-five who would return to any slipshod methods of work if the factory should suspend operations to-day. I wish that similar rules could be adopted by the creameries of our State, to the end that the careless and indifferent dairymen shall be brought up on a level with those who are disposed to take the most pains in their work. This will do very much indeed towards bettering the quality of the output of our creameries, and it will encourage those who are now trying to do good work, because it will enable them to receive more pay for their work, and to feel that others are required to comply with rules and regulations similar to those under which they are working.

Let us all start into the season of 1899 with a purpose to improve our methods, and to do better work than we have ever done in the past, remembering that it is necessary for us also, if we are satisfied that dairying is the branch of farmng that we desire to follow, to increase the amount of our output until our cow population shall be dense enough so that the creameries will be enabled to collect cream at such times and in such condition that the very best article of butter can be made from it. Let us remember that through all the depression in prices that the business world has been called to face the past few years, the products of our dairy herds have maintained their prices in the market better than any other manufactured product. We will not except those of the finer manufactures, even. Remembering this, and with the increased information which we are hoping to receive from this meeting, and from other sources, let us all take courage for the future. Our barns are filled to overflowing with the fodders which we produce to advantage, and the markets are waiting for our goods. Let us all see to it that the year 1899 marks the beginning of a new era in Maine dairying.

ECONOMICAL DAIRY FOODS.

By Prof. Joseph L. Hills, Director, Vermont Agricultural Experiment Station.

The following discussion of economical methods of dairy feeding resembles somewhat a custard pie. First there is the under crust—some six pages or so of a rather heavy mass of facts concerning the science of stock feeding. Upheld by this crust is the custard—some twenty pages or more of practical considerations touching choice of foods, which reads more easily, and, like the custard, is more succulent than the heavy foundation which underlies it. And, finally, as nutmeg sprinkled over the top, come a few remarks touching the advisability of a feeding-stuff control. From my boyhood up I have been fond of custard pie—for the sake of the custard. To this day I leave the crust uneaten. My readers are free to do likewise in partaking of this literary dish. They may, if they will, leave unread the close condensation of scientific matter given under the heading "Fundamentals of Stock Feeding," and begin with the

"Functions of Farm and of Market." They can perhaps digest the latter more easily than the former. Yet just as no cook would allow that her pie crust is not as light, flaky and wholesome as her neighbor's, I feel that those who will and can eat crust as well as custard, who will "read, mark and inwardly digest" the foundation facts of the science of stock feeding as here given, should have a better idea of what constitutes proper dairy feeding and will be more likely to know what is and what is not true economy therein.

FUNDAMENTALS OF STOCK FEEDING.

I think it will be helpful at the outset if we have a clear conception of certain underlying principles regarding stock feeding. Let us therefore devote a little time to discussing:

1. The composition of the animal body.
2. The ingredients of vegetable matter.
3. The functions in the animal economy of the principal ingredients of food.
4. Feeding standards.

I. THE ANIMAL BODY.

The body of an animal, be it ox or oyster, is made up essentially of water, ash (bony matter), protein (lean meat), and fat. The proportion of these constituents in the bodies of various classes of animals differs widely, and it is also variable in the same class at different ages.

Water is the main constituent in point of quantity, is indispensable to the life functions, yet, since it has little economic importance, for the present purpose it may be disregarded.

Ash is used mainly in building up the skeleton. While of evident importance it exists in sufficient quantities in almost every conceivable ration, hence, like the water, may be dismissed as unimportant in the present discussion.

Protein is a term applied to a group of materials best typified in the animal body by the dry matter of lean meat, the cartilaginous matter of tendons, etc. This constitutent is of vital importance in stock feeding, and will be constantly referred to throughout this article.

Fat is less important to vital processes than are the other three ingredients, yet of great economic interest.

2. VEGETABLE MATTER.

Inasmuch as all flesh is grass it naturally follows that the constituents of vegetable matter are not unlike those already described. All materials of a vegetable nature contain water, ash, protein and fat, and, also, crude fibre (cellulose) and nitrogen-free extract matter.

It may not be amiss to describe these materials briefly.

Water is the result of the chemical union of two gases, oxygen and hydrogen.

Ash is a general term used to include the materials left when vegetable matter has been burned. The ash of wood or any other vegetable materials contains mainly carbonates of potassium, sodium, calcium (lime), silicic acid (sand), etc.

Protein is a term used to include those materials which contain nitrogen and which alone are able to form the muscular tissues of the body. As a type of this material may be cited the gluten of wheat, that gummy material which when flour is kneaded enables the housewife to make it into dough. The white of the egg and the curd of skim-milk are further examples of this most valuable constituent of human and of cattle food.

Crude fibre or cellulose is the material which makes up the woody fibre, the frame work of the vegetable body. For instance, the trunk of a tree is mainly composed of this or of kindred materials. Its digestibility is relatively slight and hence it has but little feeding value.

Nitrogen-free extract is the term used to include such non-nitrogenous constituents as are dissolved from dry powdered fodder by solvents of moderate strength. It is a sort of chemical "catch all" within which, for want of a better term, are included starch, dextrin, sugars, gums, and the like.

Fat, or as it is better termed, ether extract, consists of those materials which are dissolved from the ground fodder by boiling ether. It contains the true fats, resins, chlorophyll (the green coloring matter of plants), etc.

These three ingredients have certain common characteristics, are often grouped together under the general name "carbohydrates" and are so referred to in the remainder of this discussion.

3. FUNCTIONS OF FOOD INGREDIENTS.

We may now very properly consider what are the functions of the ingredients of the food in the building up of the animal frame or in the manufacture of milk. It may be said parenthetically that these functions are much the same for either purpose. Milk is formed either by the breaking down of the mammary gland or from the blood or by both processes. It is probably true that rations well adapted to the making of flesh are also good for milk making.

We need only consider the functional activities of protein and of carbohydrates.

The functions of protein are five-fold.

(*a.*) From it are formed flesh, tendons, cartilage, etc., and the nitrogenous constituents of milk (casein, albumen, etc.).

(*b.*) It forms body fat and perhaps at times milk fat.

(*c.*) It furnishes material for the production of heat to maintain bodily warmth.

(*d.*) It furnishes material for the production of muscular energy.

(*e.*) It is held by some to be a stimulant to milk production.

(*a.*) The primary function of protein is to be found in the formation of flesh. Without it no muscular tissue can be developed. Animals fed on materials devoid of protein have starved in the midst of plenty.

(*b.*) (*c.*) (*d.*) These three functions, the formation of body fat, the furnishing of heat and of muscular energy may very properly be termed the secondary functions of protein, inasmuch as these offices can be performed more successfully and more cheaply by the carbohydrates.

(*e.*) It has long been known that, within certain limits, the more highly nitrogenous the ration, the greater its value as a milk maker. Protein, in other words, seems to act somewhat in the manner of a milk stimulant.

The functions of the carbohydrates are four in number:

(*a.*) It forms body fat.

(*b.*) It furnishes material for the production of heat to maintain bodily warmth.

(*c.*) It furnishes material for the production of muscular energy.

Butter Exhibit of the Maine Board of Agriculture at the New York State Dairy Convention, Gouverneur, Jan. 25-27, 1899.

(*d.*) It is not improbably a main supply of material from which milk fat is made.

There is no one function of the carbohydrates which, like the flesh forming function of the protein, can be considered more important than the others. The first three functions are all of the utmost importance to the animal economy.

(*a.*) It has been very thoroughly proven that the fat of the body is mainly derived from the carbohydrates of the food, and but seldom from the protein unless the former be in small quantity, a condition seldom occurring in ordinary practice. This statement is probably correct not only of the true fats of the food but also of the nitrogen-free extract matter (starch, sugar, etc.). Indeed animals have been fatted on rations containing far less actual fat than was formed in the body. While fat may be formed from protein, this ingredient is at least no better fitted for this purpose than are the carbohydrates, and, since it costs several times as much as does the latter to grow or to buy, its use for this purpose is obviously not economical.

(*b.*) Carbohydrates serve as the main supply of fuel wherewith to maintain bodily heat. A certain temperature is necessary for the functional activities of the animal body. If for any cause it falls below a certain point or through fever it increases beyond a certain point, death generally ensues. This heat is kept up by the destruction or burning of certain food ingredients in the body. If sugar or starch were burned in a stove, they would evolve more or less heat, and would form, among other things, carbonic acid gas. If, instead of being burned, the starch and sugar were eaten, they would be consumed by the vital processes of the animal, the same amount of heat would be formed, and the same chemical compounds result as in the burning. Combustion would be slower, but the results would be the same.

(*c.*) Whenever there is any decided exertion of muscular force it is accompanied by greatly increased expenditure of the carbohydrates. The nitrogenous materials suffer but little loss. Of course they are necessary, yet the carbohydrates appear to be the material most vitally concerned. Fat more than any other one constituent of the body appears to be available for this purpose.

(*d.*) Some investigators have claimed that the fat of milk was derived from the protein in the food, others that the food fat alone was concerned, while still others maintain that the carbohydrates in general furnish the raw material for the butter fat. While this point is by no means fully settled, the experiments recently reported by Director Jordan in Bulletin No. 132 of the New York (Geneva) Experiment Station go far towards proving that carbohydrates other than the fat are mainly concerned in the formation of milk fat. In this experiment a cow was fed for three months on a ration containing less than six pounds of digestible fat, yet she gave in her milk sixty-three pounds of fat. This extra fat could not have come from previously stored bodily fat, since the cow gained forty-seven pounds in weight, and was judged to be fatter at the end than at the opening of the trial instead of being thinner. In this case the starches, sugar, etc., must have been the source of the milk fat.

4. FEEDING STANDARDS.

Since protein is preëminently the flesh-forming and the carbohydrates the heat-producing food constituents, it naturally follows that certain proportions of these are best adapted to enable animals most satisfactorily to perform their functions. Just what is this proportion is a question which has received more consideration than almost any other one problem in the whole domain of experimental agriculture. Yet the chances are that no dogmatic statement can ever be made which will be exactly right for all classes of animals or be more than simply a help and a guide in stock feeding. Absolute rules, infallibly correct, applicable under all conditions and to all animals, can never be laid down. Feeding standards have been proposed by several different investigators for different classes of farm animals. Thus we have one for an ox at rest; another for the same animal at work; others for a horse at light, at medium and at hard work; yet others for milch cows, for sheep and for pigs. Indeed of recent years dietaries or standards have been proposed in human feeding. Perhaps fifty years from now the science of the feeding of human beings will have been sufficiently advanced to enable us to prescribe a different ration for the preacher than for the pugilist.

These statements on feeding standards are simply crystallizations of experimental results into mathematical formulæ. They are based upon greater or less amounts of work, many upon little data, while others are the result of many investigations of the most rigid type.

The feeding standards most widely accepted are the so-called German or Wolff standards. The German standard ration for the 1,000 pound cow, calls for 24 pounds of dry matter, 2.5 pounds of digestible protein, 12.5 pounds of digestible carbohydrates and 0.4 of a pound of digestible fat. Wolff's experiments were made many years ago with German cows, with German fodders and feeds and under German conditions. Many American investigators question the usefulness of these standards with American cows, feeds and environments. The tendency in this country has been if anything towards widening this ration, towards lessening the proportional amount of digestible protein.

The distinction should be made, however, between maximum production and economical production. What the dairyman of to-day wants is not that ration which will force a cow to do her utmost regardless of the cost of the food and its effect upon the health of the animal, but that diet upon which the cow will make the largest amount of the cheapest butter. It may be better to make somewhat less butter and make it at less cost than to make large quantities at high cost. It has been claimed that a thousand pounds of butter has been made from one cow in a year. Whether this claim is basedupon facts or not, certainly the ration eaten was excessive and uneconomical. The German standard very properly does not consider the matter of economy. The cost of fodders and feeds varies in different localities and in different years and it would be impossible to fix a standard using variables for the purpose. It is safe to say, however, that at present prices for concentrated feeds in the New England markets a fairly close approximation to the German standard has proven with high grade cows to be an economical ration.

FUNCTIONS OF FARM AND OF MARKET.

Let us now begin to build our superstructure of good dairy feeding practice upon this foundation of scientific principles in stock feeding. Let us in the first place consider what are the proper functions of the farm and of the market in the matter of the economical feeding of dairy cows.

Director Jordan of the New York Station made an epigrammatical statement in an address to the Vermont Dairymen's Association last year which is worthy of emphasis and reiteration. It seems to me that it strikes the key note of the successful dairy practice of to-day in this latitude. He said that "the proper function of the farm in dairy feeding was that of a carbohydrate factory and the proper function of the market was that of a protein supply."

What did he mean by this statement? He meant three things.

(*a.*) That carbohydrates were grown upon the farm with relative ease but that it was not easy, but, indeed, usually impossible, to grow enough protein upon the farm to feed to a large number of dairy cows, a balanced ration.

(*b.*) That since the by-products of several industries are notably rich in protein and are sold at fairly reasonable prices, it was sometimes cheaper to buy this material than to raise it.

(*c.*) That while the farm growing of protein was to be encouraged, yet it was usually in the line of economy to endeavor to grow carbohydrates in as large amounts as possible, and to buy protein in order to supplement this growth, thus properly balancing the ration, provided the class of cows to which the ration was fed was of the proper grade.

CLASSIFICATION OF FODDERS AND FEEDING STUFFS.

What may properly be termed economical and what uneconomical roughages? How shall we classify our feeding stuffs? This is to quite an extent a matter of personal judgment. I am perfectly willing to allow any one to disagree with me in the classifications which I shall offer.

ECONOMICAL ROUGHAGES.

1. Early cut hay.
2. Silage from matured corn.
3. Oats and peas.
4. Clover.

UNECONOMICAL ROUGHAGES.

1. Late cut hay.
2. Silage from immature corn.
3. Roots.
4. New and untried crops.

ECONOMICAL CONCENTRATES.

1. Cottonseed meal.
2. Linseed meals.
3. Certain gluten meals and feeds.
4. Dried brewers' grains, malt sprouts, etc.
5. Bran, middlings, etc.
6. Corn meal (sometimes).

UNECONOMICAL CONCENTRATES.

1. Cornmeal (usually).
2. Oats.
3. Oat feeds.
4. Mixed feeds or provenders.
5. Condimental foods, etc.

Tables showing analyses and digestible ingredients of the materials considered in the present discussion are presented herewith. The reader may refer to them as needed.

AVERAGE COMPOSITION OF ROUGHAGES AND CONCENTRATES REFERRED TO IN THE PRESENT ARTICLE.

Classified as Economical Roughages.	Moisture.	Dry matter.	Crude ash.	Crude protein.	Crude fiber.	Nitrogen-free extract.	Ether ext't.
Early cut hay	15.3	84.7	5.5	7.4	27.2	42.1	2.5
Silage from mature corn	77.9	22.1	1.5	2.0	5.6	12.2	0.8
Oats and peas	71.3	28.7	1.9	3.6	8.5	13.6	1.1
Red clover hay	15.3	84.7	6.2	12.3	24.8	38.1	3.3
Classified as Uneconomical Roughages.							
Late cut hay	14.1	85.9	3.9	5.0	31.1	43.7	2.2
Silage from immature corn	85.7	14.3	1.9	1.4	4.6	5.6	0.8
Roots—Beets	88.5	11.5	1.0	1.5	0.9	8.0	0.1
Carrots	88.6	11.4	1.0	1.1	1.3	7.6	0.4
Turnips	90.5	9.5	0.8	1.1	1.2	6.2	0.2
Classified as Economical Concentrates.							
Cottonseed meal	8.2	91.8	7.2	42.3	5.6	23.6	13.1
Linseed meal (new process)	10.1	89.9	5.8	33.2	9.5	38.4	3.0
Linseed meal (old process)	9.2	90.8	5.7	32.9	8.9	35.4	7.9
Flax meal	8.3	91.7	5.6	38.4	8.6	35.4	3.7
Chicago gluten meal	8.5	91.5	1.1	35.3	1.1	51.2	2.8
Cream gluten meal	8.0	92.0	1.0	34.3	1.7	53.2	2.7
King gluten meal	6.5	93.5	2.3	32.9	1.4	42.4	14.5
Buffalo gluten feed	9.0	91.0	1.0	28.2	6.6	52.4	2.8
Golden gluten feed	7.6	92.4	1.2	28.1	3.3	56.3	3.5
Diamond gluten feed	7.5	92.5	1.0	21.6	6.1	60.9	2.9
Dried brewers' grains	8.2	91.8	3.6	19.9	11.0	51.7	5.6
Malt sprouts	10.2	89.8	5.7	23.2	10.7	48.5	1.7
Atlas gluten meal	6.8	93.2	2.0	32.9	11.1	35.2	12.0
Wheat bran	11.9	88.1	5.8	15.4	9.0	53.9	4.0
Wheat middlings	12.1	87.9	3.3	15.6	4.6	60.4	4.0
Corn meal	15.0	85.0	1.4	9.2	1.9	68.7	3.8
Classified as Uneconomical Concentrates.							
Corn meal	15.0	85.0	1.4	9.2	1.9	68.7	3.8
Oats	11.0	89.0	3.0	11.8	9.5	59.7	5.0
Oat feeds*	7.5	92.5	5.5	10.0	21.5	51.9	3.
Mixed feeds*	9.8	90.2	4.4	14.2	7.9	59.1	4.6
Condimental foods, etc., and mixed feeding stuffs†	7-11	89-93	2-20	9-27	[3-16	39-64	3-10

* Oat feeds and mixed feeds are sold under many different brands and if not adulterated are usually fairly uniform in composition.

† These special goods vary much in composition. A tabulation showing composition of 22 different kinds is given in the 1897 Year Book of the U. S. Department of Agriculture, page 425.

AVERAGE DIGESTIBLE CONSTITUENTS IN ROUGHAGES AND CONCENTRATES REFERRED TO IN THE PRESENT ARTICLE.

Classified as Economical Roughages.	Protein.	Carbo-hydrates.	Ether extract.
Early cut hay	5.0	33.3	1.5
Silage from mature corn	1.3	14.1	0.6
Oats and peas	2.9	13.9	0.8
Red clover hay	6.8	22.4	1.6
Classified as Uneconomical Roughages.			
Late cut hay	2.3	42.9	1.2
Silage from immature corn	0.8	7.0	0.6
Roots—Beets	1.2	8.8	0.1
Carrots	0.8	7.8	0.2
Turnips	1.0	8.1	0.2
Classified as Economical Concentrates.			
Cottonseed meal	37.2	16.9	12.2
Linseed meal (new process)	28.2	40.1	2.8
Linseed meal (old process)	29.3	32.7	7.0
Flax meal			
Gluten meals (in general)	25.8	43.3	11.0
Gluten feeds (in general)	20.4	43.8	8.6
Dried brewers' grains	15.7	36.3	5.1
Malt sprouts	18.6	37.1	1.7
Atlas gluten meal	25.8	43.5	11.8
Wheat bran	12.2	39.2	2 7
Wheat middlings	12.8	53.0	3.4
Corn meal	7.0	65.2	3.3
Classified as Uneconomical Concentrates.			
Corn meal	7.0	65.2	3.3
Oats	9.3	48.3	4.2
Mixed feeds (corn and oats equal parts)	7.4	61.2	3.7

Oat feeds and condimental feeds are not included for lack of data.

Economical Roughages.

I. EARLY CUT HAY.

Early cut hay is to be preferred to a late cut crop purely on the grounds of quality. The dry matter of most if not all crops is relatively richer in protein in the early stages of its growth and in carbohydrates in the later stages. This point is well brought out in the following table, which shows the analyses of the dry matter of timothy hay, cut at four different times. This table, as well as that which immediately follows, is taken from Bulletin No. 5, of the Illinois Experiment Station.

COMPOSITION OF DRY MATTER OF TIMOTHY HAY CUT AT DIFFERENT PERIODS.

	Crude ash.	Crude protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.
In full bloom	6.81	7.33	32.11	48.75	5.00
Anthers half-shed	6.65	6.56	33.74	48.59	4.46
Seed in dough	6.73	6.12	34.45	48.89	3.81
Seeds nearly ripe	5.90	6.23	33.82	50.67	3.38

Owing in part to the harder coating of the stalk and seed, and the shelling of the seed, the late cut hay is less digestible than that cut early, so that this table understates rather than overstates the truth.

Attention has already been called to the difficulty of growing protein upon the farm. By cutting hay early one can do something towards increasing the farm protein supply and lessening grain bills. When hay is cut early, quantity has to be in some measure sacrificed to quality, or else in some cases extra work is involved in cutting a rowen crop. It may sometimes occur that one is so situated that it will be more economical to make but a single cutting, thus saving labor. The farmer must balance extra labor against extra farm-grown protein and decide for himself.

The following table gives a fair indication of the hay and nutrient yields from timothy at four states of growth, showing that early cutting involves a sacrifice in gross tonnage. The increase in crop, however, is in the less costly carbohydrates. The extra crude fibre may be accounted to have but little feeding value.

HAY AND NUTRIENT YIELDS IN POUNDS PER ACRE.

		Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.
In full bloom	4480	224	240	1056	1602	165
Anthers half-shed	4320	228	225	1155	1663	152
Seed in dough	5240	273	246	1380	1960	153
Seeds nearly ripe	5180	239	253	1377	2058	137

2. SILAGE FROM MATURE CORN.

It was long ago clearly shown that the most economical farm-grown carbohydrates raised in New England are derived from the corn plant and that they are more economically preserved for cattle feeding in the silo than in any other way. Occasionally one finds a man who has used the silo and abandoned it, but such are exceptions to the rule. Those who are prejudiced against it have generally become so because of its mismanagement.

Well informed farmers are rapidly becoming a unit in their appreciation of silage. The stations also have told the story of its superiority over corn fodder. Let me cite the experience of our own station in this matter:

For three years we harvested our corn crop experimentally in essentially the following manner: Taking our corn fields as a whole, one-fourth of the crop was placed in the silo; another fourth was stooked; the ears were plucked from the third fourth and the stalks put in the silo; while the ears were plucked from the fourth fourth and the stalks stooked. The plucked ears were ground and the meal fed in connection with the stalks from which they came. Each year a number of cows were selected for the test, and something over thirty cows recorded their testimonies. Each year the cows were divided into four lots. The first lot was fed for four weeks on silage, then for the next four weeks on stover silage together with the meal which belonged thereto; for the next four weeks on corn fodder; for four weeks on corn stover and meal; and for the fifth four weeks were fed the same silage that they began on. Lots 2, 3 and 4 were fed the first four weeks respectively upon stover silage and meal, upon corn fodder, and upon corn stover and meal. were shifted from time to time to the other rations and finally wound up on the fifth four weeks on the material on which their experimental feeding began. Each year each cow said by the way of the milk pail and the butter tub that she preferred to have the corn plant put in the silo, ears and all. Each year she gave more milk and butter on silage, ears and all in the silo, than when she was fed the corn plant harvested in any other way. Her testimony was unvarying that it was time and money worse than wasted to pluck the ears from the corn. The following table gives the condensed testimony of the various trials:

AREA OF CORN HANDLED IN VARIOUS WAYS NECESSARY TO FURNISH THE SAME MILK AND BUTTER YIELD AS AN ACRE OF SILAGE, EARS AND ALL IN THE SILO.

	Stover silage and meal.	Corn fodder.	Corn stover and meal.
1891		1.07	
1892	1.26	1.08	1.26
1894	1.10		

I can readily imagine that if field corn was planted it might be unfitted for silage, that there might be necessity for plucking some ears. When, however, Sanford corn or some variety of that general type is allowed to stand until the kernels are just beginning to glaze, the silage ought to prove a satisfactory and an economical source of carbohydrates.

If the corn be cut before the glazing point of the kernels there is loss of potential food ingredients. If it stands much later, but little food is gained and there is considerable danger of frost. An experiment made at the Vermont station in 1892 bears testimony upon this point.

SANFORD CORN CUT AT VARIOUS STAGES OF GROWTH.

	Dry matter.	Crude ash.	Crude protein.	Crude fiber.	Nitogen-free extract and ether extract.
Tasselling	2526	246	408	664	1208
Roasting state	4266	303	512	982	2468
Nearly ready for silo	6006	328	649	1287	3742
Glazed	6391	319	642	1194	4237

3. OATS AND PEAS.

The problem of pasture renovation is one that perplexes us all. Much of the land which once was rich in pasture feed is now given over to brakes and weeds and is more or less covered with second growth. I am no prophet, yet I believe that it is the ultimate destiny of large tracts of land in Vermont hitherto used for pasture to revert to the forest for which, I think, the Almighty designed them. I think it is safe to say that many of our so-called "abandoned farms" should never have been farms, that they would prove more profitable as forest lands. I cannot speak for Maine farmers but I am confident that considerations of economy soon will force many Vermont farmers to lessen their pasture areas and to supplement them with the larger use of the soiling crops. The experiment stations in this and other countries have for many years been experimenting with various forage crops. It is one of the proper functions of the experiment station to make the farmers' mistakes for them and we have made at Burlington a good many mistakes in growing new and untried crops. We have yet to find a forage crop more valuable as a supplement to the pasture than are oats and peas. Silage fed three hundred and sixty-five days in the year is probably the most economical means of helping out the pasture, but for summer forage oats and peas are a good second. Planted at intervals, say of ten days, this combination furnishes a very good supplement to the pasture. It is liked by the cattle and serves to keep up the milk flow. Good catches have been obtained by sowing the peas first and harrowing them in fairly deep and then putting the oats on separately, then harrowing or bushing them in. One bushel of oats to two bushels of peas is a good combination. They should be cut when the oats are just headed but before they begin to turn yellow. We have grown as high as nineteen tons of green forage to the acre at the station farm with the following composition:

Dry matter 28.73, crude ash 1.94, crude protein 3.62, crude fibre 8.49, nitrogen-free extract 13.58, ether extract 1.10.

It will be noted that this compares very favorably with early cut hay or even with clover hay. The crop is well relished by cattle fed green, as hay, or ensiled.

4. CLOVER.

Whenever one can grow a good crop of clover it is one of the very best things for balancing the ration, for renovating the soil, and for helping out the pocketbook. Farmers can hardly grow too much clover. As is well known, this crop is frequently difficult to grow. The reasons for its failure are not always easy to discern. Among them may be noted, however, a lack of lime or of potash in the soil, the absence of the nodule-forming bacteria, the acidity of the soil, etc. Vermont, and probably Maine, also, are located too far north to enable the farmer to grow the crimson clover successfully. The red and the alsike are of about even value. Clover is at its best when cut in its early bloom. It may be ensiled, but is none the better for being put through this process. If properly hayed it is in as good condition for preserving as if handled in any other way.

Uneconomical Roughages.

1. LATE CUT HAY.

Late cut hay is not an ideal feed for dairy stock, owing to the large increase of indigestible woody fiber which occurs as the crop approaches maturity. Experiments have clearly shown that there is little if any more digestible matter in a crop of late-cut than in one of early-cut hay, even though the latter be much larger in quantity. Its quality is notably inferior. It is obviously true that the farmer who has a large area of meadow land cannot cut the entire amount at just the right time; some must be cut too early and some too late. I have yet to hear, however, of the man who regretted starting his mowing machine too early in the year. *The early bird catches the protein.*

2. SILAGE FROM IMMATURE CORN.

The silo received a serious set back in its early days in this country because of the exceedingly wet, sour nature of the silage. Many costly silos were built and filled with immature corn. As a result this method of feeding animals became practically no more than an expensive way of watering cows. Cases have been known where 90 per cent, even 92 and 93 per cent of water in immature corn was put in the silo. Note for instance the composition of the Red Cob corn on August 15 and on August 29, in the following table. This is a very fair type of the corn used largely twelve to fifteen years ago for silos and too frequently planted to-day. But 10 pounds of food in 100 pounds of silage, as against 25 to 30 pounds in the ideal silage of to-day.

COMPOSITION OF RED COB CORN AT VARIOUS STAGES OF GROWTH.

		Water.	Dry matter.
August 15	Not tasselled	89.66	10.34
August 29	Tasselling	88.58	11.42
September 13	Earing	83.42	16.58
September 28	Partly eared	80.96	19.04

Corn as wet as this is bound to sour and the silage has but little value. One should avoid this error and plant only such varieties as will allow about 25 per cent of dry matter to be placed in the silo. Such varieties should be chosen as will reach the point of glazing before the first frost. It may not be amiss to call attention here to the necessity of avoiding the other extreme of putting too much dry matter in the silo. If over-ripe corn be ensiled or much more than 30 per cent of dry matter is ensiled, one may reasonably expect more or less fire-fanging.

3. ROOTS.

Many farmers have a high opinion of the value of roots as a feed for cattle. This opinion in my judgment is not well founded. It will be a surprise to many to learn that some roots are as wet as skim-milk. Mangel wurzels contain only about 9 pounds of dry matter in a hundred, while skim-milk carries 9.5 pounds. Rutabagas and carrots run from 11 to 13 pounds of dry matter to the hundred. The feeder should remember that food is valuable in proportion to the amount of digestible dry matter it contains and that water in large quantities lessens its worth. These wet materials are consequently handicapped. They have a distinct value as appetizers and to those who have not built or will not build a silo. Others will usually find them a more expensive source of digestible carbohydrates than the corn crop.

4. NEW AND UNTRIED CROPS.

It seems folly for farmers to spend much time and money in growing largely of new and untried crops. The seedmen's catalogues each year contain glowing descriptions of various new-fangled crops of greater or less agricultural value. Sachalin, flat pea and a host of others of like ilk have had their day and the place thereof knows them no more. It is one of the provinces of the experiment station to make trials of this kind, to sift out the good from the bad. It were wiser for the farmer to counsel with the station before making large outlays for new crops and determine the probabilities of success or failure. Let the station make these mistakes rather than the farmers.

The four materials noted on the past few pages as economical farm-grown crops are distinctly carbohydrate in their nature.

Granted that the early cutting of hay tends to add to its protein content, that oats and peas and clover are, as compared with other farm crops, decidedly nitrogenous ; yet notwithstanding, they are, properly speaking, of a carbohydrate nature. It was stated some pages back that the production of this material was the proper function of the farm. None of these materials can, as a rule, economically supply sufficient amounts of protein to meet the needs of large numbers of animals. Hence we must turn to the market for this protein supply and should govern our purchases largely, though not entirely, by the proportion of this ingredient in the materials offered.

Economical Concentrates.

1. COTTONSEED MEAL.

This well known material is derived from the seed of the cotton plant. This seed comes from the plant covered with a coating of white down technically known as "linters." This being removed by a special process, leaves the seed covered with a thick hard black coating or hull, containing the embryo or meat. In the process of manufacture of cottonseed oil, the hulls are removed, the meats cooked in a large kettle and, while still warm, wrapped up in hair cloth and subjected to great hydraulic pressure in order to remove the oil. The pressed cake is then broken and ground, forming the bright lemon-yellow meal. As will be seen by the analysis and in the table showing digestible constituents, this material is the richest concentrate sold in the market. Reference to the table showing plant food contents in the fodders and feeds now under discussion shows it is similarly rich in plant food. This feeding stuff is very desirable as a means of narrowing the ration and bettering its service for dairy purposes. In brief it may be said that when fed in reasonable quantities together with other and proper feeding stuffs, satisfactory results may be secured with all farm animals except calves and swine. Care should be taken, however, that wet or mouldy meal be not fed. One should buy only that having a bright lemon-yellow color and a fresh, clean, nutty taste. Dull red, dull yellow or dull brown meals should be looked at with suspicion as they usually are either injured through being exposed to the air, have been overheated, are mouldy or musty, or are adulterated.

2. LINSEED MEALS.

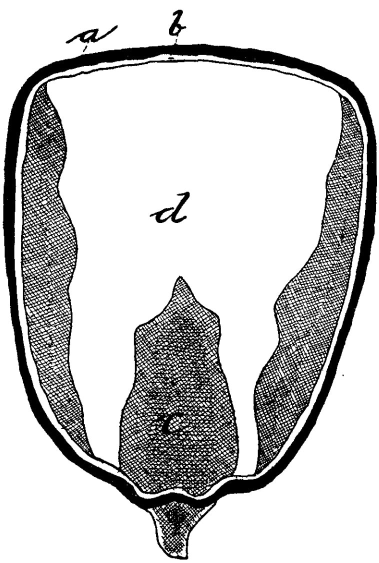
Linseed meals are the refuse remaining after the oil has been expressed or extracted from the flaxseed. These seeds are treated much in the same way as the cottonseeds for the extraction of oil. The new process meals have a larger proportion of the oil extracted, since in addition to hydraulic pressure naphtha is used as an oil solvent. The so-called flax meal is practically but a variety of linseed meal which has been subjected to steam treatment. It is more coarse and flaky than the ordinary linseed meal. The linseeds, while at ruling prices somewhat more costly, are notably desirable. They are largely used as a basis of condimental feeds. They have a good effect upon the digestive system and, barring the tendency of softening the butter which will be referred to later on, are in every way suitable for dairy feeding.

3. GLUTEN MEALS AND FEEDS.

These materials are by-products of the manufacture of glucose. They are made essentially as follows: The whole corn is soaked in warm water for many hours until swollen and thoroughly softened. It is then run through stones set quite a distance apart. This rubs off the husk and the germ, and at the same time beats up the starch and the gluten. The mass is sifted through fine sieves, the starch and gluten passing through, the husk and the germ remaining behind to be separated, if desired, by gravity, the husks floating and the germs sinking in water. The starch and gluten which have passed through the sieves are separated by running into large tanks and settling, or by slowly running through long troughs. The starch, being heavier, settles to the bottom, while the lighter yellow gluten-containing material runs off from the top. The portions thus separated form the gluten meal. When, as is frequently the case, the corn skins and germs are mixed with the meal, the material is termed gluten feed.

PARTS OF CORN.

The accompanying enlarged cut of a corn, or maize, kernel will assist in locating the four distinct parts which are of interest in this study. a is the husk, or skin, which covers the whole kernel; it consists of two distinct layers, the outer and inner, which, when removed, constitute the bran, and contain practically all of the crude fiber of the whole grain. b. is a layer of gluten cells, which lies immediately underneath the husk; it is yellow in color and cannot be readily separated from the remainder of the kernel. This part is the richest of any in gluten.



c is the germ, which is readily distinguished by its position and form; it also contains gluten, though it is particularly rich in oil and mineral constituents. The large portion, d, is composed chiefly of starch; the dark color indicates the yellow, flinty part, in which the starch-holding cells are more closely compacted.

These goods have varied more or less in years past, one brand from the other, but of late years they have become quite uniform in composition and have been among the cheapest of our concentrates. The meals have as a rule been cheaper than the feeds in proportion to the food contents. As will be noted farther on these materials have sometimes been found to cause digestive troubles and injured the quality of butter, hence, while valuable when fed in moderate rations, they should not be fed in over large quantities.

4. DRIED BREWERS' GRAINS, MALT SPROUTS, ETC.

These refuse materials are distillery and brewery by-products. When dry they are safe to feed to milch cows and have been found to be quite cheap sources of protein. They are not so rich as cottonseed and linseed meals, yet are often cheaper than these two materials and are apt to be safer than the former one. Their effect upon the quality of the product is not as yet clearly defined. We have used the so-called Atlas gluten meal (a distillery by-product wrongly called gluten) at the experiment station for three years and have found it a desirable and economical form of protein. A few cows have not eaten it when fed in large quantities and one or two have utterly refused it even in the smallest quantities. Most of the animals have taken to it readily and done well upon it.

5. WHEAT BRAN AND WHEAT MIDDLINGS.

These materials are so well known, so widely used and their good qualities so generally appreciated that stress need not be laid upon them here. They are pre-eminently milk makers. I believe they are absolutely safe when fed in any possible quantities, they carry considerable percentages of protein, and, at ruling prices, are in every way desirable dairy feeds.

6. CORN MEAL (SOMETIMES).

I have classified corn meal under both the economical and the uneconomical headings. Sometimes corn meal may be used to an advantage in the dairy ration. I find fault more particularly, however, with the extent of its use. I think it is wiser to feed corn in the form of silage rather than to pluck and grind the ear. If, however, the silage is deficient in corn it may be supplied in the shape of meal. Indeed, up to the limit of making the ration too heating, one may sometimes to advantage add corn meal to the ration even when the silage is well eared, more particularly because it tends to better the grain of butter.

Uneconomical Concentrates.

1. CORN MEAL (USUALLY).

My associate upon the Vermont State Board, Mr. Williams, spent a good deal of time during last year taking statistics for Vermont touching the use of feeding stuffs for domestic animals. He finds that nearly $3,500,000 are spent annually for this class of materials, and that of this sum a million and a quarter are spent for western corn. I will freely grant that it may not infrequently prove worth while to buy western corn. I question, however, the wisdom of putting forty per cent of this money to this use. I have no hesitation in saying that as a rule corn may be grown more cheaply than it can be bought, that better service for the same expenditure would generally be obtained by the purchase of materials more nitrogenous and less carbohydrate in their nature. It is like carrying coals to Newcastle. The buyer of corn meal gets those ingredients which are most easily raised upon the farm and not those which the ration lacks. A million and a quarter is far too large a sum to spend for carbohydrates. It is an economic crime. Vermont dairymen need to awaken to this mistaken policy and in these days of close markets and low profits to buy what they want and not add to the stock of what they have.

2. OATS.

Mr. Williams finds that over half a million is paid out in Vermont each year for oats. Oats are an excellent dairy feed and well adapted for milk making. They are far better for this purpose than is corn. It may well be questioned, however, if they are economical at present prices as compared with other and richer concentrates.

3. OAT FEEDS.

A class of materials known as "oat feeds" has been sold for several years upon the New England market. These goods have usually had a fairly uniform composition and in states where analysis needs to be guaranteed they have been found to be as a rule all that they are promised to be. They are made up usually of more or less corn and oats with sometimes a mixture of some material like gluten meal that is richer in protein and they contain considerable quantities of oat hulls. Their excuse for existence is simply and solely as a means whereby oat-meal manufacturers may work off their by-products, such as oat hulls, light oats, etc. It seems as if it hardly needed argument that this class of material cannot be very economical at the prices asked. The food ingredients are not as cheap as in most other feeding stuffs, and I do not feel that they are to be recommended to dairymen.

4. MIXED FEEDS AND PROVENDERS.

Most of these materials are combinations in different proportions of corn and oats. Inasmuch as these two ingredients have already been considered separately, and classified as uneconomical, their mixtures are naturally to be placed under the same ban. It happens, moreover, that these mixtures have of late years been found ready means of disposing of oat hulls, and not infrequently mixed feeds are found upon the market which carry undue proportions of these hulls. Oat hulls have hardly more food value than ground toothpicks. If one desires to feed corn and oats, it is far better to have the materials ground by a miller whose responsibility can be vouched for than to buy ground materials.

5. CONDIMENTAL FOODS.

The list of condimental feeds, patent medicines and cure-alls for cattle, etc., is a long one. The late lamented P. T. Barnum once said that "the American public likes to be humbugged," but one who was greater than he, who guided the destinies of this nation through the Civil War, said "you can fool all the people part of the time and part of the people all the time, but you cannot fool all the people all the time." This being the case I look forward to the day when this class of material will be relegated to the rear by intelligent farmers and be less widely used. It has been shown that condimental foods seldom if ever increase production or materially better the conditions of healthy animals. If animals are ailing it is generally wiser to consult a veterinarian than to doctor them with nostrums.

Further Considerations Guiding Choice.

In the choice of economical concentrates one should bear in mind several points other than simply the protein content of the material, including

1. Effect upon the health of the animal.
2. Effect upon the quality of the product.
3. Effect upon the quality of the manure.
4. Relation of cost to value.
5. Dairy character of the herd.

1. EFFECT UPON THE HEALTH OF THE ANIMAL.

The question is often asked, "How much cottonseed, linseed or gluten is it safe to feed to a cow?" This question cannot be dogmatically answered. One might as well ask "How much beefsteak can I eat without suffering a fit of indigestion?" The amount which may be safely fed is determined mainly by the individual make-up of the animal. We had a cow once in our herd which consumed an almost fabulous amount of cottonseed meal, while others have been thrown off their feed by two pounds a day. Linseed meals appear to be quite safe in any quantity. Cottonseeds and glutens in quantity will sometimes tend to cause garget and fever. The only rule which can be safely given is to feed these materials with a sparing hand until the digestive capabilities of each animal are thoroughly gauged, then if one has high grade animals able to make large quantities of butter one can generally afford to feed up to the limit of healthful production.

2. EFFECT UPON THE QUALITY OF THE PRODUCT.

The quality of the butter or cheese, i. e., its grain and consistency, is affected sometimes by changes in feeding. Cottonseed products are apt to make butter hard, while linseeds and, as a rule, glutens, soften it. The effect of the distillery by-products is not as yet thoroughly understood. The intelligent feeder should know these points and govern himself accordingly.

3. EFFECT UPON THE QUALITY OF THE MANURE.

To the farmer who carefully observes the well known methods of preserving manure from fermentation and leaching, this point is of much importance. To him who does not try to follow modern methods in this respect it is of little value. The animal voids nothing that it does not eat or drink and its voidings are of a different quality, so far as plant food is concerned, in proportion to the variations in the food eaten. Rich food makes rich manure and poor food, poor manure. Cottonseed, linseeds, glutens, brans, distillery by-products, etc., are of distinct value in this respect, while corn meal and the like rank relatively low. The following table shows something of the manurial values of the various fodders and feeds considered in this article. It should not be supposed that every particle of the plant food will of necessity reach the soil. More or less, according to the care or lack of care with which the manure is handled, will be of use. It is fair to assume, however, that the losses will be proportional regardless of the quality of the manure.

PLANT FOOD IN POUNDS PER TON IN ROUGHAGES AND CONCENTRATES DESCRIBED IN THIS ARTICLE.

	Nitrogen.	Phosphoric Acid.	Potash.	Valuation*
Early cut hay	30	9	16	$ 5 24
Silage from mature corn	6	2	7	1 22
Oats and peas (green)	13	3	13	2 49
Red clover hay	41	7	44	7 89
Late cut hay	25	11	18	4 71
Silage from immature corn	4	2	6	1 00
Roots—Beets	5	2	8	1 12
Roots—Carrots	3	2	10	0 93
Roots—Turnips	4	2	10	1 07
Cottonseed meal	136	58	17	22 08
Linseed meal (new process)	116	37	28	18 91
Linseed meal (old process)	109	33	27	17 73
Flax meal	123	17	28	19 09
Chicago gluten meal	112	8	1	16 04
Cream gluten meal	110	7	4	15 86
King gluten meal	105	15	1	15 34
Buffalo gluten meal	90	6	2	12 92

	Nitrogen.	Phosphoric Acid.	Potash.	Valuation.
Golden gluten meal	90	8	1	12 96
Diamond gluten meal	70	8	1	10 16
Dried brewers' grain	72	21	2	11 00
Malt sprouts	71	28	33	12 46
Atlas gluten meal	105	12	2	15 26
Wheat bran	53	58	32	11 10
Wheat middlings	53	19	13	8 73
Corn meal	36	14	8	5 92
Oats	41	16	12	6 88
Oat feeds	34	18	11	5 95
Mixed feeds	45	15	20	7 75

*Allowing 14 cents for nitrogen, 4 cents for phosphoric acid and 4¼ cents for potash, the prices at which these ingredients in forms of like availability could be bought in 1898 in the shape of crude stock for commercial fertilizers.

4. RELATION OF COST TO VALUE.

It is difficult to say dogmatically whether one or another grain feed relatively contains the most value for the dollar invested. It is impossible to apply a valuation system to feeding stuffs with the same degree of certainty with which it may be used with commercial fertilizers. Various attempts to do this have been made with rather doubtful success. This failure is on the whole an advantage. It would be a misfortune were it ever possible to reduce the science of stock feeding to the condition of a branch of applied mathematics. It might then be carried out in a perfunctory manner; now it is a study worthy of a high order of intellect. Chemical analyses, feeding and digestion experiments and the like are helpful but cannot take the place of careful observation.

The selling prices of the various concentrates are not always, indeed they are seldom, gauged by their compositions. They are governed by considerations of supply and demand, and are, moreover, quite open to fluctuation. Hence it follows, since the proper function of the market is that of protein supply and not a source of carbohydrates, that those materials rich in protein are usually the cheapest.

5. DAIRY CHARACTER OF THE HERD.

Quite as important as anything else in connection with economical dairy feeding, is the character of the cows. I do not care to take sides with the Jerseys, the Ayrshires, the Guernseys or the Holsteins. There are good and there are poor individuals in all breeds. It is folly, however, to feed high grade food to low grade cows. A herd giving at least 250 or, better, 300 pounds or more of butter to the cow in a year, may well be well feed. Dairying with such a herd, economically and properly fed, is still profitable.

FEEDING-STUFFS CONTROL.

The question is sometimes asked whether there are sufficient variations in the composition of feeding stuffs, brought about by natural causes, changes in methods of manufacture or by adulteration, to make worth while a system of inspection of feeding-stuffs similar to that exercised over the commercial fertilizer trade. I think that this question may be properly answered in the affirmative.

Feeding-stuff controls have been in vogue in European countries for many years. Maine and Massachusetts have led in this matter in this country, the Vermont legislature passed a law a few days ago similar to that in force in this State and New Hampshire, Rhode Island and Delaware are considering the advisability of following suit. The arguments in favor of a state control of feeding stuffs are briefly as follows:

1. The trade involves enormous sums. Approximately $3,500,000 a year is expended in Vermont for feeding stuffs for domestic animals and larger amounts in Maine.

2. The feeding stuffs sold are of many kinds, they often bear misleading names, and their selling prices are no certain index of their value as feeds.

3. Different feeding stuffs vary largely in composition, one from another, while those of the same name may be widely apart in feeding values owing to differences brought about (a) by variations in the composition of the material from which they are derived; (b) by differences or changes in methods of manufacture; (c) by adulteration.

4. Guaranteed compositions would tend to insure better values, wiser purchases and greater confidence. A feeding stuff control would aid in money saving and be of distinct educational advantage.

All the arguments favoring a control of the sale of commercial fertilizers are applicable to the present case.

The director of your own station has stated that "the most noticeable thing accomplished by the law is the driving out of the State of the adulterated cottonseed meal which was so largely sold in 1897. The inspection law has driven it to other states." The chief chemist of the Rhode Island Station says: "I regret to say that Rhode Island is becoming the dumping ground of adulterated cottonseed meal, etc." The law has been found in experience to "protect both the dealer and the consumer" and to "tend toward a more rational use of feeding stuffs, which will be alike beneficial to the feeder and the dealer." Dr. Lindsey of the Massachusetts station states that "while fully one-third of all samples of cottonseed meal received at this station during 1897 proved to be seriously adulterated, thus far in 1898 not a single adulterated article has been discovered." He also says that "the inspection shows the feed stuffs to be comparatively free from serious adulteration. Some show rather wide variations in composition, which it is hoped will be corrected in the future." Also "a great variety of oat refuse is now finding its way into our markets. It has been found to contain from thirty-five to nearly sixty per cent of hulls . . . farmers are cautioned against paying excessive prices for material of this kind." There seems to be no valid argument against the law from the standpoint of the farmer and I have no doubt that in proportion as it becomes common among the states its benefits will become yet more apparent and that it will outrival even the fertilizer laws in popularity.

Ques. You stated that corn meal was sometimes a fattening food. If your main object was to fatten cattle would not corn meal be economical?

Ans. It would be decidedly the most economical, but my talk this afternoon has been on economical *dairy* feeding, not economical stock feeding. Corn meal is par excellence the thing for fattening, but not for putting that fat into the milk pail.

Ques. What would you prescribe for a balanced ration for dairy cows?

Ans. There are a great many of them. I can simply indicate one which has worked very nicely for many years at our Station, and that is as follows: Anywhere from seven to twelve pounds of good hay, according to the animal's capacity, as much silage as she will eat and eight pounds a day of a ration containing three pounds of wheat bran, two pounds of corn meal, and one and one-half pounds each of linseed and cottonseed. If an objection is raised ouching the price of linseed, the cottonseed might be increased to two pounds and one pound of gluten substituted for the linseed.

Ques. Would you feed bran, or something of that nature, with corn meal in fattening an animal, or corn meal alone with roughage?

Ans. My safest answer to that question is that I do not know, because I have not donevery much of that work; but in my judgment is would be a wise thing, for some animals, to feed bran with the corn meal. Corn meal is heating, and will pack in the stomach, and bran would tend to lighten it up, and the health of the animal would be better. I do not think bran is quite as efficient a fattening agent as corn meal.

Ques. Is it not economical to put corn into the silo and then feed it?

Ans. It is economical to feed, but not to buy.

Ques. Cannot we obtain the protein in gluten meal and have a safe feed, instead of obtaining it from cottonseed meal, which is a questionable feed?

Ans. Our experience as between cottonseed and gluten is that so far as safety is concerned one is as bad as the other. We have made our cows sick with gluten, and we have made our cows sick with cottonseed. I think gluten protein is cheaper than cottonseed protein, but I think it is almost, if not quite, as dangerous.

Ques. Did I understand you to say that you fed all the ensilage the animal would eat?

Ans. Yes; I think after the cow has had a plentiful ration of hay, she might as well have all the ensilage she will eat.

Ques. Do you feed the hay before the ensilage?

Ans. I think it makes but little difference, as to the details of feeding. We feed ensilage sometimes once a day and sometimes twice a day. We feed only twice a day, of any feed, once in the morning and once at night.

Ques. Will you please describe gluten meal?

Ans. There are two different classes, in fact three different classes, of so-called gluten products on the market,—gluten meal, gluten feed and a class of materials that are masking under that name. The gluten meal is made as follows: the corn is taken into the glucose factories and is moistened and then rubbed between grindstones to break off the skin of the kernel and the germ, then the interior of the kernel is ground very fine, and is sifted and dropped into water. The starch is heavier than the gluten, and therefore the starch, or a large part of it, sinks to the bottom, while the gluten, mixed with some starch, floats on the surface of the water, and simply runs off or is skimmed off, and is dried and makes the gluten meal. The gluten feed is made by the mixing with this meal of the skins and germs. There are several materials that are on the market masking as gluten that are really distillery by-products, among them the Atlas and the Otswego gluten. The Atlas is a very good feed, the other I know nothing about.

Ques. You think the gluten is injurious?

Ans. It is injurious of itself, in large quantities. Fed in quantities of three or four pounds a day I do not think it is at all hurtful, but if seven or eight pounds a day are fed it must make a pretty salvy butter and must be rather hard on the digestion of the animal.

Ques. Is it wise to feed oftener than twice a day?

Ans. I do not know, but in my judgment twice a day is sufficient.

Ques. Is it not true that much of the gluten meal that is sold to-day is a vastly different thing from the gluten meal referred to in your chart? We have a gluten meal that carries only two or three per cent. of fat and does not make soft butter.

Ans. There are glutens and glutens. One of the best arguments for the enactment of the feeding stuff law which was put through the Maine legislature two years ago and went through the Vermont legislature two weeks ago was the fact that there are so many different things selling under the same name, so widely different in their character. There are some glutens rich in fat and some of recent manufacture poor in fat. This chart was made four or five years ago, and most of our experiments with gluten were made three or four years ago, but those have invariably produced, so far as I know, soft butters. I cannot say from my own knowledge whether the glutens that are poor in fat will make soft butter or not. There are many glutens still on the market which have large percentages of fat and do make these soft butters. I should say to those who are using glutens, get those relatively low in fat.

R. W. ELLIS.

Mr. President; Ladies and Gentlemen: I was called up by Brother McKeen, I suppose, for the reason that I am somewhat of a crank on feeding matters and he thought I might advance some cranky ideas that would bring out a lively discussion. I have been in the dairy business 46 years, and economy in feeding is one of the things that I was obliged to practice. I started with nothing but my bare hands, and the determination to succeed, if possible, in the dairy business. I ran in debt for my first cows, and they not only had to supply the running expenses but pay for themselves as well, and consequently I was obliged to practice the most rigid economy, and study the feeding problems as well as I could. At that time we had no agricultural experiment stations, no colleges, no boards of agriculture, and we had to grope our way in the dark, stumble along the best we could in finding our most economical rations. The first experiment that I made was sort of accidental. The hay crop was cut off very severely, and hay was $25 a ton in the market. I thought I could not afford to pay that and I did not want to reduce my little herd. I made up my mind that I would cut my garment according to my cloth. I measured and estimated my hay as nearly as I could, divided it by the number of cows and by the number of days, and found I could feed fifteen pounds of hay a day to each cow. I gave this to them, with two quarts of Indian meal and four quarts of shorts, and I wintered them in fine shape and they made a pound of butter a day for the entire winter. That was the best experiment I ever made. From that day up to the time when I commenced to feed ensilage, I weighed about all of the hay I fed. One winter I commenced the experiment of feeding the cows all the hay they wanted; then I reduced the amount two pounds per day at six different intervals until I got down to 12 pounds; and the result of that experiment was that that herd of cows, fifteen to twenty in number, gave only one pint of milk a day less, on fifteen pounds of hay, with the same amount of concentrated feeds, than they did on all the hay they would eat, which was about 25 pounds a day. It satisfied me that a great deal of money was thrown away in the extra amount of coarse fodders that we feed our stock. It is true they will make a little more butter, they will give a little more milk, but only on an average of one pint for the extra ten pounds of hay. This year, when our barns are full of hay and we cannot get more than five or six dollars a ton, it is different. And when we can cut our corn into the silo at only about half the expense, the cows will eat a very large amount of corn ensilage and make a profitable use of it, as it is so soft and easily digested.

There is one other point I wish to make, and then I will not take any more of your time. I am somewhat of a crank on the matter of balanced rations. It is impossible for the cow to make protein out of carbohydrates. When we feed an unbalanced ration, not containing enough of protein, but with an excess of carbohydrates, one of two things will follow: either she will give you a very small amount of milk, or she has to eat more of this carbonaceous food than she can make use of, and some of it will pass off and be lost. So that true economy in feeding means to balance up this ration according to the demands of the animal. I do not think the most profitable ration for milk production has been reached yet. I have fed as low a ration as 1 to 3½, and it was the most profitable ration I ever fed. I do not know but I might have gone below that and have had a still greater profit. The gentleman that preceded me said that this matter had been experimented on a great deal. The only experiments that I know about that have been made in this country are those of Prof. Woods and Prof. Phelps in Connecticut. Prof. Woll of Wisconsin wrote to about 100 of the largest feeders in the country and asked them what they were feeding, and from the returns received, he averaged the carbon and protein and called that an American ration. It proved nothing. It simply showed that 100 men were feeding so and so, it did not prove that that was the best ration. Prof. Woods and Prof. Phelps went out among the farmers and made experiments, commencing with a pretty wide ration, I think about 1 to 6 or 6½, and they reduced it until they got down to about 1 to 5, I think, and their report shows that they reduced the cost of production to a very large extent. But they stopped there. I believe if they had gone right on until they reached a ration of 1 to 4, they would have found an equal reduction in the cost of production. I do not believe the limit of the narrow ration, for the most profitable production, has been reached yet. Protein is what makes the meat, what makes the sinews, what makes the largest proportion of the milk, and I believe that farmers should try to raise more protein feeds. I do not believe with Prof. Jordan that we should call the farm the source of the carbohydrates and the mills or the traders the source of the protein. I believe we can raise oats and peas, and clover, and I am backing up my belief with my system of farming. Those are just the crops I raise, and I believe we should practice a rotation of corn, oats and peas, and clover, and the oftener we get around over our farm with that rotation the greater will be the profit. If I were set back twenty-five years I would fight it out on that line, and I never would exclaim "Eureka!" until I kept a cow for every acre and produced butter for eight cents a pound.

Ques. I would like to inquire of Prof. Woods if our feeding stuff law is giving general satisfaction in its working?

Prof. Woods—I think it is giving general satisfaction. That every man is pleased with it I do not think is strictly true. I have seen now and then a man who was dissatisfied; sometimes he was a dealer and sometimes he was a feeder. But the law has been in operation fourteen months, and is working so much smoother and better, and doing so much more for us than was anticipated when we were talking about it two years ago that it seems to me it is doing everything we can hope for it to do at present.

Ques. Have you ever analyzed cottonseed meal that tested 54 per cent?

Ans. We analyzed one sample last year that carried very nearly 54 per cent., and four or five samples which were above 50 per cent. There was one brand of cottonseed meal made in

Verona, Texas, and sold by Thaxter & Co. of this city, which they guaranteed to contain 52½ per cent., and it was up to the guarantee.

Ques. There are a large number of brands of mixed feed on the market. How do they compare with bran and middlings for feed for milch cows?

Ans. Last April we collected in all the counties about 75 samples of various wheat offals, and we collected in November about the same number, and the analyses of these will be printed in a bulletin which will be issued in about three weeks. I was very agreeably surprised to find that wheat brans as sold in the State are running as uniform as they are. I think the lowest wheat bran we examined, if I remember correctly, carried 13½ per cent. and the highest 15½ per cent. I was also agreeably surprised to find that the mixed feeds are running as uniform as they are. From the nature of their name and their appearance I was very much afraid we were going to find some very good and others very poor, but most of them are running about the same as the wheat brans, so far as the protein is concerned. The middlings are not as uniform, and the flour feeds are also somewhat varied.

Ques. How does spring wheat bran compare with winter wheat?

Ans. It is almost impossible, as we get our brans here in the State, to tell what are spring wheat brans and what are winter wheat. Of the 60 or more samples of bran which we have, there are only four that I know are winter wheat, and only one that I know is spring wheat from the brand. In the few analyses which have been made, the spring wheat brans usually carry about one per cent. more protein.

Ques. What is the standard of gluten meal that you require?

Ans. There is no standard required. The man can place any guarantee he chooses on the goods. The cottonseeds are guaranteed practically all alike, but the gluten meals are guaranteed very differently; the Chicago people on their Chicago gluten guaranteed last year 33 per cent. protein and 9 per cent. fat, and this year I think 39 per cent. protein and 2 per cent. fat. The manufacturers of the King gluten have two mills from which they send goods into the State. One of the mills sends goods containing 33 per cent. protein and 15 per cent. fat, and those from the other mill are very much like the Chicago gluten in composition.

Ques. If fat is largely composed of carbon cannot the carbohydrates in the animal economy of the cow be worked up into fat without any other fat being present in the food?

Ans. Physiologists have long thought that that was probable, but Prof. Jordan's experiment is the only one that seems to at all adequately demonstrate it.

Ques. How does Quaker oat feed compare with mixed feed?

Ans. Quaker oat feed usually contains about 12 per cent. of protein and mixed feed about 16 per cent.; but when we buy mixed feed or bran we are buying more than the protein, we are buying ash, mineral constituents, and if we are feeding growing stock the oat feed is not desirable, because it has practically none of the minerals. Of course oat feeds can be made up in any way. They are oat hulls mixed with refuse oats, and they may be built up, as in the case of H. O. feeds, for instance, by the addition of cottonseed meal, linseed meal, wheat bran, or something of that kind.

Ques. Would it not be possible for feed that contained 15 per cent. of protein to contain less digestible matter than one containing 12 per cent?

Ans. Yes, sir; but there have been no digestion experiments on oat feed. We are planning some experiments on these feeds but they are comparatively new. I should be very much surprised if we should find oat feeds as digestible as the protein in bran.

Wednesday Evening.

HOW I MANAGE MY DAIRY.

By Mrs. Carrie J. Nelson, Ryegate, Vt.

Ladies and Gentlemen: I am not the one to stand before you to-night, as I came here only to learn and have a few points to carry home to my own farm for butter-making. But your secretary has been so urgent to have me tell what little I have done that I have consented. Fifteen years ago I was left with four children upon my hands to support, and with but very little to support them with. The farm was heavily mortgaged, and I knew of no way but to sell it, and in August after the death of my husband in May, I sold the farm to a relative with the understanding that I should carry it on for him, and that he should live in Boston. I was to look after the farm and to look after the house, and he would support my family. I knew of no way in which I could support my family any better than that, as I knew my hands could not do it. I carried it on for him nearly five years, with his coming up about once in every six weeks. Of course there were lots of things that a Boston farmer wanted different from what a Vermont farmer would want, and it took a considerable to run the farm; but he always told me whenever I lacked for funds to write for them and never looked over my accounts. At the end of the five years he was to go into other business and wanted the money and thought he would sell, and I thought that if I had carried the farm on for him I could do so for myself, so in May, 1888, I bought back the farm and all that was on it as I had sold it to him, stock, tools and everything except household furniture. So I sold out and bought back and never moved. I carried on the farm as well as I could for myself, and also for him, but I found that in carrying it on for myself there were a great many things that I could omit that he would have done, and of course I have been more successful than I could have been while carrying it on for some one else. Three years ago I bought forty-three acres of new land, adjoining my pasture, that had never been seeded down, and added it to my pasture. This made a farm of 216 acres. It took about two years to get this new land into grass. It was sown with white clover to quite an extent, to add to my dairy feeds. The expense of that land was $656, which, added to the amount that I paid for my farm, including everything that went with it, made over $8,000 that my farm stands me. I would say that at the time I bought the farm I gave my notes for $5,000. I thought it quite a burden for a woman's shoulders, but mine being broad I have stood it. My dairy is principally Jerseys, some thoroughbred Cattle Club stock, and some very high grades. In 1897 I made 11,851 pounds of butter from an average of thirty-six cows. My way of estimating the number of cows is this: I set down at the first of each month the number of cows I own—not the number of cows I am milking but the number of dairy cows that I own—and then add these up and divide by twelve to get the average number I have owned during the year. Then I deduct one cow for the milk and cream that I use in the family. That may seem large to those who are not accustomed to cooking with cream, but with a family of seven or eight it takes all the milk one cow will give and she has to be a pretty good cow at that. This would give 329 pounds per cow, which, if sold at twenty cents per pound, would bring $65.80 per cow. I think my average was a little over twenty cents per pound.

In regard to the feed for my cows, I intend to have the hay cut not as early as some of the Ryegate farmers cut their hay, but what we would call pretty early. I commence about the last week in June, and finish, if the weather is favorable, by the middle of July. Then I usually have some oats that are cut green and made into hay, to feed for a change for the cows, and once a day I feed corn ensilage, and oftener if I have ensilage enough to last through the winter by so doing. Sometimes I will feed it for two months twice a day, and the remainder of the winter once a day. The meal ration is corn meal and bran. Brother Hill would hardly agree with me on this ration. I think I shall have to try his ration and see if I cannot do better. If this ration has brought me 329 pounds of butter per cow, and is not a balanced ration, my cows would probably do more than that with a balanced ration. I mix corn meal and bran in equal parts by weight, and feed from two to four quarts to a feed, according to the amount of milk the cow is giving. The fresh cow gets four quarts, and the one nearly dry only two. In summer I do not feed any meal at all, they only get pasturage. I do not think I shall do quite as well this year as last, as last year I made almost six tons of butter and this year I shall make only about five tons, having reduced my herd somewhat. In June I sold seven cows, and since then I have beefed and sold five more. To take the place of these cows I have about twenty-four heifers under three years old. These I intend shall fill the places of all the cows I sell. I seldom buy any cows, I raise them from my own herd. I have exhibited butter six times this year, and if I have secured a prize here, as I have been informed is the case, it will make five times out of the six that I have secured a prize, and the sixth time I came in for the pro rata above ninety points.

As to the income of my farming, I will merely state that I reduced my debt over $600 last year.

THE VALUE OF FEEDING STANDARDS TO THE PRACTICAL FARMER.

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

The year 1874 marks the beginning of a new era of the feeding of animals, more particularly dairy stock, in this country. At a meeting of the Maine Board of Agriculture held in Wiscasset, Prof. W. O. Atwater, now of Wesleyan University, Middletown, Connecticut, presented a paper upon "The Science of Cattle Feeding." This was the first attempt, not only in America, but in the English language, to set forth the principles of physiological chemistry which underlie all successful feeding. These principles, then for the first time outlined in English, have since become widely circulated and accepted. The teachings of Wolff, Kuehn, Henneberg, and others which were then for the first time placed in English have been followed alike by scientific and practical feeders in this country. The so-called standard rations have become so common that our agricultural and particularly our dairy papers are filled with calculated rations based on these figures.

When it is remembered that it is less than twenty-five years since these principles were first brought to the attention of American feeders by a then young chemist, the progress which scientific feeding has made among practical men is indeed wonderful.

It is the speaker's purpose to call attention to the general principles underlying successful feeding and to point out the limitations of our knowledge and to call attention to some of the errors which users of these food formulas have fallen into. Partly because this is a dairymen's meeting and partly because the ration for the dairy cow has been more carefully studied, in the discussion which follows standard rations for cows are used instead of those which have been prepared for other animals. It was my privilege as student, assistant and co-laborer along the lines of nutrition of man and animals to be associated with Prof. Atwater for twenty years from 1876. I may, therefore, be pardoned for closely following the later teachings of Prof. Atwater on these subjects. Probably nothing has come from his pen bearing on these subjects for the last fifteen years that has not been worked over by us together. In a few instances selected sentences from Prof. Atwater's articles are here used without quotation marks.

The first attempt to systematically compare various feeding stuffs with one another was made by Thaer of Leipsic, Germany, in 1810. He published a table giving what he termed hay equivalents, assuming common hay as a standard unit. Some of the feeding values were as follows:

One hundred pounds of meadow hay is equal in food value to 200 pounds of potatoes; 100 pounds of meadow hay is equal in food value to 625 pounds of mangolds; 100 pounds of meadow hay is equal in food value to 417 pounds of rutabagas; 100 pounds of meadow hay is equal in food value to 91 pounds of clover hay.

This system of hay equivalents was quite widely adopted, but as, naturally, opinions varied as to the comparative value of various feeding stuffs, there were about as many tables on "hay equivalents" as there were writers on economic agriculture.

When in the year 1859 Grouven proposed the first feeding standards in opposition to the theory of hay equivalents, he inaugurated the most significant advance in the theory of animal nutrients. Although the compounding of rations for animals with reference to the actual amounts of the different nutrients they contain had been suggested by Haubner and put into practice by a Prussian farmer, the credit of having recognized the importance of the principle and of having broadened and deepened it and of bringing it into general recognition belongs to Grouven. All later progress rests on this foundation. Grouven's feeding standards were based upon the total quantities of protein, fat and carbohydrates in feeding stuffs as indicated by a chemical analysis. Later the investigations of Henneberg and Stohman in Weende showed that these nutrients were not digested in the same proportions from different feeding stuffs. These results being confirmed by numerous investigators, Henneberg proposed to distinguish between the amounts of the several nutrients found by analysis and the portions which were digestible, and to use the digestible nutrients in the calculated feeding rations. Wolff, who had given up the theory of hay equivalents, which he with the others had formerly followed, constructed new feeding standards based on the amounts of digestible nutrients. The standards of both Grouven and Wolff have the feature in common that as an aid to the farmer in making up his rations they give absolute, definite figures for the total quantity of the food of the several nutrients to be fed. In the standards of Wolff which were published in 1864 the attempt was made to meet the physiological requirements of the animal by supplying sufficient protein, carbohydrates and fat for all the needs of the body without waste of any of the nutrients. It was these feeding standards of Wolff that Prof. Atwater first introduced to American readers in his paper before the Maine Board of Agriculture in February, 1874, and which he further elaborated in December of the same year in a paper presented to the Connecticut Board of Agriculture. Wolff's feeding standards have become popular among the more progressive American farmers and stockmen and have been used whenever agricultural science is recognized. The rapidity with which they have come into notice, their very general adoption in this country by writers upon the subject, by teachers and by experimenters, and the extent to which they have become a part of the familiar knowledge of intelligent, practical men is not only an interesting phenomenon but an auspicious omen, also, of the progress of the higher knowledge as applied to the arts and industries of farm life in the United States.

For all this progress, wide spread, rapid and inspiring, let us be deeply thankful. If the last quarter of the nineteenth century has seen so much accomplished, what may not be hoped for in the future? But this subject has another side. The modern theory of food and nutrition as applied to the nutrition of domestic animals is in danger of being misapplied. The mistakes are practically three: A failure to recognize the true meaning of feeding standards, the setting up of incorrect standards, and the blind use of such standards in the calculation of rations.

PHYSIOLOGICAL STANDARDS.

The physiological standards would express the proportions of the different nutrients, protein, fats and carbohydrates, which best fit the demands of the animal for the particular kind of product demanded of it, whether the product is growth, as in the case of young animals; or meat, as in the fattening of cattle, sheep and swine; or milk, with milch cows; or work, as with horses and oxen. In all of these cases a certain amount of nutrients is required for maintenance and a certain additional amount for production. The functions of the several classes of nutrients in meeting the demands for maintenance and production have been more or less definitely shown by feeding experiments, and we have to-day, as the result of a great deal of experimenting, somewhat of an idea of the relation between the physiological demands of an animal of a given class and fed for a given purpose and the quantities of nutrients needed to supply it. But, unfortunately, our knowledge in all these respects is still deficient, and furthermore the differences of individual animals of the same breed, to say nothing of the differences between animals of different breeds and species, are so wide that with the most perfect knowledge of the laws of nutrition it will be hardly possible to set up accurate physiological standards for large classes of animals, and when we get that standard we shall doubtless find that it is after all indefinite, that it varies with the animal as well as with the conditions of feeding; in other words, it will be at best only an average estimate and not an unvarying formula.

FORMULAS FOR PROFITABLE FEEDING.

But the practical feeder feeds for profit, and the ration which will produce the largest amount of growth, or of total flesh or of lean or fat meat, or the largest amount of milk or butter-fat, or enable the animal to do the largest amount of work from a given quantity of nutrients, is not always or generally the one which will bring the most profit to the feeder. In other words, the physiological standard may not be the most profitable formula for feeding. The factors of profit are numerous. One of the chief is the physiological action of the nutrients, but the cost of the food and the value of the product have to be taken into account. It may be to the feeder's advantage to use a wide ration when a narrow one would give more yield for less raw material. There is a very wide difference with respect to the width of a ration between the physiological standards as we now understand them and the actual feeding practice of most American farmers, but it would be as wrong to advise them to conform exactly to the physiological standard as it would be to take the average of the practice of successful feeders for either a physiological standard or a formula for profitable feeding. Nearly a quarter of a century ago, as the result of quite accurate feeding experiments, the standard ration for milch cows with which we have become so familiar, was advanced by Prof. Wolff. Prof. Kuehn criticises the Wolff standards and their blind following. The following is quoted from an article prepared by him for the "Experiment Station Record."

"For milch cows it is advisable first of all to determine the quantity of nutrients which represent the minimum requirements per 1,000 pounds live weight of the animals; that is, the quantity which covers the needs of the cows which are dry or nearly dry, and which while producing little or no milk are usually more or less advanced with calf. This minimum amount may be designated as the *basal ration*. It will naturally be more liberal for breeds of high productive capacity and those which keep up their milk yield well in the latter part of the lactation period and only go dry a short time, than for those of inferior milking qualities. For the latter the basal ration need not contain more than 1.5 to 1.7 pounds of digestible actual albuminoids per 1,000 pounds live weight, while with the former up to 1.8 pounds, and with breeds of exceptionally high capacity even more will be needed. The same considerations will enter into account in determining the amounts of fat and non-nitrogenous substances for the basal ration. Amounts ranging from the minimum to a medium amount are to be recommended. In addition to this basal ration each cow should receive as much concentrated food as she will yield profitable returns for. The cow of the highest productive capacity will naturally need a larger quantity of nutrients, commensurate with her large production of milk. But the amount of nutrients in the daily ration of one and the same cow should also vary as her milk production varies, being greatest early in the milking period when she is producing the most milk, and gradually decreasing with the advance of the period, until as she becomes dry the concentrated food is discontinued altogther and the basal ration alone is fed. While this means of feeding of course requires attention, it insures the greatest possible profit from the animals, and results in the highest development of the milking qualities of the herd, which being transmitted by heredity, effects a continual improvement of the stock.

"To feed an animal highly during the most productive part of lactation pays well, but to feed the entire herd equally well, without regard to individual production, can prove remunerative only when in addition to yielding milk the cows are to be fattened. Otherwise such feeding results in great waste of food, is not infrequently the cause of the low profits in dairying, and makes the barnyard manure expensive."

After the death of Prof. Wolff, his feeding standards have been revised by Doctor C. Lehmann of the Agricultural College of Berlin. He has changed the arrangement somewhat but the most important departure from the standard of Wolff is that the standards recognize the varying wants of dairy cows by classifying them in four divisions according to the milk they yield. The heaviest milkers receive the most nutrients. These modifications of Wolff's tables are such as must commend themselves to those who have up to the present time been using Wolff's standard rations as a basis. Based upon the Wolff-Lehmann standard the Storrs Experiment Station has suggested feeding formulas similar to those of Lehmann. "In these the protein is increased according as the milk yield is larger, although the increase in protein is less rapid in our proposed formula. Allowance is thus made for the relative cheapness in this country of feeding stuffs rich in carbohydrates. These formulas provided for a basal ration which shall be fed to all cows of the herd giving ten or more pounds of milk per day. This is supposed to include all of the cows giving milk except those that may be drying off preparatory to calving."

There are some important differences between the way in which the Germans are feeding, and the common practice in America. The Wisconsin Experiment Station obtained, although in rather a crude manner, the feeding practices of 128 different men in different parts of the country. The practices of twenty-five men have been studied in Connecticut by the Storrs Station in very nearly as thorough and painstaking a manner as practicable.

The following table shows the German standards, the average as ascertained by the Wisconsin Station, and the actual feeding

THE PRINCIPAL STANDARD RATIONS PROPOSED FOR MILCH COWS OF 1,000 POUNDS LIVE WEIGHT PER DIFFERENT WRITERS.

	Dry matter.	Digestible Nutrients. Protein.	Fat.	Carbohydrates.	Nutritive ratio.
	lbs.	lbs.	lbs.	lbs.	
Wolff's German Standard	24.0	2.5	.4	12.5	1:5.4
Average of 128 American rations compiled by the Wisconsin Experiment Station	24.5	2.15	.74	13.27	1:6.9
Average of 32 rations found in Connecticut by the Storrs Station	*26.4	1.97	.73	11.57	1:7.0
Wolff-Lehmann Standards:					
11 lbs. milk per day	25.0	1.6	.3	10.0	1:6.7
16½ lbs. " " "	27.0	2.0	.4	11.0	1:6.0
22 lbs. " " "	29.0	2.5	.5	13.0	1:5.7
27½ lbs. " " "	32.0	3.3	.8	13.0	1:4.5
Storrs Station Formula:					
10 to 20 lbs. milk per day	21.0	2.0	.4	11.0	1:6.0
20 to 25 lbs. " " "	22.0	2.3	.5	11.0	1:5.3
25 to 30 lbs. " " "	22.0	2.6	.5	11.0	1:4.7
30 to 35 lbs. " " "	23.0	2.9	.6	12.0	1:4.6
35 to 45 lbs. " " "	23.0	3.2	.6	12.0	1:4.2
10 to 20 lbs. milk per day	23.0	2.3	.5	13.0	1:6.1
20 to 25 lbs. " " "	24.0	2.6	.6	13.0	1:5.5
25 to 30 lbs. " " "	24.0	2.9	.6	13.0	1:5.0
30 to 35 lbs. " " "	25.0	3.2	.7	14.0	1:4.9
35 to 40 lbs. " " "	25.0	3.5	.7	14.0	1:4.4

* Average of 16.

practices in Connecticut so far as thirty-two men are concerned and a suggested standard by the Storrs Station:

In Germany there is a tendency to the more liberal use of protein. The standard ration proposed by the Wisconsin Station advocates less protein and more of the fuel ingredients of the food. Because carbohydrates and fats are so abundant and cheap in this country that we feed them liberally, does not imply, much less prove, that we are using them wisely.

Another primary factor in feeding is the bulk of the ration. This arises from the fact that the digestive apparatus requires to be suitably distended to insure its normal action. We must plan not to have the ration in too concentrated a form. If we feed much gluten, corn and oil meals, they must be mixed with bran, hay, stover, or other coarse food in order to furnish the requisite amount of organic matter necessary to give the needed bulk.

Unquestionably the experience of practical feeders, and especially the experience of the most successful ones, is of the highest value. It is with the aid of such men that the doctrine of successful cattle feeding will be best worked out. The place of the chemist and physiologist is rather to explain the theory than to lay down rules for the practice of feeding. In developing his theory he will be most successful if he does as the most successful teachers, like Liebig, Henneberg, Kuehn and Wolff in Germany, and Lawes and Gilbert in England have done, namely, to make as accurate experiments and observations as possible and collate and explain their results as accurately and as simply as he can. But the science of cattle feeding is not a branch of applied mathematics, in which the data for the calculations are to be found in tables of composition of feeding stuffs and the formulas of feeding standards.

A FEW PRACTICAL SUGGESTIONS.

Of all the different breeds of cattle in our country, there are only three classes of cows which can be kept with profit: the fancy stock for beef, the great milker, and the butter cow. The cheese cow we used to hear about, and the general purpose cow, belong to an extinct variety which never existed other than in the imagination of their owners. To have a cow for profit, we must breed with the one purpose in view. If beef cattle are wanted, breed from the class best adapted for that purpose, and breed for that purpose alone. If large milkers are desired select a breed for that purpose. If butter is wanted, breed with that idea in mind. For beef, a perfect form and an animal that will put on flesh rapidly and at an early age, is to be sought for. In this animal milk cannot be produced with a profit. For milk, a cow made for the business, one that will turn her feed into milk and not put it into flesh, is wanted.

It would seem hardly necessary to say that the food is the prime requisite of production. It is fundamental here, as elsewhere, that nothing comes of itself. Life is a wonderful transformer, but it is not a creator. Vital force is merely a new manifestation of other forces and forms of energy. The energy of the food may be changed into animal force and animal production, but this is always done at a loss.

Viewed in one light, the dairy animal is a machine, albeit a very complex one. In another light, she is much more than a machine. The animal uses the food she eats for many purposes. Construction and repair of the body, maintenance of animal temperature, etc., must be supplied by the food. The food necessary for this is unproductive, and it is only that which is provided in excess of these maintenance demands which can bring returns in work performed, in increase of flesh (fattening) or in reproduction, including the production of milk, which accompanies, and is dependent upon the maternal functions. The secret of success is to develop each cow to her greatest capacity, and consequently to her greatest limit of profit. Nothing illustrates this principle better than the familiar one of the locomotive. A certain amount of fuel is required to keep the water just hot enough to make steam. In a sense, this amount of fuel is wasted, for while the water is just on the point of turning into steam, it still lacks the necessary extra heat to produce steam. When extra fuel is added the water becomes steam and the engine is ready to do its work. It is much the same with the cow. It takes a certain amount of food to keep her alive. In a sense this food is wasted; but provide her extra food, and she turns it into milk. It may happen that a cow will not turn the food into that product which the owner wishes. It is, however, largely the owner's fault, if he has a cow which is turning food into beef, when he wants the food manufactured into butter.

The subject of cattle feeding is a broad one. The experimenter can only lay down broad, general principles. The right application in each case must depend upon the intelligence and care of the feeder. Specific rules to cover all cases and conditions are not known, nor are they possible. There is no "best ration" for milch cows or any other animals.

Different breeds and different animals of the same breed differ widely in their demands for food and the use they can make of the nutrients it furnishes. The food that is the most profitable for a cow when she is giving the largest amount of milk might be very unprofitable for the same cow near the end of the period of lactation. Feeding stuffs of the same kind vary in composition, so that a given specimen may have more or less nutrients than the figures for average composition imply. They vary still more in cost, so that a given food material might be fed with large profit in one case and with equally large loss in another.

Different as are the standards for feeding milch cows, it is probably true that three-fourths of the feeders in this State would find their herds give better returns if they should try to make the rations which they feed conform to either one of the three cited. This would follow not more from the improvement in the ration fed than from the increased attention to details in care and handling which would follow better attention to feeding.

Like other manufacturers, the dairyman must reduce the cost of production to keep up his profits. The minute economics have become necessities. Science can help the dairyman by giving him the results of its accurate experimenting, but, after all, the best it can do for him is to help him to help himself.

J. M. Connor—Mr. President; Ladies and Gentlemen: It gives me great pleasure to meet you here, to attend your dairy conference, and I must say that I was agreeably disappointed in your audience and your exhibition. I am glad that these states can in some measure unite and consult together upon dairy matters, and I hope this is the beginning of more work in this direction, more interchange of methods. We should not be too exclusive but should mingle together and learn of each other. I represent a state which, but a very few years ago, had no reputation in the butter market. Fifteen or twenty years ago New Hampshire was not known in the Boston market. Its dairy products could hardly sell there, because they did not know anything about New Hampshire butter. The butter came mainly from Vermont and the states farther west. But I think we have made very creditable progress in our dairy work in the last fifteen years. We certainly took a high stand at the World's Fair, and last year I think that our average scoring was the highest of any state in the Union.

Now it seems to me that the great problem is not so much in regard to dairy feeds, balanced rations and these matters that are all very well in their place, as to how we are to sustain ourselves in our productions, how we are to be self-sustaining, how we are to increase our products and not be so dependent upon other sections of the country for food for our cattle and for the products which we are attempting to produce here. My friend here informs me that he alone has sent into Maine since the first of August $15,000 worth of butter, coming from the distant state of Minnesota, at a cost of probably in the vicinity of two cents a pound for freight. Now it is a great problem how we are to arrest that state of things. Why should we be so dependent upon other sections of the country for the food that we feed our animals and for the products that we fail to produce. This is a great problem, and one which leading minds need to take hold of. How shall we keep our sons and daughters on the farm? How can we expect to be self-sustaining when everybody is running away from the farm, and when there is not half help enough to carry on the farm? How can we raise these products which we need and are continually buying unless we have somebody there to do some work. This condition ought to be arrested. We need more young men who are not ashamed to put their hands to the plow. We need more intelligence on the farm, and more disposition to work. The great difficulty is that everybody is trying to shirk labor, and there is work in farming. We should try to enlist the young, if possible, the rising generation, to take the places of their fathers and work at this noble, God ordained industry. It is true that we have a great deal of machinery, a great deal to do with that our fathers did not have, but that will not do all the work. We cannot shirk it on to the machine. "He that by the plow would thrive himself must either hold or drive." No man ought to be ashamed to labor, to labor in God's vineyard, to labor in this noble occupation which requires a greater intelligence than any other industry in the world, because it is of such a varied character.

Contemplate for a moment how much there is involved in farming, especially in mixed farming, where you have to do with creatures that have numerous wants, and with varying soils and varying seasons. To understand this business requires more intelligence than it does to be a professional man, or to follow any other occupation; and no man ought to shrink from this, because it is the best field for self-improvement that there is in the world. When a man is mingling with nature and studying all her requirements, when he is studying the wants and the character of his animals and the methods of feeding,—all these delicate points, it brings into requisition more faculties than any other industry in the world, and does more to elevate a man. It is for this reason that our greatest men come from the country. It is for this reason that our progressive farmers, our leading men in all these states, are the most level-headed class of men, the men of the best judgment, the men the best rounded out of any class of men on God's earth. If they do not think so, I think so. There may be men who make a brillant show in some particular direction, but you cannot find a class of men that are so well fitted for the general purposes of life as the progressive, intelligent farmer, and he ought not to be ashamed of his occupation.

I again thank you for this opportunity, and I must say that I shall return very much pleased with my visit, this being the first time I ever stepped foot upon Maine soil.

L. O. STRAW—Mr. President; Ladies and Gentlemen: All who know Prof. Woods know that whenever he undertakes a subject he very nearly, or quite, exhausts it. So there is but little left for me to say in opening this discussion. Agricultural colleges and experiment stations have done very much for the benefit of man, and through man, of the animals; scientific investigation has revealed much, but the question arises sometimes whether or not too much scientific investigation is not puzzling to the common man, to the farmer. Our stations, both

State and National, are sending out pamphlets and pages by the ton amongst the farmers of the different states in this Union, and I venture to say that but very few of the recipients of those documents have read them, even. Many peruse them slightly and throw them into the waste basket. A great many dollars are spent, earnestly and honestly, for the benefit of those people who need to be benefited in the educational line. The trouble is that those people do not understand scientific terms well enough to understand the adoption of our balanced rations, if you please. Now it is not all in a balanced ration, as it seems to me. There are other things incidental. We need a well ventilated barn, we need a well lighted barn, and we need a warm barn, for a part of the food is used as fuel to keep the animals warm unless preparations are made in other ways. There are other things that are important, the selection of stock, for instance. It is true that the majority, perhaps, of our farmers are not careful enough in the selection of the herd. As has been stated this evening, too many of the farmers are carrying in their herds cows that are not paying. In some cases we have become wedded to the animal, and hate to part with it, but this should not be.

Sanitary conditions are essential, and regular and systematic feeding of animals. But very few of us are regular in our care of the animals. We are not studious enough in the selection of our feeds, to be sure, but we are not careful enough in our feeding after the selection is made. If we are milking a herd of cows and milk this morning at five o'clock and to-morrow morning at six, this evening at half past four and to-morrow evening at half past five,—all those things have been proven to be very injurious to the profits of the herd. It is very necessary, then, that we be regular in our work. Having learned the scientific side of the question, next comes the practical side, and it is simply the practical side that I am speaking to you about at this time. The question of the kind of fodders we shall raise is a very important one. But few of us understand well enough whether the clover is profitable, whether the pea or bean is profitable, or whether it is best for us to raise timothy hay. Scientists have told us that it is a very important thing to raise the legumes, and I have no doubt it is so. Very few of us practice it, however. I venture to say that there is not one out of ten of the farmers throughout our section of the county who takes pains to raise anything but the straight timothy hay, except corn fodder; and in many instances fields are covered to-day with corn fodder, the best fodder that we can feed to milch cows in connection with other fodders. You will see acres and acres of this fodder, as you travel the country over, stemming the winter storm. If we could only educate the farmer in this simple way, so that he would realize that it is better for him to raise the legumes than it is to raise timothy hay altogether, it would be one step in advance. Many of our farmers are raising what we term meadow hay, or fresh hay, and feeding it with small grain rations, and are expecting large results, large returns in cream. I have experimented a little in the use of meadow hay and corn fodder and timothy hay, and I find that I can get as good returns from corn fodder and meadow hay as from timothy hay, with the same grain ration. We often hear it said that meadow hay is not worth anything, but the analysis shows that corn fodder and meadow hay are equal to timothy hay in milk producing qualities. Continuous feeding of either will be as nauseating to the animal as the eating of mince pie continuously will be to a man. It is variety in feeding that produces good results, as much as anything else, outside of exceptionally good sanitary conditions. Care is one of the leading elements in the dairy business, as well as in the beef business.

I will say in closing that I wish to add my testimony to that of the gentleman who spoke last. It is quite a hard thing to farm unless we have some help to do the work. We must try to induce the boys to stay at home, and how can that be brought about? Simply by making the farm so inviting that they would rather stay there than go to the city; that they would rather stay on the farm and get an honest and a good living than go to the city and make what we may call a starvation living. We have in our own vicinity farms that are going to waste, while the boys are just getting a living in the cities, and the old fathers are doing what little they are able to do on the farm. An effort should be made to keep our boys at home.

R. W. ELLIS—Mr. Chairman; Ladies and Gentlemen: I want to say a word in continuation of the excellent speech of my friend from New Hampshire, in relation to keeping the boys on the farm. Boys, if they are worth anything on the farm, are intelligent and can see as they go along what the farm is doing.

The farmer should induce the boys to stay on the farm by his own practice and experience. The boy learns from what he sees every day, from what his father or his mother tells him. You may tell him of the beauties of farm life and all that, but if it is drudgery with him from morning till night, and he sees that his father has made nothing but a meagre living all through his days, he is not very likely to want to follow in those footsteps and stay on the farm, and I do not blame him. I tell you there is no trouble in keeping the boys on the farm if the parent shows them that there is something on the farm to work for, that there is a little something for them when they want it, to go here and there and have a good time. The man who has energy and shows the boys that there is something on the farm to stay for, will be likely to keep them there. The responsibility is on us. If we are willing to take hold and do something for ourselves and our family, and let them see that there is money in farming, there is enjoyment in it, there is something in it besides drudgery, they will stay on the farm. I can cite you to hundreds of instances in this State to prove what I say. In nine cases out of ten where the farmer has been prosperous, where the farm is paying something right along, the boys are willing to stay on it. But we have too many farmers who are complaining all the time that farming does not pay and all that sort of thing, because they have not the pluck, the ambition, and the determination to succeed. If the farmers of this State who are trying to do something in the dairy business would do as they are doing on the Connecticut river, in New Hampshire and Vermont, stock their farms to the fullest capacity and put their shoulders to the wheel, they would soon have money enough so that they could enjoy the comforts and luxuries of life, and there would be no trouble in keeping the boys on the farm.

I would like to say a little something on the balanced ration question. It has always been very curious to me that these scientific men show us so plainly that almost all that a dairy cow needs is protein, and still they will recommend a ration which has only about one-sixth part protein. I do not understand it. They tell us that they cannot possibly use carbohydrates to take the place of protein, while they can use protein to take the place of almost all the other elements, and still they claim that an animal is not entitled to more than one part protein to five of carbohydrates. In almost every instance where cows have been made to make an extra record their feed has been very highly protein. I do not say that the feeding of protein may not be carried to that extent that it will injure the cow, but I do say that many common farmers, in my opinion, do not feed nearly protein enough for their own profit. What we want in keeping dairy cows is the dollars and cents. We want to keep them healthy, of course, we do not want to give a ration that will take them off their feed, but I know from my own experience that the more protein feeds I feed, the greater are the profits. Now why stick to this ration of one to five, or one to six, when every man that has tried it knows that the narrower the ration the greater the amount of profit? I never have been able to see that my stock have been injured by protein feeds. It is true that you may feed enough of one protein feed, as cottonseed meal, to injure the cow, but you are not obliged to feed all of one protein feed. I am satisfied, with the experience that I have had, that a ration of one to four is plenty wide enough, and I am not sure but a narrower ration than that could be fed with still more profit.

I am one of those who believe that the farm should be self-sustaining. I do not believe in buying so much western feed as we have been in the habit of buying. I believe that there are crops that we can raise that will furnish everything but a part of the protein. I believe we should raise all the protein feeds we can, and make up the deficiency by raising some other crops. I do not necessarily mean that we shall feed what we raise. For instance, we raise all we feed but we do not feed all we raise. We raise sweet corn and carry it to the factory and take the money and buy cottonseed meal and shorts. We are raising all we feed, but not feeding what we raise. I believe every dairyman should make it a point to raise enough of some crop that he can sell to buy what he lacks in protein feeds, and thus practically raise all he feeds. We are lacking tremendously in that direction. We are sending out of the State thousands and thousands of dollars for feeding stuff, the equivalent of which we should raise on our own farms. This question of feeding is the most important of any that the dairyman has to meet, and we do not study it enough. We do not look after the dollars and cents as carefully as we ought.

Now, gentlemen, let us look after these things a little better, and we shall not need to complain so much about the boys leaving the farm. I have raised four boys and every one of them is willing to stay on the farm. I never told one of them that farming was the best business in the world, or that I thought it an extra business, but they are always willing to stay on the farm.

THURSDAY FORENOON.

THE SELECTION, BREEDING AND HANDLING OF THE MODERN DAIRY COW TO SECURE MOST PROFIT.

BY VALANCY E. FULLER of New York.

THE MODERN DAIRY COW,

as she exists to-day, is the creation of man's handiwork, a triumph of mind over matter.

In a state of nature the cow gave but enough milk to nurture her calf for a few months, and was dry till next calving. The enormous milking machine we have to-day in our dairies is the result of careful selection, wise coupling and judicious care and handling. She may be aptly called an artificial machine, and being artificial there is a strong tendency to revert back to the less desirable side of her ancestry.

To produce improvement in our cows in each succeeding generation should be the aim of every breeder and dairyman. But such improvement is not attained by chance. Eternal vigilance, judgment and patience are the price exacted by success.

Dairying and dairy ideas have changed in the past decade. Specialties have become the necessities of the hour in that keen competition that exists in every line of business. The dairy cow has become an institution of herself. She has come to stay.

The farming community, including the dairymen, has been passing through a period of trying depression. Low prices and low profits and in too many cases no profits at all, have been the return for expenditure of labor and capital. Mark you, I do not say for expenditure of thought, labor and capital; for the thoughtful man, seeing the trend of events, usually puts his house in order to meet the exigencies of his changing conditions.

WHAT ARE THE KEY-NOTES TO SUCCESSFUL DAIRYING?

1. Economy in production.
2. Goods of the highest quality and uniformity.

How can the dairyman trim his sails to meet the lowering prices and be economical?

Assuming that the dairyman has a farm well suited for his purpose, with good pasture, water in abundance, barns to properly house his stock in winter, land enough to raise his own grain and hay for his stock; that he has a love for his calling, (for without it no one will ever succeed); the all-important element, to success and economy, is to have the proper machinery (in this case the cows) to turn out his product at the lowest possible cost, without deteriorating the quality of such products.

This brings us to the consideration of the elements necessary to be concentrated in the profitable dairy cow. I will divide them into these headings:

1. A cow of a breed especially bred for the purpose for which she is to be used, be it milk, cheese or butter.
2. One that will come into profit at as early an age as possible, and yet have the stamina to continue profitable for many a year.
3. One that will be tenacious in milking; and this is the most important element of all.
4. If for cheese or butter, a cow that will give a high percentage of butter-fat.
5. A cow that will produce the greatest product at least cost.

Let us now consider requisite No. 1.

A COW BRED ESPECIALLY FOR THE DAIRY.

No successful dairyman, actuated by the desire for profit, can now afford to keep the general-purpose cow. His pocket teaches him that the hereditary tendency to put fat on the carcass is incompatible with economy in putting milk in the pail in the last period of gestation, and that the larger carcass, of necessity, takes the greater quantity of feed to sustain life and to give the necessary heat to the body, after which the surplus feed is converted into products. Taking cows, therefore, of equal ability at the pail or churn, the smaller cow is the more economical in production, and economy is really the key-note to success.

For economy in dairying the successful dairyman must have the cow of a breed especially bred for the dairy. Such a one, if pure-bred, possesses by inheritance the characteristics he seeks, and has the power fixed in her to transmit her own qualities to her offspring, thus fulfilling the double function of a profitable dairy cow and a breeder.

EARLY MATURITY.

It must be manifest that if we can have our heifer come into profit at two years old in place of three, without detriment to her future growth, we have gained one year in profit.

The custom of bringing her in when so young, in my judgment, tends to prevent the habit of putting fat on her back and to fix in her the milking habit; if liberally fed and well cared for between her second and third year, her growth will be all that is desired.

TENACITY IN MILKING.

The necessity for tenacity in milking, and the economy there is in this feature of the cow, is so apparent it seems almost superfluous that I should dwell upon it; yet in my travels through even well-established dairy districts I find its importance is not thoroughly appreciated.

Any dairy cow worthy of the name will give a profit to her owner in the first period of lactation, but far too many cows in the last four to five months of gestation fall off so rapidly in their milk that they rob the owners of the profit they have made in the first period of lactation. Many men owning cows giving a very large flow of milk at flush, are prone to believe they are the most profitable cows. Unless they are in the habit of weighing their milk, they do not realize that the largest milker at her flush is not always the cow that gives the greatest quantity of milk throughout the year.

Some of the most profitable cows a man can own are those which do not give so large a flow of milk immediately after calving, but which, being very tenacious in their milking, give a large quantity of it throughout the year.

HIGH FAT PERCENTAGE.

When I was a younger man (I am not so very ancient now) it was believed that the cow whose milk was especially adapted for butter—that is, one whose percentage of butter-fat was high—was not a profitable cheese cow. Thanks to the work of the experimental stations, this fallacious idea is pretty well set at rest. When in the World's Fair dairy tests the daily analyses of the milk of 75 cows showed that the solids other than fat follow the fat—that is, that when milk is rich in butter-fat up to five or six per cent., it is proportionately rich in solids other than butter-fat, and when milk is low in butter-fat it is proportionately low in solids,—it became universally admitted that a milk that was profitable for butter was equally profitable for cheese. It therefore follows that for butter or cheese making, to produce the greatest profit, you must have cows whose milk is rich in butter-fat.

The day was, but happily it is fast passing away, when "milk was milk," without taking into consideration the solids it contained.

The use of the Babcock tester and the ever-growing custom of the creameries of paying for the milk of their patrons by the butter-fat as ascertained by the Babcock machine, is fast teaching the dairymen of this country the economy of producing rich milk.

All rich milk, however, is not alike. The cream from milk of certain breeds is more easily gathered together in the churn or is more "churnable," and less is lost in churning.

If you are selling cream you must have a cow of a breed whose milk contains a large percentage of cream. Even for

THE MILK ROUTE

the same necessity exists in town and cities to deliver a rich milk.

Most of the states now have laws that prohibit the selling of milk unless it has the requisite amount of butter-fat. Laws requiring three per cent. of fat in milk sold within their boundaries are in effect in the following states: Iowa, Maine, Massachusetts (from April to August), Michigan, New York, Ohio, Oregon, Washington, Pennsylvania and Wisconsin. In Georgia, District of Columbia and Minnesota the requisite fat is three and a half per cent., and in Massachusetts from August to April the milk must analyze three and seven-tenths.

A good rich milk is best appreciated by your customers, the more neatly it is put up the better, and the more cream that rises on your milk the greater will be the demand for it, even at enhanced prices.

ECONOMY IN PRODUCTION

is the key-note to success, and this might be considered in conjunction with, and as part of, requisite No. 1: "An animal of a breed especially bred for the purpose;" because if you have a good animal so bred, economy in production is assured.

In the earlier part of my paper I reminded you of the generally accepted axiom that a cow consumes food in proportion to her weight. I must not, however, be construed as advocating that the cow that eats the least food is the most profitable one; on the contrary, my experience teaches me that a cow that can profitably consume food is the best one for dairy purposes; that is, if she will convert that food into milk after appropriating what is necessary to support her own carcass, without putting fat upon her back. A cow with a natural tendency to fatness must be avoided in the dairy.

Having considered the requisites in the profitable dairy cow, let us next see how we can acquire such. There are two ways open: By purchase and by breeding.

I am an advocate of having them bred on the farm, by means of a pure-bred bull. If you have such a bull, descended from a long line of large milkers and butter-makers, he ought to breed with a uniformity that will ensure you the class of animals you desire. They will be profitable to keep, and profitable to sell when you have too many. By raising your own stock you can sell off older cows, replace them by those of your own breeding, and thus keep cows only during the most profitable time of their life. A man who is constantly changing his cows by purchase is very liable to introduce disease into his herd.

To grade up your stock use none but a

THOROUGHBRED BULL.

Remember that the bull should impress upon his get either his own likeness or the likeness of an ancestor; unless a bull be extraordinarily prepotent he most often impresses upon his offspring a likeness of a remote ancestor rather than of an immediate progenitor. Therefore in using any bull it does not follow that his daughters will have the characteristics of his dam. The chances are his get will partake more closely in resemblance and characteristics to a more remote ancestor than the dam of the bull.

It follows if there be any impure blood in the sire used, there is a chance that his offspring may partake of the impure characteristics, and they will not be possessed of the characteristics you seek to the same extent as if he were pure.

See that the dam of your bull has the characteristics in either milk-giving or butter-making, and in form and size of udder, you desire to see perpetuated in your herd; that his grandams are possessed of like characteristics, and so back for at least four generations. While registration does not guarantee the individuality of ancestors, it does their purity of blood, and it is always more desirable to use a registered than an unregistered bull, even if the latter be pure.

No one realizes more than the writer does that the only infallible rule to judge the merits of a dairy cow is the scale and churn, or the scale and Babcock machine. There are, however, some points which may usually be borne in mind by one seeking a good dairy cow.

Not many years since the dairy farmer looked askance at a cow that gave an undue showing of bone; or in other words, was "scraggy." He sought for a nice, sleek, fat cow, and one that gave a large flow of milk at flush. He did not realize that the tendency to sleekness and good condition shown by the cow was a warning that as she got more distant from calving she had a natural aptitude to put the feed on her back rather than into the pail.

In referring to sleekness and good condition I must not be taken to mean that I do not like to see a cow thrifty, her skin glossy and loose, and oily to the touch. On the contrary, a herd of dairy cows properly maintained and properly fed for the best production will, as a natural consequence, possess a sleekness of hair, as evidence of good-keep. If the food is of the proper nature and such as will produce a good flow of milk, there will be no excess of fat on a good dairy cow. Her condition will indicate that she is thrifty and hardy. The drain upon her system in the secretion of milk should keep the fat from her back, otherwise she is not a profitable dairy cow.

Having emphasized these points, the deduction will naturally be made that in looking for the characteristics of a profitable dairy cow we must seek the reverse of a beefy animal. We want a cow with a long slim neck, thin over front shoulder and gradually widening along her barrel and belly until it forms a perfect wedge. If this be coupled with a long deep barrel, a large paunch in which to stow away her food; if she be wedge shape; if her hip bones be prominent, affording a resting place for your hat; if her thighs be flat; then you may be reasonably assured that you have the form of a cow with a natural tendency to convert her feed into milk rather than to put it upon her back.

If with these characteristics she spreads wide her legs in walking; if she has a large udder, not too fleshy, fed by large, tortuous and elastic milk veins, that spring back rapidly when compressed; if she has good lung power; if her jaws are large, and she has open, well-sprung ribs, and her general conformation shows good constitution; then you may expect a deep milker. I have found the more loosely-jointed a cow is the better she is as a dairy cow. I have often been deceived in a deep milker by her having small milk-veins, but I have generally found that while they are small, they resist the pressure of the fingers and when compressed spring back rapidly into place, showing that the veins are very active, though small.

See that your cow be provided with good stowage capacity; that she is not leggy or flat-sided.

Examine the udder; see that it is not too fleshy; that there is ample space in which to store her milk. Remember that you do not keep your cow for three or four months in the year, but for a whole year, therefore it is essential that she respond to her feed by way of the pail ten months in the year, rather than put it on her back.

Having now dealt with the selection and breeding of the profitable modern dairy cow, it is necessary for us to deal, somewhat shortly, as time will not permit of dwelling upon it too long, with

THE FEEDING

of your herd of cows:

The individuality of one cow varies so much from that of another and the digestive capabilities of cows differ so much, that it is impossible to lay down any fixed rule to suit each cow.

Study your cows closely. Watch their feed-box to see that they clean up their feed thoroughly; their droppings to note that no feed passes through them undigested. Watch results in conjunction with any new feeding you may try.

Treat your cows kindly. Feed them regularly. Milk them at a fixed time each day, and if possible have the same person always milk the same cow. Never abuse your cows. Have them dry at least four weeks before calving.

There is one principle, however, that may be laid down, applicable to all dairy cows, and that is, that if the best production a cow is capable of accomplishing is to be obtained, you must from the first thirty to thirty-five days after calving procure her largest possible flow of milk. Experience has taught me this, and the result of handling the herd of Jerseys in the World's Fair dairy tests, where each step and its causes and effects were marked with the most careful attention, further emphasizes this fact. Whether the cow be kept for the production of milk alone, or for the making of butter and cheese, it is equally important that we get the highest production of milk in the first thirty to thirty-five days after calving, regardless of quantity of butter-fat contained in the milk. If you are keeping her for butter-making, and if she is a cow of a breed whose habit it is to produce butter, when she begins to shrink in her flow, her milk will be enriched proportionately. Unless you bring the cow to her highest production within that time, her total production until next calving will be materially decreased.

If we have been fortunate enough to procure from her her best yield in that time, with careful handling and feeding we can retain her, as a rule, upon a good flow for a considerable time; but once permit the cow in her earlier period of lactation to be without the necessary food and care for the production of a good flow of milk, and you have lost her best services until next calving.

With the object in view I am advocating, it is very desirable to stimulate the cow to a large flow by feed such as will tend to that end. Do not give her what is commonly called "rich feed." Make the food rather "sloppy" in the earlier period of lactation, and make every effort to increase her flow. Every check or set-back at this time of lactation has a lasting effect.

I dislike to see a cow come too rapidly to her milk shortly after calving. I prefer to see her gain gradually, in proportion to the increase of feed.

My practice has been to give the freshly-calved cow about two pounds of bran, two pounds of ground oats and a half pound of linseed oil meal (old process) for the first six to eight days, as a mash, using hot water, dividing it into three feeds; to give her all the warm water she will drink; if she will not drink the warm water, add part of the mash to it. For the first six to eight days treat her as a sick cow, and nurse her.

If at the end of that time she is doing well, increase her bran and ground oats by one-half pound per day until she has 3½ pounds of bran and 3½ of ground oats, and one pound of linseed oil meal, which she ought to take about the 15th day after calving. Feed this quantity from about the 15th to the 20th day after calving. When she is taking care of this, give her plenty of bulky food; cut clover, corn stalks, green feed or ensilage. At the end of the 25th day after calving increase the bran and oats, and from the 30th day after calving add corn meal, if she is used to it and it produces good results.

The main feature to be observed is, never increase your feed by more than one-half pound per day. Increase at that rate for three to four days; then rest the cow for a like period, in order that her digestive organs may become used to taking care of this. Then you can go on safely, and increase feed, but never more than one-half pound per day.

If you find your cow under this treatment at any time decreases her flow rather than increases it, you may feel pretty well assured you are over-feeding her; therefore cut down her feed, until she again responds to it.

When she has been in milk thirty to forty-five days, according to the individuality of the cow, add a little more corn meal and cotton-seed meal, and gradually increase it, if you are seeking butter, until you have brought your cow to her best production in butter. Experience of the individual cow must be your guide as to how fast you will increase her feed, and the composition thereof.

If I am not exhausting the patience of my audience I will briefly touch upon some of the troubles in the care of a dairy herd. I need hardly speak of that great bugbear,

TUBERCULOSIS,

which I do not believe exists to-day to any greater extent than twenty years ago, and which is not nearly so injurious to the human race (unless the tubercles have lodged in the udder of the cow) as many would have us believe.

Tuberculosis is an insidious and much-to-be-dreaded disease. It is no respecter of breeds; all are liable to it, under environments that tend toward it. Keep your cows in clean stables, well-fed but not pampered; give them plenty of light, ventilation and exercise; see that the water they drink is not contaminated, and you have gone a long way toward keeping tuberculosis out of your herd, unless you are unfortunate enough to introduce a diseased animal into it.

There is one disease that almost every man who continues in the dairy business is liable to have sooner or later, and that is

ABORTION,

whether it be contagious or non-contagious.

I might keep you here all day discoursing on this subject, before we could exhaust it; but time will permit to only lightly touch on it.

Non-contagious abortion—that is, isolated cases of it—are produced by traceable causes. An accident to the cow, being hooked by another cow, chased by dogs, sudden chill, etc.

CONTAGIOUS ABORTION

is of a wholly different nature. It is a specific disease, and is most contagious, usually going through almost the entire herd before it is checked; reducing the natural product of the aborted cows at least twenty-five per cent. and re-occurring with next calf, and even the third calf if it be not checked.

What causes this contagious abortion? I hear some one say. I answer: A germ, which is often conveyed from one aborted cow to another; arises from the unclean portion of the discharge from the vagina of an aborted cow, and in many other ways when it has once found lodgment. The germ lodges on the hind-quarters of the cow, and passing through the vagina and into the uterus destroys the foetus.

The germ of abortion even remains in the uterus after a cow has aborted, and attacks the next foetus, causing her to abort again at from six to twelve weeks, or later. I have often known breeders to have cows that went six to nine weeks and then aborted; this they would repeat again and again. The owners thought they were non-breeders. Such was not the case. They were aborters, as was proven when they followed my advice, and as a consequence these cows produced live calves. I could cite many such cases in my experience.

I will briefly state what to do in cases of Contagious Abortion. Isolate the aborted cow; thoroughly disinfect the stall and stable where she was, wash the hind-quarters, vulva, tail and udder of the cows that stood near her, three times a week, for two weeks thereafter; remove all droppings and straw in or near stall where cow aborted. If any other cow threatens to abort remove her from the stable. In case of the aborted cow, you will usually find a discharge which is putrid and which is full of the germs of abortion; this discharge must be dried up by injection of disinfectants; burn all the straw and her droppings while she has this discharge. Do not breed her until about the same time you would have bred her had she carried her calf the full time. The object of this is to allow her generative organs to resume their normal condition, and with that object in view, you should supplement this by proper treatment of the cow to build up these organs.

Two objects are sought: 1. The destruction of the germ. 2. The building up of the generative organs.

Another source of great loss to dairymen is

MILK FEVER,

usually caused by the blood being too lethargic or too thick.

An ounce of prevention is worth a ton of cure. To lessen its re-occurrence, take the grain feed away from your cow for at least four weeks before calving, or reduce it to one quart of bran and one-half pint of linseed-oil meal per day. This will reduce her in flesh.

To thin her blood, three weeks before calving, seven days before calving, and immediately after calving, give her a drench of one to one and a half pounds of Epsom salts, two tablespoonfuls of ground ginger, and one quart of molasses, all disolved in two quarts of hot water. In addition, give her a handful of Epsom salts, either in her feed or as a drench, every day for three weeks previous to her calving. Some may doubt the theory as to milk fever being caused by the congested blood; to such I say: Have you ever seen the blood of a cow that died of milk fever under a microscope? I have, and have seen it in water, and when so placed in water the globules of blood expanded to double their size, showing clearly there was too little water in the blood. Increase the water and you avoid congestion, or in other words, milk fever.

I have put my words in the plainest way possible in dealing with this matter. I am no scientist, but a poor, everyday dairyman, and as such speak in the language I would desire to be spoken to. I speak on no theory as to the effect my system of drenching has in averting milk fever; I have tried it; others have tried it, and with the best results.

Gentlemen, I have traversed a good deal of ground; have taxed your patience, yet I would have liked to talk with you further on this great subject, but I must forbear.

Before closing let me say to you, you are aware that the champions of each breed will advise you that the profitable modern dairy cow is of that breed he believes in, and pins his faith to. In so doing he will be honest in such advice, even as I am, in saying that all the requisites of the profitable modern dairy cow are concentrated in the Jerseys.

1. She comes into profit at two years old and is a profitable producer to a ripe old age.

2. Her tenacity in milking, and consequently in butter-making, is a fixed characteristic, established beyond all doubt.

3. As an all-around year's milker, on an economical consumption of food, no breed can approach her.

4. Her milk contains a greater quantity of butter per hundred pounds than any other breed.

5. Her milk contains a greater quantity of cheese per hundred pounds than any other breed.

6. The quality of butter and cheese is of the very best.

7. She can assimilate and profitably take care of her food, to better advantage than any other breed.

All of these facts have been established by numerous, lengthy and exhaustive tests. It but remained for the World's Fair dairy test, the greatest which has ever taken place in the world, to emphasize these facts, and to entrench her in the unassailable position as the greatest of all dairy cows.

In these tests the following are the quantities of milk, cheese and butter given by the three breeds contending:

Milk: Jerseys, 105,131 pounds; Guernseys, 90,053 pounds; Short Horns, 98,097 pounds.

Cheese, for 15 days: Jerseys, 1,452 pounds; Guernseys, 1,131 pounds; Short Horns, 1,078 pounds.

Butter: Jerseys, 6,117 pounds; Guernseys, 4,905 pounds; Short Horns, 4,279 pounds.

The quality was of the best, and the cost per pound in cheese and butter was in favor of the Jerseys.

When I have stated these hard-pan facts, such facts as no special pleading will overcome, I have demonstrated to you that the Jersey is *par excellence* the profitable dairy cow.

In conclusion, let me urge every dairy farmer to study his cows closely; learn their individualities and their needs; supply such needs, tempered by judgment; seek by careful selection and coupling, and by skilful handling, and feeding, to make the daughter better than the mother; be as true to your cows as they have been to you, and they will prove not only a pleasure to you, but the most profitable bank account you can have, a worthy heritage to be handed down to your sons and your daughters.

Ques. I have two very nice Jersey cows, and I am bothered exceedingly to get them with calf. I have driven both of these cows to a bull half a dozen times within the past year, and I have no assurance to-day that either is with calf.

Ans. One great trouble is that the os is closed. If the cows are too fat, by thinning their blood you can at times get them in calf. If the os is closed and you are not fortunate enough to get it open by chance in service, the chances are against you. Yet, at the same time, by using a young and vigorous bull you do at times get them in calf, if you allow them to run with the bull. The opening of the os mechanically, if done properly, will sometimes make them breed but not very often.

Ques. I would like to inquire if you have ever known of any dairy in any part of this country where in cold weather tepid water was used for the cows rather than cold water as it comes from the well or cistern?

Ans. I may say that that was always my practice. I had water from a spring running through a trough in front of my cows. The cover was put on with hinges so that it could be opened to let them drink when they wanted to, and I ran a steam pipe through the water to take off the chill. I know of other places where this method is adopted, and the parties like it. They think it does not take away a certain amount of animal heat, as the cold water would.

Ques. Do they know about the profit, the increase in butter fat?

Ans. I know that my cows gave less milk when I gave them cold water and more when I gave them tepid water. There is a general concurrence in the advisability of warming the water.

Ques. Will the increase of profit be equal to the expense of warming the water?

Ans. It was no expense to me, because I had to have an engine for the purpose of running separators, and steam was always available. A boiler can be run at a very little expense.

Ques. Will you please explain a little more what you mean by need of exercise for dairy cows?

Ans. I mean that cows should be allowed to roam over the pasture rather than be kept tied up, a method some people have adopted for the purpose of stall feeding. I do not presume it prevails in this State but it has prevailed in others, and tuberculosis has followed in the wake of such treatment. You ought to allow your cows to be as near a state of nature as possible. It was always intended that they should roam the pastures when the weather was not too severe.

Ques. What I referred to more particularly was in regard to exercise in the winter.

Ans. If you let your cows out into a well protected barnyard it will do no harm, even in a cold climate. I always let my cows out in fine days, but I do not exercise them. All they practically do when they go out is to breathe pure air, which is beneficial.

Ques. Would not water pumped from a deep well be much better for the cows than water running from a spring?

Ans. It would be beneficial only in one sense,—the temperature might not be as low as that from the spring.

Ques. What is the cause of garget, and what is the best process to relieve it?

Ans. I will divide garget into two classes. One is what I call caked udder, or a hard substance in the udder. The udder gets hard and the cow gets feverish. Another is what I call gargety milk. Both are caused by fever, and an improper condition of the blood, and the process to relieve that is to correct the blood. Outward applications, rubbing with any liniment or applications of hot lard, will help to soften the udder, but will not take away the cause. In cases of garget I give three times a day fifteen grains of iodide of potassium dissolved in hot water and about twenty drops of fluid extract of poke root. I take away all the grain and give the cow drink to cool down her blood. In cases of gargety milk I get the milk from the udder in some way without using a tube. I do not believe in a milk tube. My experience shows me that it does harm by pushing the gargety milk back into the udder.

Ques. Would it not be possible by some system of ensilage or roots to prepare the system of the cow so as to guard against milk fever and save depending on the drug store?

Ans. Not according to my experience, in the case of deep milkers. Cows that are kept at their best production are always in a pretty good condition to take milk fever, and if you want to be free from milk fever you must have a barrel full of Epsom salts. I had charge of a very valuable herd at one time, and the owner and I differed on this system of drenching. He said that it was unnecessary, and that it was injurious to the cow, especially to her production after calving, which I admitted; but I told him it was far better to have a live cow than a carcass. He told me to watch the cow's droppings, and feed her ensilage, and see if we could not get along without milk fever. I was so satisfied that he was wrong and I right that I insisted upon his instructions being put in writing. We adopted that system, and after losing three cows in three months he came back to the system of salts.

Ques. How often would you calve a cow if you did not calve her for the calf?

Ans. That must be governed by your own surroundings and necessities. One man's necessities differ from another's, but you will make more out of your cow by having her calve every year.

Ques. I have a work which recommends aconite for garget, and I have used it with success, and some of my neighbors also. What is your opinion of this remedy?

Ans. Aconite is a fever medicine, and I can understand how it would remove the fever, but it will not correct the blood. It is a good medicine if it is not abused. It is one of the best medicines if a cow is threatened with milk fever. Let me mention one thing that is very little understood. Whenever you give a cow any medicine, get her to drink as much as possible. If she will not drink put salt in her mouth until she will. I remember when in Chicago we had a great heat, lasting from three to four days. Forest fires were raging right back of the World's Fair barns. The heat was something intense, and all my cows were practically on the verge of sun stroke. I had not a cow in the barn whose temperature was less than 103½, and the temperature of one cow from Connecticut went up to 107. That cow gave me an immense amount of uneasiness. I poured aconite into her as much as I dared, but it had no effect upon her. But within twenty minutes after I got her to drink freely, her temperature went down. If we will take into consideration the immense bulk of food there is in the stomach of the cow, we will see that if we want that to be taken up by the blood and carried through the system we must add water to it. That is the reason I advocate making the drenches in two quarts of hot water rather than one, and I have often taken three quarts. Then if you want to have your medicine affect your animals get them to drink, and the action, especially of aconite, is very rapid after that where before it had no effect. It is taken up by the large bulk of food and there it stays until it is diffused through the system.

Ques. What is your method of giving a cow a drench?

Ans. I take a champagne bottle, and if I am not fortunate enough to have some man to hold the cow's horns back I put my arm around her neck, standing at her right, and hit a thump under the tongue, and down it goes. If a cow is going into milk fever she very often is incapable of taking a drench, and you have to be very careful that you do not pour it down her windpipe. Never attempt, then, to give a drench alone. I have some person hold the cow's head and get my bottle in under her tongue and always hold my hands on her throat to know if it passes down. If she cannot swallow I put my hand down and allow it to come out. When a cow has gone very far and cannot swallow of her own accord, pull out her tongue and let it go back and the drench will go down.

Ques. What I wanted to bring out was whether it was wise to pull the cow's head around to one side of the body?

Ans. I keep it as straight as I can. I was once sent for by a friend of mine to see a cow that was down with milk fever, and I knew by her breathing that that cow had had a drench go down her windpipe. He asked me if I thought the cow would recover and I told him no. I did not tell him why, but I knew perfectly well, and it proved to be so. She came out of her milk fever but died from the effects of the salts having gone down her windpipe.

Ques. What do you think about the homeopathic specifics?

Ans. They are very good if you understand their use.

Ques. Would they take the place of salts?

Ans. No, sir; if you had not prepared your cow ahead of time in right shape and she came down with milk fever those would not take her out of it.

Ques. What is your dose of salts?

Ans. A pound to a pound and a half of Epsom salts, according to the size of the cow, a quart of molasses, and two heaping tablespoonfuls of common ginger, all dissolved in two quarts of hot water. The ginger is to keep the cow from griping, the molasses acts as a lubricant, and the salts act directly on the bowels.

Ques. Can a cow be dehorned without injury?

Ans. I think so, without permanent injury, except to injure her looks.

Ques. What percentage of cows affected with parturient apoplexy or milk fever recover with your treatment?

Ans. There are two classes of milk fever. One is milk fever proper where the temperature rises to 104½ or 105 and then recedes very rapidly down to ninety-eight or even ninety-two before the cow dies. That is, strictly speaking, milk fever. In the other, parturient apoplexy, the temperature never rises, is low all the time, low at the time of calving. This is a much more difficult case to contend with than milk fever itself. My process is not for the purpose of taking care of the cow after she has got milk fever; it is for the purpose of preparing her for calving, and to avert it. If she has been treated in that way her chances of recovery are very much greater than if she has not been so treated. Any person who has waited on a cow with milk fever knows that if we get a drench through her the chances of the cow's recovery are very great. The drench has had its effect of thinning the blood. My system is for prevention, not for cure, but my experience enables me to say that a cow so treated has more chances of recovery than a cow not so treated.

Ques. The question I asked was what percentage of cases of parturient apoplexy, where no precautionary measures had been taken, would recover under this treatment?

Ans. I cannot tell you the percentage. At Chicago I had six down and saved five.

Ques. What do you think of saltpeter? That has been the sovereign remedy for Maine dairymen.

Ans. I have used very little of it, and I would rather not speak on the subject of how it should be used, but I know saltpeter is an excellent thing to give in case of garget. I know people who use saltpeter regularly and claim to have good results, but I have used very little.

Ques. What would you do in a case of compaction in the manifold?

Ans. This is very difficult to deal with. I have seen cases successfully treated where the cow has been opened, and if I had another case of it I should open the cow in the early stages of compaction and take all the food out. You must get at the third stomach of the cow. If she stops chewing her cud it is an evidence that the digestive organs are not working, the third stomach is not working, it is still; and if the food stays here long enough it dries up. If there is an immense mass in the stomach of the cow, you will rarely get at that third stomach, without opening her. Nux Vomica used in proper proportions (I would not advise anybody to use it who does not understand it), is about the best thing in a case of that sort. It acts upon the muscles and starts them. This is a very hard disease to cure. When you see the first indications, give the cow a drench, and stop giving her any food except grass or green corn stalks, and the probability is that in twenty-four hours she will be back again.

Ques. How many salts would you give in a case like that?

Ans. A pound to a pound and a half, to a cow.

Ques. Would you give any cow that was going to calve the treatment that you have recommended for the prevention of milk fever?

Ans. No; some cows are not good enough to have milk fever. I would treat only those who are large milkers and you are afraid of, in this way.

Ques. In case of milk fever have you ever given a cow stimulants?

Ans. Yes, I give the cow the poorest whiskey I can get, all I can pour into her; make a vat of her. I have had a cow so drunk that she gave whiskey in her milk for days after.

Ques. What do you think of dehorning dairy animals?

Ans. I do not believe it does any good. If I had a vicious bull, I would dehorn him, or kill him, I do not know which. I do not like to see dehorned cattle. I do not think it is necessary in dairy cattle though it certainly is in cattle that you are shipping for beef in cars where they are packed closely. I do know this,—that in pure bred cattle, among Jerseys, it decreases the price about twenty per cent, if you want to sell, and some of us do want to sell occasionally.

Ques. What would you do for a cow that gave bloody milk when she came in, if there appeared to be no heat, and no swelling?

Ans. I should treat her the same as a gargety cow. That is a form of garget.

Thursday Afternoon.

THE SANITARY ASPECTS OF DAIRYING.

By Theobald Smith, M. D.

A discourse on the protection of the public health is not, I believe, a very agreeable or entertaining thing for most people. The work of public health authorities is associated in the minds of many, with unnecessary, often harsh measures, which inflict injury on somebody's business without doing any special good. The course of legislation looking towards the protection of the public and the difficulties encountered in obtaining laws on this subject, illustrate well this general statement. The incredulity frequently manifested towards the results of investigations concerning the causes of disease would lead one to believe that many people are convinced that scientists are a little unbalanced, but usually harmless, and that they may be allowed now and then to have their way. I do not mean to imply that all people or even the majority look upon sanitary work in this light, but they are not heard from as often as they should be when it becomes necessary to protect our families against the ignorance, shiftlessness, and often criminal negligence of certain members of the community.

RESULTS OF THE WORK.

The great obstacle in the path of sanitary reform and improvement is the quiet and unobtrusive way in which results of its work are manifested. A reduction in the mortality does not appeal to the average citizen's imagination, although this is the chief indication of its efficiency. No one knows how often he has been saved from disease by the intervention of the public health machine, which in our large cities works today without friction and with remarkable success. If every one whose life and health has been protected from imminent danger in this way had been snatched from the brink of the grave and his case reported in the papers, with suitable headlines, there would be neither dearth of legislation nor money to help public sanitation along, but this means of advertisement is not available and until human nature changes the sanitarian will have to make up with personal enthusiasm and devotion what he lacks in public support.

The necessity for the enforcement of vigorous measures to protect life and limb lies on the surface in many kinds of business. We force railroads to invest vast sums of money on safety devices, interlocking plants and signals, and to abolish grade crossings and yet it might be possible by the exercise of great care to get on without them. A railroad corporation that should refuse to introduce them on the ground that no accident had yet happened on its road would not be listened to.

So in ship-building the costliest contrivances are resorted to that will tend to keep a vessel afloat after an accident that may never happen. In these kinds of business the people themselves can appreciate the dangers. In the matter of disease they must rely on expert knowledge and training to point them out. Unfortunately for us, that respect for and deference to special training and fitness, that singling out of the best man for the most important place, and keeping him there during good behavior, making him independent of every consideration excepting his fidelity to the public service, is a virtue still to be acquired by us as a nation. Whatever superiority other nations may justly claim over us is due, in my estimation, to a proper regard for organized knowledge. But it is not my intention to lecture on civil service reform excepting in so far as it is vital to the execution of laws pertaining to the public health.

Rules and regulations forcing the individual to do certain things, or not to do certain other things, in order that the health and life of others may not be threatened are somewhat like our fire or life insurance. We cheerfully pay a small sum annually to a company which promises to protect us against loss by fire though we earnestly hope that this may never be necessary. So various trades and occupations, including the dairy business, must be taxed by law to do certain things over and above what many may think is necessary to protect, not their own interests, but that of their helpless customers.

In short, the civilization of to-day has pronounced unequivocally for the saving of human life and the protection of human well-being wherever possible. In the study and investigation of the means by which man may be saved from preventable disease with the least amount of trouble, the whole civilized world is active, and legislation looking to the protection of society from the ignorance, indifference and criminal negligence of some of its members is making rapid progress. Even from the overburdened countries of Europe we are continually learning new ways and means of combatting disease, though these very countries appear to be ever ready to destroy one another in war.

MILK SUPPLY AND SANITATION.

The important relations which exist between the milk supply and sanitation are due:

1. To the great value of milk as a food for infants, children and invalids.

2. To the consumption of milk uncooked.

It is hardly necessary for me to spend any time upon the discussion of so well known a subject as milk as an important article of food. But the second topic contains in a few words the gist of my lecture. Let us see how much the cooking of food means to us. One important difference between the diseases which afflict mankind and those which attack the domestic animals living in our midst is due to the fact that we eat most of our food cooked. Heat destroys the bacteria and other microbes and thus renders them harmless. We are free from hosts of worms and other animal parasites that infest domestic animals, and the few dangerous ones that still inflict the race, trichina and tape worms, are introduced in underdone or raw beef and pork. I do not exaggerate when I state that probably three-fourths of all infectious diseases of animals could be gotten rid of by feeding cooked food. I do not thereby mean to say that it is practicable or desirable to do so. But mankind has not yet gotten rid of all infectious diseases transmitted in the food, because we still eat and drink raw things. If we could give up this habit and eat with absolutely clean hands we would get rid of typhoid fever, dysentery and most stomach and bowel troubles. We would not need to fear Asiatic cholera, and the plague of the east would lose many of its terrors.

In certain countries where meats are still preferred in a raw condition, notably certain regions of Germany, we hear not infrequently of epidemics of meat poisoning and of trichinosis. Public health learns much from these experiments which the people inflict upon themselves. The farmer and breeder is beginning to realize now and then the necessity of feeding boiled milk to calves to prevent and cure fatal scouring. There is no special virtue in it save the absence of harmful bacteria.

From this brief sketch of the possibilities confronting us in uncooked food, you will see the importance of keeping a close watch of the dairy, what is going on within and around it. In communities otherwise well protected against the importation of dangerous diseases from without and the spread of children's diseases in schools, the milk supply and the water supply are the two most important factors in the health problem. Let us look somewhat more carefully at the specific dangers involved. We must bear in mind that we are discussing possible events which may occur but once or never in any one business but which, as we take a bird's-eye view of a whole state, for example, occurs frequently enough to call for protective measures.

The sources of disease associated with the milk supply may be classified as follows:

1. The general filth and want of cleanliness of stables, cattle and utensils.

2. Specific infectious diseases of human beings handling the milk, typhoid fever, diphtheria, dysentery, scarlet fever.

3. Occasional bacterial diseases of cattle such as diarrhoea, foul condition of the uterus after calving, inflammatory diseases of the udder.

4. Specific diseases of the cow, tuberculosis, foot and mouth disease (restricted to the European continent).

The want of cleanliness in the dairy is shown more particularly in the enormous numbers of bacteria found in samples of milk, as well as in the presence of bacteria, which we know come from the dung or droppings of cows. Milk has been declared to be the filthiest article of food we consume and any one who has been drawn into the bacteriological study of milk will give a general assent to this statement. The miscellaneous bacteria come chiefly from the dried, powdery dirt on the skin of the cow, also from the dust of the stable. Some come from the milk ducts of the udder itself.

In the warm season of the year these bacteria begin to multiply at once unless the milk is promptly cooled and kept at a low temperature. On the way to the large cities and in the hands of the peddlers and storekeepers the milk becomes still more deteriorated and infected until the number of bacteria in a teaspoonful of apparently good milk may be ten millions and over. The effect of this condition of the milk manifests itself in a high death rate among children in the earliest years of life, who live upon cow's milk.

Dr. S. W. Abbott, secretary of the state board of health of Massachusetts, has recently compiled some very interesting figures upon infant mortality in that state. We will consider only those bearing upon our theme.

During the past five years (1892-6) fully 25 per cent. of all deaths occurring in children under one year of age were due to intestinal disease; 8 per cent. of the whole number are stated to be due to tuberculosis of the bowels. In children between one and two years of age, about 11 per cent. of all deaths were due to intestinal diseases. When we consider that in the same state 156 out of every 1,000 infants born during the year died, we have some idea of the large sacrifice of life which is caused by food, combined, to be sure, in summer, with other causes. Yet we may safely say that the majority of these deaths are directly or indirectly due to the bacteria introduced into the body in the milk.

The precise manner in which the deteriorated milk of the summer months acts in producing these bowel diseases of infants is not known. Whether the large numbers of bacteria or certain combinations of them cause disease is not determined. It is probable that in this class of diseases the dairy is only partly to blame and that the deterioration is largely due to causes operating after the milk leaves the producer's hands. Yet he can do much to improve the situation. If the milk is not too abundantly seeded with germs at the very outset, from the cow, the stable, or the utensils, it will remain sweet much longer.

A fertile source of disease germs are certain diseases of cows themselves. Among these are inflammatory diseases of the udder, the so-called garget. Diarrhoeal diseases of the cow have been found to be caused by bacteria dangerous to man. In some animals the uterus remains large after the birth of the calf and a diseased condition results which harbors hosts of bacteria. In such diseases the dangerous bacteria are probably not in the milk as it comes from the udder, but the milk becomes contaminated by the discharges which may soil the cow and the udder.

We will now consider for a moment the infectious diseases which may be transmitted in the milk. Chief among these is typhoid fever.

The speaker then described the bacillus of typhoid fever, how it enters the body, its multiplication in the intestines, its discharge in the stools, and more rarely in the urine, during and for some time after the disease.

Mild cases of this disease may be mistaken for some other malady.

The bacteria may be put into the milk directly by the sick or recovered person who milks or handles the milk or they may find their way from the surface of the ground in cesspools, into the water used in the dairy.

Dysentery which occurs occasionally in epidemics in our climate resembles typhoid fever in its mode of propagation.

Milder diseases of the bowels are undoubtedly due to milk now and then.

Diphtheria has been traced to the milk supply. The sick or recovered person who handles milk may introduce into it the germs of this disease.

Scarlet fever has also been traced along certain milk routes supplied from a given dairy.

Asiatic cholera and the eastern plague would find the milk a very ready and convenient vehicle for transmission.

TUBERCULOSIS.

The one disease which in recent years has occupied the attention of agriculturist and sanitarian almost to the exclusion of every other malady likely to be transmitted in the milk, is tuberculosis. In the discussion of this disease and of the probable danger of bovine tuberculosis to human health, all hands have taken part, whether they knew anything of the subject or not. In their hot haste to discover some additional danger due to the bovine malady men standing high in the public estimation have given forth some very peculiar ideas and theories concerning it. Undoubtedly the intention was good but the method was wrong. Instead of appealing to the public for aid to investigate the subject, they have taken it for granted that everything was known that could be known. But even to-day we are far from having firm ground under our feet and more light is needed in various directions. Let us see what we believe we know, and what we still need to discover. The use of tuberculin has revealed a very high per cent. of cattle infected with tuberculosis over the entire civilized world. Some of these are found badly diseased, others,—in fact, the majority—are but slightly diseased. They are, nevertheless, infected, for the regions of disease, however insignificant, contain the specific germs of this disease. Even if we were in position to affirm that these germs only very rarely produce disease in human beings, the situation is one of grave import to agriculture, one that cannot be argued or ignored out of existence. With the increasing draught upon the cow for dairy products, and the consequent lowering of her vitality, aided and abetted by most unnatural surroundings, this contagion is likely to spread more and more, probably increase in virulence until suppression or eradication can no longer be thought of.

This is the agricultural side of the problem. The sanitary aspect is a corollary of the generally accepted view that the bovine bacillus produces disease in the human being.

The bacilli from the cow are disseminated in several ways. As the disease spreads in the lungs, these organs begin to break down and particles of disintegrated lung tissue containing bacilli are coughed up. These, after conversion into dust by drying, may enter the lungs of human beings taking care of such animals.

As the disease spreads through the body of the cow it occasionally lodges in the udder. Here the bacilli multiply and gradually destroy the gland. They also pass out into the milk. Probably not more than 1% of all tuberculous cattle have tuberculosis of the udder. In advanced stages of the disease tubercle bacilli are occasionally found in the milk when there is no recognizable udder disease.

We know then that tubercle bacilli often in large numbers pass into the milk when the udder is diseased. We know also that they may pass into the milk in small numbers when the general disease is in an advanced stage. They have furthermore been found in butter.

To what extent are these bacilli likely to produce disease in man? This we do not know. Nine-tenths of all the writing on this subject has been pure guess work.

For a number of years I have devoted much time to this phase of the subject and from the results obtained I have begun to realize that we are still in the beginning of our knowledge. *The bacilli from human disease were easily distinguishable from those of the bovine disease in my studies.* Since the publication of these results, a German investigator has published similar results. He has found one out of twenty-eight bacilli from man identical with those from cattle. Taking these with mine, we may say that one out of thirty-six random cases may have been infected from cattle. But more evidence is needed and it is my hope to study the bacilli from some of those cases which are regarded as due to milk infection, provided the means for such investigations are forthcoming. You will see that only by such researches can we throw out guess work and learn precisely what percentage of tuberculosis and what form of this disease to attribute to cattle. In the meantime the circumstantial evidence accumulated warrants public health in regarding it criminal for any one knowingly to draw milk from a tuberculous udder or from cows emaciated and in advanced stages of the disease. The majority of cows reacting to tuberculin do not shed bacilli in the milk but they may do so if the disease spreads through the body. Here we are confronted with another query. What becomes of the disease in those cows which show only very slight disease changes when killed and examined? Do such animals eventually recover or do they go down hill to a general disease and death? I am inclined to believe that the majority of such animals would recover if decently treated and not exposed to continual reinfection in bad surroundings. But this needs careful investigation.

LAWS RELATING TO TUBERCULOSIS.

The laws dealing with bovine tuberculosis from a sanitary standpoint will probably depend largely upon future investigations as to its relative transmissibility to man. At present the whole subject of dairy sanitation points to the necessity of periodic inspection of dairies which should take into consideration all diseases transmissible through milk, and not tuberculosis only, for it is not improbable that tuberculosis plays quite a minor part in the sickness and mortality due to milk. This inspection, which should pay especial attention to the udders of cows and their general condition, should be done by trained men who have studied the subject and passed a satisfactory examination.

The agricultural interests are in so far identical with those seeking to protect health and life as both are promoted by a restriction and final suppression of this disease. Any let-alone policy will not do. Already this disease has been widely transmitted, in some European states, to swine which are being fed with waste products from the dairy. What policy can be pursued which will find the farmers and cattle owners responsive and not violently opposed? It is too much to expect our large centers of population to pay forever for tuberculous cattle frequently reared by negligence and ignorance in the country districts. On the other hand the agriculturist can hardly be expected to clean out this Augean stable without help from the whole country. The Denmark method which has been introduced by Bang and which has been so widely advertised by our agricultural experiment stations since the reaction against extreme measures has set in, seems to me to be rational. In our own country this method found at first an insurmountable obstacle in the unscientific and wasteful view held concerning the utilization of the flesh of animals having only very slight tuberculous lesions. No other country has held such extravagant notions and I am happy to say that they are being rapidly replaced by more rational views. In this fight against tuberculosis the State should give each cattle owner an opportunity of having his cattle tested with tuberculin. He may then know where he stands. Such a test should be given free only on condition that the trained inspector have the authority of removing any animals which have udder disease or are emaciated or otherwise suspicious. The reacting animals, in other respects sound, may then be separated from the non-reacting and fattened for the butcher at the owner's discretion. This he will learn is in his best interest. That infected stables should be disinfected needs no comment. Thereafter the owner should be able to make his tuberculin tests himself with tuberculin provided for him at public cost, an item of little consequence. This weeding out process, coupled with the periodic inspection of dairies on the part of public health authorities, seems to me all that is necessary or wise at present. But less than this should not be attempted. The consumers of milk have a right to this minimum amount of protection until we have made our information more definite.

Unfortunately for us, there has arisen, especially in the state of Massachusetts, an unreasonable prejudice against tuberculin. That it is a specific reagent for tuberculosis, has been demonstrated over and over in the laboratory. It is not injurious in the doses administered, it can never produce tuberculosis because the living bacilli have been exposed to a prolonged boiling which renders them obviously harmless as propagating organisms. It is not infallible and its errors run from 5 to 10 per cent. But no principle however well established, works without exceptions in actual practice. The reasons why tuberculin fails now and then will eventually be found in entire harmony with our conception of its specific powers. This brings us to another subject needing more study, and that is the tuberculin reaction. The main objection to this agent has probably arisen from its power to point out the mildest cases of the disease, one of its most valuable characteristics. But if we do not insist on the immediate destruction of these animals this objection must fall to the ground.

The use of the flesh of cattle having but traces of tuberculosis is sanctioned by all authorities and practiced in all countries. The disease is, as a rule, situated in organs or glands always removed at the abattoir. The general condition of the animal and the flesh are not affected at all in the earliest stages of the disease. Adequate inspection should, however, be provided so that the consumer may be protected not only against advanced tuberculosis but against other diseases of cattle as well.

EFFORTS TO IMPROVE SANITARY CONDITIONS.

All efforts to protect the health of the community appear on the surface costly as compared with the intangible results. So the improvement in methods of dairying looking towards the elimination of animal diseases and greater cleanliness must increase the cost of the product. Unfortunately a large proportion of our milk consuming public is not likely to appreciate such efforts because the reasons therefor are not obvious to them. However, the beginning in the education of both the public and the farmer has been made, and the time is coming when the confidence of the public in clean and safe milk will lead to a far greater use of this article of food. Whenever the confidence of the medical profession has been fully restored milk will be the staple food of the sick, the convalescent and the debilitated. It would take the place of the host of nostrums and patent medicines whose virtues are extolled with so much ingenuity in the daily papers.

In the general improvement of our milk supply I believe that the first step is to educate those engaged in this business thoroughly in the sources of danger arising from general filth, from human and from animal diseases. There should also be instruction in the action of various bacteria on milk and the restraining and favoring influences of temperature.

The dairyman fully equipped with this information will then be able to meet most of the difficulties himself.

It is, furthermore, necessary for the State or local authorities, or both combined, to prescribe certain broad rules which will compel the shiftless, the careless and the ignorant to fall in line. Such rules are especially needed in a business whose bad methods are not traceable but manifest themselves in a far distant city. The sickness and deaths in our large cities, caused directly or indirectly by milk, cannot be laid at the door of any one excepting under certain very favorable circumstances. The milk supply of Boston, for example, comes from the greater part of Massachusetts, from Connecticut, New Hampshire and Maine. Evidently with such a complex system and such a wide area of supply the greatest effort should be made to keep the spring pure at the source.

GENERAL CONDITIONS OF THE DAIRY.

To come to more specific suggestions it is generally conceded that the general condition of the dairy should be subject to official inspecion from time to time. This would be in the interest of the best dairies as well as that of the consumers. The animals, their food, the storage of manure, the drinking water, the relation of the dwelling house to the dairy room should be subject to inspection. If done by competent trained men this would tend to equalize methods of production and act as a check upon ignorance and unscrupulousness in an important business.

In regard to general cleanliness certain simple rules should always be followed. Before milking the udder and belly of the animal should be sponged to keep the dirt from getting into the milk. The milker should always thoroughly wash his hands with soap and water and not in the first milk from the udder. Everything that tends to raise the dust should be stopped or else the milking done in a separate compartment. The clothes of the milker should be covered with a frequently washed linen duster or other washable garment.

The existence of any disease among the help in the dairy or in the family should always be regarded as a possibly serious thing and the nature of the disease should be promptly determined, if possible, by a physician. Local boards of health are as a rule armed with sufficient power to act whenever an infectious disease occurs and the duty of the milk producer lies in prompt notification and not in concealment. The danger of convalescents from typhoid fever, scarlet fever and diphtheria must be specially emphasized, for it is not generally understood by the people that persons who are to all appearances well may, and frequently do, carry germs for some time after. The stools of persons who have recovered from typhoid are infectious for weeks after. In some cases children who have recovered from diphtheria have the germs of this disease in their throats for three months after. But even these possible dangers would be

Potato Field of M. H. Wiswell, East Machias, Washington County, Me.

greatly lessened with the introduction of more cleanly habits and methods. A convalescent with unclean hands and soiled clothes might infect milk where one with hands thoroughly washed and his clothes covered with a washable garment would not. A person with a few diphtheria bacteria still in his throat would be harmless if he refrained from spitting or putting his fingers into his mouth or nose while at work. A person suffering with consumption is dangerous only when he spits about indiscriminately or into his handkerchief. I mention these facts not to encourage carelessness but to show that with more thorough information we might do that which would be eminently unsafe if done by ignorant persons. The absolute separation of the housekeeping from the dairy business is becoming more and more necessary. Flagrant violations of this rule are frequently observed by sanitary inspectors in and about our large cities. A single cow there often forms an important means of support and the kitchen serves both as dairy room and living room. The protection of the drinking water is another essential feature of dairy management. This subject you will find treated in a farmers' bulletin written by me and which is distributed free by the agricultural department at Washington.

PASTEURIZATION OF MILK.

In conclusion I wish to say a few words concerning pasteurization of milk in the interests of public health. This process consists in heating milk to a certain temperature and keeping it at that point for a certain length of time. Different persons may choose different temperatures. In any case it should not fall below 140° F. The lower the temperature the longer the time necessary to make the process successful. A satisfactory rule is to keep the milk at 155° F. for fifteen or twenty minutes. This destroys the great majority of bacteria which cause the acidity and curdling and all disease germs of any importance. If the milk be promptly cooled and kept cool the few remaining bacteria are restrained from multiplying and the milk remains sweet for at least twenty-four hours longer than unpasteurized milk.

Pasteurization is, therefore, in the interest of the dairy as well as of public health. I believe that the way out of much of the difficulty now confronting the milk supply of large cities is the uniform pasteurization of all milk. It is frequently urged that the proper place to do this is in the home where the milk is to be consumed, but this fails to take into consideration the vast number of families, where want of time or ignorance and prejudice stand in the way and where pasteurization is precisely the thing needed. In those households where the simple process will be properly carried out it is best done because it comes at the end of a long chain of possible contaminations. I also think that the degree of heat necessary to destroy disease germs, including tubercle bacilli, is lower than that now actually applied. Any improvements in this direction which will tend to preserve still better the natural flavor of milk will probably assist its more general introduction.

But pasteurization will not restore to healthfulness milk which is already loaded with myriads of bacteria. In fact the poison contained in these bacteria, even when they have been killed by heat, has been regarded by a high authority as a cause of infantile disease.

Pasteurization must not be depended on, therefore, to take the place of the measures I have suggested. Its use in the dairy will be simply to supplement these measures and to neutralize those difficulties which the greatest amount of care at times may be unable to prevent.

Ques. In sterilizing milk, if it does not actually destroy the bacteria is there any possible way by which it can be done, either by a longer heating process or by the addition of some substance?

Ans. It is perfectly possible to sterilize milk, but you will have to either boil it under pressure,—heat it to a temperature above the boiling point—or boil it two or three times, on different days. In the laboratory we frequently sterilize milk so that it will keep for years, but it takes boiling for ten or fifteen minutes on three different days. It is absolutely sterilized in that way, but it is rather expensive. I have some samples that were boiled three times, on three different days, and the milk remains fluid indefinitely, until it is dried up.

Ques. How long may infection remain in a house, from tuberculosis of human beings, provided the germs remain where the sun does not strike them.

Ans. It takes from four to six months for the tubercle bacilli to become harmless. If you allow a mass of tubercular sputum to dry on a piece of glass, and inoculate guinea pigs with it from time to time, they will become tuberculous up to the fourth month, at least. The bacilli will live probably four months dry, but if sunlight strikes them they are killed very soon.

Ques. Is not what is sometimes called hereditary tuberculosis often due to the infection of the house in which the family lives?

Ans. Precisely; because tuberculosis is probably very rarely born with the individual. It is usually acquired after birth, and of course it is due to the children living in surroundings that are infected with tubercle bacilli that survive for months. It has been found that the greatest danger is nearest the person who has the disease. The dust on a head-board in a bed has been found to produce tuberculosis while the dust nearer the door would not do it. The nearer to the patient the more the danger.

Ques. What are some of the simple things to be attended to where there is a case of tuberculosis in a home, to prevent danger?

Ans. The only thing is to make the person expectorate into some disinfectant fluid, because the bacilli are not driven off in any other way, as a rule, except in the sputum, and if this is in some disinfectant or some water boiled afterwards, the surroundings are apt to be safe. There is a little spray that comes from an individual in coughing that you can scarcely see, so that the living room of any tuberculous patient should not be the living room of anybody else.

Ques. In the use of tuberculin, how is it to be determined whether an animal is badly diseased so that she should be killed, or only slightly diseased, so that she should be isolated and an attempt made to save her?

Ans. As a rule an animal in the advanced stages of tuberculosis will show signs of the disease. The method used in Denmark is this: The state furnishes a man to test the cattle, and the owner is recommended strongly to separate those who have given the reaction from those who have not and fatten them for the butcher, and then they are slaughtered and all mild cases are allowed to be consumed as healthy animals. That is the rule in all countries excepting this. When animals are but slightly diseased the flesh is as good as any, because the tubercles are simply in one spot, and it is simply throwing away the carcass to throw them away, or to use them for fertilizers, as has been done in this country, at a loss, I might say, of almost millions of dollars.

Ques. Your idea would be that it cannot be determined during the life of the animal whether it is a mild case or not?

Ans. Not absolutely. Any animal that is free from other diseases, if it is in an advanced stage of the disease will not shed many tubercles in the milk. A good many cases that have been tested have not showed any, and these few are not likely to be dangerous. The infection of any person is due to numbers of bacilli rather than to a few. A few may pass the digestive organs without doing any harm. *All the evidence goes to show that the infection of human beings from animals is much smaller than it is supposed to be.*

Ques. If an animal in advanced stages of tuberculosis is killed and put on to the land, is there danger to rising generations?

Ans. The process of converting flesh into fertilizers is such that no living thing can escape. The acids, etc., destroy them entirely, so there is no danger whatever from that source.

Ques. Suppose the animal is put upon the land without being boiled or treated with sulphuric acid.

Ans. I should suppose no farmer would allow such a thing to be done. It is possible that animals having access to such carcasses, as dogs, cats and swine, would infect themselves, because we know that these animals have tuberculosis. I have tubercle bacilli from swine and cats that were evidently derived from cattle.

Ques. If the animal is buried two feet deep is there any danger?

Ans. I think it is safe, provided the carcasses cannot be reached by animals. Of course I should recommend that in such a case the carcass be covered with ordinary unslaked lime. I think that would be absolutely safe where the burial is not deeper than two feet. Unslaked lime is an excellent disinfectant, and covering the carcass with two feet of it would absolutely prevent any danger from the buried tuberculosis.

Ques. Is there a tendency towards tuberculosis created in an animal by the injection of tuberculin?

Ans. I should think the tendency might be neutralized, because it is used as a cure. I think that is quite impossible, as the tendency would be to make the cow less susceptible to tuberculosis.

Ques. Is pasteurization—heating the milk to 155 degrees and holding it at that temperature for twenty minutes—perfectly efficient for killing all germ life in milk?

Ans. That is perfectly safe, and, as I stated, I believe that the temperature can be still more reduced. I have been at work on that for a year and a half, and I hope to publish some results very soon. I cannot state any definite figures at present, but I think the temperature in pasteurization can be reduced from those figures and still the milk will be safe against the carrying of tubercle bacilli or any other pathogenic germ, like that of diphtheria.

Ques. Are there any germs that would not be taken care of by pasteurization?

Ans. I know of none except in the case of anthrax, in which the spores might resist. But anthrax is not indigenous to this State. Inside of these bacilli resistant spores form, which may withstand boiling a few minutes. Blackleg in cattle has a spore in one end that will withstand boiling for hours. Those are the only diseases that would come into consideration. Anthrax is a very rare disease, introduced from foreign countries. In some parts of the country, like Delaware, the disease has been introduced from tanneries, and has been spread by means of a stream which conveys the outflow of the tanneries to the ocean. It has made a great deal of difficulty in that State, and they have resorted to the use of vaccine in order to protect the animals that graze upon the pastures. In Delaware it exists along the lower Mississippi, and it exists in Nevada, but it does not exist in the New England States, and I hope it never will, because it is a serious thing to get rid of on account of the spores which are so tenacious of life.

Ques. Are there any dangerous bacteria that might arise from the opening in the animal in the spring of the year where the gad fly comes out?

Ans. I think not. Ordinary bacteria that produce slight sores on the hands might be there, but they would be easily destroyed by pasteurization. I do not think they would be dangerous if taken into the stomach. I think that is not anything to be worried about at all.

Ques. In your judgment, if an animal is very slightly diseased with tuberculosis, having it in a latent form, and is subjected to the tuberculin test, is there any possible danger of increasing or encouraging that disease so that it might take on an active form?

Ans. I think not, in cattle. It is a question that I have looked into more or less in examining animals that were slaughtered, and I could never convince myself that there was any possibility of this. It has been claimed with reference to the use of tuberculin in the human subject, but the human subject is more susceptible than the cattle, and I, personally, should never hesitate to use tuberculin for that reason.

Dr. W. H. Jordan.

Mr. President; Ladies and Gentlemen: I suppose some of my friends who occasionally guy me will not believe me if I say that I came 200 miles to travel back over the same distance just for the sake of shaking hands, because some of them claim that I like to make speeches. I do not know but that I do, when I am down in Maine. I am glad to see you, I am grateful for your kindly reception, and I want to congratulate you as a man who stands and views you from a somewhat outside standpoint. First of all, I want to congratulate you because of your institutes. We are beginning to realize after these few years of experience what a profound influence this institute system is having upon the life and upon the thinking, not only of the rural people but of the whole people of the State. We have seen here to-day, an evidence of the fact that the knowledge which is useful to the farmer is useful to everybody. There is not a fact of life that is useful to the farmer but that is useful to any man who must live, and eat, and raise a family, because the same facts, the same laws, the same forces, that touch the farmer touch every man, woman and child. And that is one of the reasons, my friends, why the new institutions that are behind the institute system, the land grant colleges, stand so close to the life of the people, and why they have a peculiar claim upon the people to-day that no other institutions have. It is because those institutions are dealing with the knowledge that pertains to the life of the people, what you might call scientifically, their biological relations. The knowledge which these institutions bring to you is not abstractions merely, but it is the relations of facts in science to your life. I, myself, believe that the relation of these institutions to the whole life of the people has never been fully developed. I spoke to the people in Massachusetts, Tuesday, and in discussing the question of the agricultural college, I told them that it is not only the farmer, but it is the farmer's wife, it is the farmer's son, (and this next statement appealed to the young men present) it is the farmer's daughter also that is involved in this education; and I am glad to know that the institution in which I have the greatest interest that I have in any institution of an educational character in the whole world, the one at Orono, has opened its doors to the young women as well as to the young men, so that the knowledge which touches the life of the farm may touch the life of the home. I believe in it; it is right. And so I congratulate you that you have this institute here in the midst of the citizens of Portland, and I am glad to know that they are interested in those things in which you are interested because the facts touch them as fully as they touch you.

I am going to tell a story about Mary, the servant girl, who got engaged to be married. It is a very common experience, but it was a delightful one to Mary. She went to confession not long after, and in confessing her sins, I do not know whether they were large or small, she let slip the fact in the good Father's hearing that she had become engaged, and in telling of it she let slip the other fact that Patrick kissed her. That amused the good priest. His eyes twinkled, and he thought he would ask Mary one or two more questions. He said, "Mary, didn't Patrick kiss you more than once?" Mary took in the situation in a moment, and with that peculiar quality of Irish wit which no other nationality can equal, she said, "Your Riverence, I came here to confess and not to boast." Now, my friends, I did not come here to confess, I came here to boast; not of myself, nor of my work, nor of the great state of which I have become a citizen, but of my own State; and this is why I boast—because I have become so impressed with the opinion that the citizens of other states have of this State of Maine. That is not flattery. I do not say this here to-day simply because I am here, but because in going through New York and other states, wherever I go, I find the State of Maine and the citizens of the State of Maine are held in the highest respect. And I simply want to appeal to you here to-day, friends, to hold yourselves in as great confidence and faith as the citizens of other states hold you, and that is the essential thing for your success. Do you know, faith and courage create conditions. You are not merely in the grasp of conditions that surround you; you control conditions. And the man who has faith, who believes in himself, believes in what he is doing, believes in his State, believes in the things that are around him that are good, that man creates conditions and is not merely the tool of circumstances. You may say, that is all sentiment. Well, it is sentiment. You may say, sentiment will not destroy the potato rot, nor kill tuberculosis. Well, directly, sentiment does not; but the right sort of faith and courage finds a way to do it. Yes, it is sentiment! But it was sentiment in the State of New York that this fall compelled the most powerful political machine in state politics that exists in this country to put at the head of its ticket, Roosevelt of the Rough Riders, nothing but sentiment. And sentiment is all powerful. Now you have as much faith in old Maine as other people have in you and the citizenship and the success of Maine will never be lowered.

Thursday Evening.

ADDRESS.

By Dr. A. W. Harris, President of the University of Maine.

Mr. President, Ladies and Gentlemen: There is an old saying that every goose thinks her own goslings swans, and if you have had experience with parents, you will agree with me that the proverb is not very far wrong. I plead this saying as my justification in talking to you on the subject with which I am most familiar. It would be idle for me to attempt to tell men and women who, by their works, have proved their knowledge of dairying, how they should conduct that business. And I trust that the subject which I have chosen may not seen inappropriate in this audience.

I propose to speak upon "The Relation of Agriculture to Higher Education." This is a subject on which very few men would have ventured to speak at all, fifty years ago, because no relation was recognized. It is only a little more than a generation since Congress passed the law which led to the establishment, in each state, of a state college, an agricultural college, or a state university. These institutions differed in some important respects from any which preceded them. Almost all of them differed from others, in that they were under the control of the State, belonged to it, and were maintained by it, usually without any help from private organizations. All of them differed from existing colleges, in giving, as directed by law, their first attention to the subjects by which the people won their living, in the shop, or in the field. There can be very few men before me who were in active life when these institutions were established, and we may well ask the question, What has been accomplished for agriculture and other industries by these institutions?

In the first place let us acknowledge that the results reached are not the same that were expected. But we must not count results failures because they fail to meet our expectations. Some of you remember the anxious days preceding the war between the States, and a few of you may have belonged to the extreme abolitionist group, who were ready to pay any price to wipe out the accursed thing, slavery. You were often discouraged, because Providence seemed against those who had striven to make clean the national record. The first important outcome of the slavery struggle was the Missouri Compromise of 1820, which seemed to fix forever slavery upon a part of this country. Later, after years of struggle, the abolitionist thought he had built up a party which would destroy slavery, but found that the first mutterings of war caused his supporters to desert, ready for any compromise, if only peace might be maintained. And yet Providence was in it all; for these long years of compromise and seeming shame, were the growing time of the North, developing the power needed to end the evil. Perhaps some of our seeming failures in agricultural education may prove the means of ultimate success. There have been few students in agricultural courses in comparison with the great numbers which the founders of these courses pictured as sitting at the seats of learning. But if we consider the results attained, we shall confess that they are important, even though they may not include class rooms filled to overflowing with students, who are to go back to the farm.

Let me call attention, hurriedly, to a few of the more important results obtained. First, the great success of the agricultural college is to be found in educating the farmer's son. It has opened a thousand doors, throughout the rural sections of the land, to boys who but for them might never have found any advantages whatever. It has made higher education cheap, and that alone is one of the most important achievements. Somebody has said that he who would find the leaders of the people, must go not only to the palaces of the rich, but to the cottages of the poor; and that he will find more leaders in the cottages than in the palaces; if for no other reason, because there are so many more cottages than palaces.

Again, the agricultural college has been the faithful champion of the farmer and of agriculture, in the fields of science and of learning. It has been ever ready to consider the farmer's interest; ready to grasp every opportunity to increase the product of his labor, to guide his methods, and to enlarge his opportunities.

The agricultural college or department is nearly the only institution, certainly the only college, which has given any attention whatever to agriculture. It is not very many years since I was a college student, and I can remember that it was then common to speak in a slighting way of "bread and butter" education. It was thought rather beneath the scholar to give much attention to those things by which he was to wring his living from a stingy nature. That day is gone, and it is gone largely as the result of the effects of the class of institutions to which the agricultural college belongs, which by study, investigation, and teaching, have made the people understand that it is a dignified thing, as well as a great benefit to humanity, to make it a little easier for a man to tread the ordinary walks of life.

The agricultural college, though it has not graduated a great number of farmers, nor attracted many students to its agricultural courses, has still educated nearly all the leaders in agricultural progress and science. In our own State, I need mention only a few of the graduates of the college at Orono. Jordan, the Director of the first Experiment Station—I mean first in wealth, importance and opportunities—has already spoken to you a few words. Balentine was for many years an inspiration to every man who attempted to work for the advancement of the agricultural interests of the State. Scribner, of the U. S. Department of Agriculture, though little known in Maine, is a man in whom we may take the greatest pride. If he succeeds in his problem, which has for its object, to find a grass of economic value for the great grassless plains of the South, he will have deserved a thousandfold the commendation of him who said that "he who makes two blades of grass grow where only one grew before, is a benefactor of humanity."

Perhaps the most important result of the agricultural college is the agricultural experiment station. In his day, Washington was interested in agricultural investigations. Some of you may know of the efforts which Jefferson made to diversify our agricultural products. But until within the last generation, it was very slowly indeed, that men came to understand that science had something which might be worked out in a practical way, upon our farms. There has been used a great many times to-day, a word which I never heard when in college; a word which is perhaps more important in connection with dairying than any other—I mean bacteria. If you had asked me, or any member of my class, in 1880, or if you had asked the learned faculty whom I so reverenced, I think that all, or nearly all, would have been unable to give a definition of the word. I am not sure that it existed at that time. This illustrates the rapid progress in the application of science to agricultural problems.

I cannot take the time, which a catalogue of experiment station results would require, although it is scarcely ten years since the stations were established, but will confine myself to the mention of two. In this exhibit, you have seen the Babcock milk test; and if you understand what it means, I think you will agree that the man who worked out that machine probably did more for his country than if he had discovered a gold mine, and we as yet know only a small part of its possible results in the breeding of cattle. Perhaps I am visionary, but I expect our grandchildren to look upon our dairy records with the same pity with which we look upon those of our grandmothers and grandfathers.

A second important class of results from experiment station work, has been reached in the study of plant disease. I cannot tell you of the unnumbered applications of the theories of plant disease to the production of food and wealth. It must be enough to say that the time cannot be far distant when the farmer will control the diseases that attack his plants, as well as he controls the diseases that threaten his children.

The agricultural college is constantly on the watch in the farmer's interest. Is there an advance in medicine, the college looks for its applications to stock raising. Is there a discovery in botany, the college claims a part of its results for the farmer. I need not tell the farmers of this State of the value of the various controls—the feeding stuffs control, the fertilizer control, etc. Every one would be at least very difficult of execution, but for the agricultural college, or the agricultural experiment station. They have guarded both the farmer's interests and the interests of the dealers who serve him.

The agricultural college has trained the men who, in institutes and papers, are to serve as the great teachers of the farmers. Prof. Jordan this morning laid stress upon the importance of the farmers' institute. I agree with every word he said, and I am proud to notice the record that the college I represent has made in such meetings. If the professors of the agricultural college have few students in their class rooms, they have succeeded in applying the great idea of university extension, even before it was famous in England. Perhaps it may be fortunate that our teachers of animal industry, agriculture, agricultural chemistry, botany, zoology, bacteriology, and veterinary science, have had some leisure in which to give instruction in the institutes, and increase their own knowledge by studying the problems of their departments, at first hand, among the men who are practical farmers. For such teachers, this has been a generation of preparation, and I trust that in time—not far distant—the students will come to the agricultural colleges in greater numbers.

A few weeks ago, I had a letter from the western part of the State, asking for suggestions to be used in a grange discussion. The writer asked what value to the farmers and to agriculture a state university possessed over a state college or an agricultural college. The second part of my address will be along the lines of my reply. As a definition of terms it will be sufficient to say that I mean by state university, not an institution that excludes agriculture, or treats it as of little importance, but an institution, like the University of Maine, where other lines of instruction have been added to the agricultural and mechanical courses of the State College.

First it seems to me best that agriculture should be taught in a state university rather than in an agricultural college, because the university allows greater freedom of choice. A boy sent to a college in which there is only one course must follow that course into life. It may lead to your own pursuit, the pursuit which you think the best, but it may not be wise to limit the boy to it, for nature has so ordained that the avocation of the father, is often not the best avocation for the son. It sometimes happens that the boy who goes to college expecting to study agriculture, finds himself better suited for languages, and it is then best for the boy—and for agriculture too—that he study languages. Language boys should not go to farming; they would better do their work in language. On the other hand, it sometimes happens that the boy started for a literary course is drawn into the agricultural course. There is an evident advantage in sending a boy to a college where transfers from one course to another are possible, and in which the final choice may be postponed as long as possible.

I believe the university best for our farmer's son, because there he has the opportunity to know men who are preparing for many different pursuits, to measure himself by them, and be measured by them. This measurement almost always gives him a better opinion of himself, and gives the lawyer, or the doctor, or the minister, a better opinion of him also. It is a custom to speak of the farmer as a hayseed, and it has been the custom to talk of the farmers' college as the cow college. The farmer does not like his name, and the college does not like its name, and both object because of an implied lack of respect. The way to make the world appreciate you, is to go into the world. One way for the farmers' boys to hold the respect they deserve, is to educate them with other boys, and let them win their spurs.

The state university gives special chances to the boys, who, by lack of opportunity, by taste or other circumstances, are forced to leave the farm. Farmers are asking why the boys leave the farm, and all of them are troubled by it. Not long ago, I heard a business man say he did not understand why the farmers seemed anxious to keep all the boys on the farm, when agriculture was already depressed because there were too many farmers. Manufacturers get up trusts to keep other men out of their business. Not all the boys who leave go of choice, but many are forced off. During the time in which the population of the United States has doubled, the number of farmers has remained almost constant. This means that improvements in agricultural methods and machinery have been so great that one farmer now produces twice as much as thirty years ago, and makes it evident that there has not been room upon the farms for all the boys born there. The state university, which has been constantly preaching to farmers, at the institutes and in the Grange, the advantages of higher education, has opened up to many of these boys new vocations in which they have found welcome and success.

The university promises great things for agriculture, because it attempts to train teachers. The first opportunities for a young teacher, just out of college, are in the small high schools, in which the one man employed must usually teach at least one of the classical languages. As a result the graduates of scientific institutions have sought nearly in vain for opportunities to teach, and the agricultural colleges, without classical courses, have been hung up in the air, as it were, without any preparatory schools under them; for it is perfectly natural that teachers trained in literary colleges should send their brightest boys, and some of them, all their boys, to the same kind of college. If we would turn to the scientific, technical, and agricultural institutions, those boys who ought to go to them, we must put into the high schools a fair proportion of teachers who understand the work of such institutions. I believe that in the introduction of literary courses in the state university to train teachers for the high schools and academies, there is greater promise for education in agricultural science and technology than in any other recent development.

I shall not attempt to marshal more arguments for the position in which I so thoroughly believe, but conclude my remarks with a brief exhortation, covering two points. Farmers and teachers ought to feel that they are working together for a common cause, and indulge in less criticism of each other. The teacher is impatient with the farmer, and wishes to lay out his path too exactly. Again the farmer sometimes imagines that he knows just how to conduct the college, and blames its officers for results that they cannot control. Unless each party credits the other with earnestness and honesty, good results from the labors of either will be interfered with.

In the second place, grant me a word which will apply not only to agricultural education, but to every other kind as well. I see many boys struggling for an education against great discouragement. Parents, make some sacrifices to give your boys the best start in life. We are just at the close of a war. You cannot forget how, after the first brief news of the battle at Manila, we waited day after day for a further report of the loss and the victory; each, in his own mind, setting the loss higher and higher, as the days went by, until we were almost ready to expect a defeat. Then the news came, and we could not believe it. We were not ready to accept the statement that in the mists of the morning, the American fleet had sailed, past forts and batteries, and over bursting mines, into Manila bay, and then calmly steaming in circle after circle before the enemy, had done its work so completely that the whole fleet of Spain had been wiped out, while our fleet had not lost a vessel, nor a vessel lost a man, nor a man lost a meal. Men asked why it was. Some attributed it to magnificent vessels, built in time of peace, but so wonderfully fitted for war when the test came. Others said it was great armament. Some gave the victory to the cool, collected, commanders. All said the truth, but no verdict possessed so much of truth, for war or peace, for education or commerce, as the criticism of the English military officer who declared that the victory belonged to the man behind the gun. We may spend too much in forts and fortifications, too much in vessels, too much in arms; but never too much in buying skill to put behind the guns and fortifications. What is true of war is true of education. We shall never spend too much of the treasure of the State in providing the richest and best opportunities for the development of the minds and hearts of the youth of our land, who, in the end, constitute its best resource.

Voted, that the thanks of the Board be extended to the railroads of the State, express companies and hotels for favors received, and to the citizens of Portland for kindnesses shown by them during this conference.

Grade Oxford Down sheep, bred from imported prize-winning Oxford Down Buck "English Prince of Mapleton," No. 7810, weight 228 pounds at three years of age. Average weight of the fleece of the entire flock 8 1-3 pounds. Owned by W. P. Atherton, Hallowell.

INSTITUTE PAPERS.

SHEEP.

A lecture delivered at institutes in Franklin and Somerset counties, by L. B. Harris of Lyndonville, Vt.

As men who desire the greatest good to the greatest number, we should discuss the sheep question from a practical and not from a sentimental standpoint. The fact that sheep in Maine have fallen off in numbers until to-day there is only about one-third as many as there were a few years ago, may or may not be a matter to regret. The bare quotation of a Spanish proverb that "the hoof of the sheep is golden" does not settle the question. That trite and poetical remark points to nothing practical on the question as to whether the farmers of Maine are making a mistake in quietly going out of the sheep business. It is not every man that is suited to the sheep business. While visiting a friend in the business in the great Southwest, a Mexican laborer was for a day detailed to help tend the sheep, while the regular shepherd was away. In that country, the shepherd takes his sheep out in early morning and keeps them constantly until dark; there must not be a moment's relaxation or the wolves will break in. There is no one to see or to speak to, no moment of rest even, as those hugh flocks must be kept in motion to get feed.

The next morning as our laborer went at his work with the mules, he said "nobody but a fool will tend sheep." Now if the regular shepherd could have an abandoned farm in Maine, and could have it stocked with a sheep suited to the farm, and to his own ideas of a sheep, and if in addition to this he has a fair business ability he would succeed; place the other man in the same condition and failure will result, notwithstanding the fact that he is a good teamster.

Perhaps the farmer is right after all; let us not condemn him without a careful review of the facts. Our domestic affairs do not require sheep as they once did. Within the memory of many of us a suit of homespun was common, and the blankets and underclothing were produced at home; then the wife had an interest in keeping a small flock of sheep, other than her general interest in the farm. But now it is very difficult to find a homespun mitten even. There was much that was comfortable and interesting in the old way, but I am not certain on the whole, that the change has been a damage to us.

The modern dairy barn is as poor a sheep barn as can well be imagined, and the man who wisely tells you that the production of wool has fallen off, so many thousand pounds, does not tell you that the production of butter has increased in a much greater proportion, and he tries to make you think that it is every man's duty to keep a flock of sheep; but a plainer duty is, unless you can give your sheep your first care, to let them alone. Do one thing well. And unless you have a large acreage you cannot maintain a choice dairy and a choice flock of sheep on the same farm; success with both will be the exception.

The sheep industry is one capable of good things, the production of wool and mutton will repay the earnest care of the master, and upon it you may build homes and fortunes. So far, our discussion has been of a negative kind, now let us see what can be called up of a positive nature.

First, we must deal with the crank who is constantly declaring that twenty-five, or fifty, or seventy-five, or a hundred sheep are all that can be maintained upon one farm. There is no more sense in that proposition than in a parallel one in regard to cows. If your thrifty neighbor should do well with ten cows and should then buy ten more, but having no stable room beyond the original ten, should crowd twenty into such quarters that none would do well, would that experiment prove that you cannot keep twenty cows on one farm? No; it would prove this; that the man did not take proportionate care of the twenty—and nothing else. Your thoughtful farmer, if he buys extra cows, only does so after he has seen that he can feed them without injury to the others, and has provided comfortable stables for them. The flock master must do the same. If you have been keeping a hundred sheep and have been successful with them, do not hesitate to double your flock, but you must double your facilities also. Do not hesitate an instant to put a thousand sheep into the same proportionate surroundings that you do a hundred or twenty-five, with the advantage in favor of the large flock, for the earnings of the business will enable you to do many things that you will never do with a small lot. You can increase your facilities for fighting disease, you can afford a skilled shepherd, you can manage the young lambs better and raise a greater percentage; your dipping vat, which in the case of a small lot will be a crude affair, can be a good piece of machinery, and the annual or semi-annual dipping be more effective, and less likely to be forgotten. It is easy to see how the cry got started, that large flocks were impossible. In the roomy shed in the barnyard, a few sheep would thrive; double the number and disease and disaster followed, and the conclusion is that it is impossible to keep large bodies of sheep together. On their native soil, middle wool sheep in flocks of one or two thousand are as successful as any, and the conditions are similar to ours, perhaps they are more likely to get disease. In dry climates, six thousand in-lamb ewes, in one flock, are not unusual. Tell me what more pleasing sight can gladden the eye than six thousand lambs in a bunch racing up and down by their mothers' feeding grounds, or one in which more profit may be looked for.

There is no disease among sheep that cannot be handled by a good shepherd. In fact, disease is rare in a well managed flock. And if you are not prepared to fight disease in every form, you had better let sheep alone, be they few or many.

What kind of sheep shall we keep?

This is a question that cannot be answered with certainty, or in a way to satisfy all. Probably a majority of Maine farmers will say that some of the middle wool sheep are best suited to Maine conditions, but we must not be too positive.

If the early merino had fallen into the right hands in Maine, who can doubt but that the results would have been the same here as they have been in Vermont, for no impartial observer can deny that merino sheep have done more to make Vermont rich than any live stock has done for any country elsewhere. So if you prefer the merino make the most of them, and if you are a good sheep man, and have a liking for a long wool sheep, do not hesitate to stick by your favorites, for if you are well informed, you will know that those sheep must be housed in bad weather, and must have other care not required by the middle wool breeds, and you also know that they repay all the labor so spent. These conditions are not peculiar to Maine, they prevail everywhere except in the dry climates.

Notwithstanding all that can be said for the merino and for the long wools, the popular verdict is probably correct, and you will be most likely to succeed with some of the middle wool sheep. I have always bred pure Shropshires and shall never breed any other. But we must not get beyond the point in favoritism which allows us to cling to our idol, and allows our neighbor the same privilege. The lesson of the great shows is that no one breed has, in its own class, any towering advantage over another. After you have stocked your farm with sheep they must be fed, and the question of feed is of much more importance than the question of breed.

The old saw, that "the corn crib cross is the best of all crosses" holds good with sheep as well as cattle. The first great rule should be liberality. Plenty of good food is imperative, and amongst all the little arts that are essential to good management of the flock there is none so happy as that which detects by instinct almost, the likes and dislikes of the sheep, for this animal is almost devoid of brains. He cannot compare with the other four-footed animals of the farm, and is dependent on his master to look out for him.

The sheep has a great and wonderful fleece of wool to make out of what he eats, in addition to the building up of his body and the waste of life, so that his digestion is called upon to do more than is that of any other animal, and should be fostered accordingly.

The practical question is, What shall we feed? For in this climate there is a long cold winter to provide for. Probably the idea feed within our reach would be clover hay and rutabagas, and around this ration, the feed should always cling. Good oat straw and turnips would be a ration far excelling timothy hay and grain in almost any quantity. We can make the best of mutton on good straw and roots, with a small grain ration to finish off with. Four hundred pounds of clover hay, with sixteen hundred pounds of bright oat straw is equal to a ton of ordinary hay, if you add a small ration of roots.

The rutabaga should be the backbone of the winter feed for the growing lambs and all sheep being fitted for market or sale. On them, all kinds of sheep thrive as upon no other feed. They are easy to cultivate, and should never be planted before June 20th. They require a very rich soil, and can be gathered late. Claim is made that some feeders have made wethers, in the pink of condition, take thirty pounds per day. I am satisfied that seven pounds per day will equal one pound of dry feed, and fifteen pounds a day is a reasonable ration for a mature sheep that you are pushing for the best results.

Roots of all kinds should be fed whole to animals having a full mouth, but lambs should always have their roots cut for them. In the absence of roots, ensilage is an excellent sheep feed; clover ensilage is the best, but common corn ensilage is good.

Good results may be had on early cut stock hay without roots or ensilage, but not the best results, and unless you have either early cut hay or weeds, or roots, or ensilage, at hand, you had better not try to keep sheep. But with either one of the three a small quantity of poor food may be consumed.

A thrifty flock of ewes will eat two and one-half pounds of dry feed per day. If the ration includes grain, its weight may be deducted from the weight of the hay, and, of course, roots and ensilage the same, to an extent. I am inclined to think that a small ration of roots would not lessen the amount of dry fodder, but it would vastly improve the condition of the animal.

In feeding sheep, great care should be taken to keep everything neat and tidy, and that the feed be as dainty and sweet as possible. Regularity should be the first law. A flock cannot thrive unless they are fed at the same time every day. I do not care how many times or how few, but it must come each day alike, Sundays not excepted.

If you have a weedy, bushy, foul piece of grass, cut it early, and it is all right for sheep. The flavor of the mutton is no doubt improved by their eating a variety of herbs, and the lean meat is increased as well.

Peas, beans and vetches are valuable sheep plants, and I do not think it is possible to equal rape as a forage to take sheep and lambs from the sweet grass of summer to the dry feed of winter.

Plans should be laid to have a rape field large enough to carry the flock from October 1st to December 15th. If snow comes, it will do no harm and freezing does not hurt it. A sufficient feed of rape, with a small run of grass, and later hay, will make as much mutton as can be made with any ration obtainable, and at less cost. Rape should never be sown before June 20th and may be sown as late as July 15th. Two pounds of seed per acre, broadcast, is enough, or you can cultivate in drills. This plant grows so fast that when it gets started, it will choke out all other plants, and is valuable in clearing land.

The question of feed racks is an all-important one. If you use them, they must be kept clean. I have not fed hay in a rack for many years, and I never allow sheep to waste any fodder, or leave any orts. I feed on the clean ground or upon clean snow, shaking the hay out in a tidy little swath on the edge of the clean snow, making the circle a little larger each day, until a fresh storm brings us back to the sheds again, when the process is repeated. In this way, if you cut your hay when it ought to be cut, and feed it as you want your own feed served, that is, in good order, and correct quantities, they will eat every particle, and will do better than they will with any system of racks. But unless you will be careful and observing in feeding, you had better use racks.

Feed troughs are necessary for grain and for cut roots, though if you feed whole grain you had better feed on the clean grass until snow comes and roots fed whole will be eaten better and cleaner and relished better if flung upon the clean snow. But never put feed of any kind in a dirty or a sloppy place, nor where there are any bad odors.

There is no domestic animal as dainty as the sheep, yet there is no animal that can be fed on as cheap feed as he can if properly managed, and no animal shows bad food quicker.

Allied to the question of feed is that of housing, and it would be easy to demonstrate that more sheep are killed or damaged by housing than from lack of it, and one of the greatest enemies of the sheep is the barnyard. They should never be confined in a yard except a few minutes at a time when it becomes necessary to handle them. Give them sheds on high ground, open to the east, and the range of the field or pasture at all times as far as they choose to tread the snow, with a wind-break to protect them from the south and east winds. An ideal place would be a hollow square, with three sides taken up with open sheds. But this is frequently hard to get. A high tight fence is not the worst sheep shed in the world, and much preferable to a barn cellar, or a shed with a dirty barnyard to run in.

A sheep feels a draught very quickly and it kills more of them than storms do. I have many a pure Shropshire ewe that was never under a roof in summer or winter, except a few days at lambing time.

Given a perfectly dry place, out of the wind, and a middle wool sheep requires no shelter, and will chew her cud in contentment in the coldest and stormiest weather; yet sheep will huddle together so as to smother themselves and die in an endeavor to escape a driving storm. If you can afford straw for a bed, so much the better, they must be dry underfoot. I imagine that a sheep who was made to lie one night in a wet place at the beginning of winter, would show the bad results arising from it all winter, if not always. Overhead, it matters little, but underfoot, it must be dry.

It is easy to remodel any old set of farm barns so as to make them good sheep barns, but be sure to fix them so that it will be impossible to shut the doors in such a way as to leave anything like a tight room. Plenty of air is requisite every moment of a sheep's life.

A long stable in a cow barn would be perfectly comfortable, tied full of cows, but fill it full of sheep for an hour, and every one of them would run at the nose for the rest of the season, and for mutton or for breeders, they would never be quite the same sheep again, and it is these little things that keep so many flocks arouna an average of ninety pounds weight, instead of one hundred and forty or fifty, where they belong if handled right.

It has been many years since I have had a sheep with a dripping nose. Sometimes when on our rounds of the fairs, they take colds but at home never, and my sheep are never under cover, and that in a colder and perhaps a stormier place than this.

The sheep business in this country must always be managed so as to keep up the fertility of the farm. It is easier to waste sheep manure than any other, it heats so quickly, and gets so hot; but this is no weakness; it does so because of its strength. If we have that nice knowledge which is so essential to all branches of the business, we can save it all. The best way is to use the open shed and sprinkle a little litter all winter long, never cleaning it out until ready to spread it on the ground. So treated, it will never heat and if you begin early in the fall to accumulate a little in the floor of the shed and add a little straw, it will never freeze. Piled in piles for a longer time than seven days, it will burn and spoil. The scrapings in front of the shed should be piled from day to day as it is thawing out in early spring. It is so wet then that it will not heat, and it can be done with less labor and more manure saved than in any other way, and it leaves the ice uncovered so it will go quickly.

This discussion so far is confined to the middle wools and of course we shall have mutton to produce and sell. The difference between the best and medium mutton is enough to make or unmake a sheep venture. The raising of early lambs for market is theme enough for a paper by itself, beside it is better understood than other branches of the sheep business, and we will pass by that and take up the question of mutton. You can mature a wether at from twenty to twenty-four months old to dress from ninety-five to one hundred and fifteen pounds, with a pelt that will weigh from twenty-two to twenty-six pounds. Your barren ewes and some of your drafted ewes can be brought into this class, though of course not at these ages. The feed that I have indicated, with good pasture, will do it, if you follow the simple rules laid down.

To finish off wethers for this kind of mutton, two feeds of whole grain per day will be required after the flush of summer feed is over. For many years I have sold my mutton for the top prices of the world, to special customers, and I have made it by the very course I have described.

You may, if you take to sheep, feel certain that you can make your wethers net you ten dollars each at home, but many discouraging disappointments will come. The future will look very black at times, and you will be almost ready to give up, yet persistent intelligent effort will win. Sheep require more skill and less labor in their care than any other live stock, and if you are wise and faithful then indeed is "the hoof of the sheep golden."

Ques. When you speak of dry feed, what do you mean?

Ans. I mean dry feed in the common acceptance of the term, hay or grain. I find that a full grown sheep will take 2½ pounds of hay, but if I give her a pound of oats, she will take 1½ pounds of hay, and so on. It takes 2½ pounds per day of dry feed of that description.

Ques. A pound of the grain takes the place of a pound of the hay?

Ans. Yes, and I do not think any more.

Ques. Do you mean that for a 100 pound sheep or a 150 pound?

Ans. I never fed any to a 100 pound sheep.

Ques. You speak of taking off one pound of the hay and adding a pound of oats. Is that a better ration?

Ans. Unquestionably it is. And you might go a little further and not hurt the sheep.

Ques. Would you advise anybody to try keeping sheep on wet pasture land?

Ans. I would not. Sheep need a high, dry pasture always. There is a sheep which will live in a wet pasture, but it would not be profitable to keep here.

Ques. We have been told that the French merino, or the Rambouillet would be the ideal sheep for us. What do you think?

Ans. I do not know anything about fine wool sheep. I know that the merino sheep that bring the biggest prices in the markets of the world are those that have the most wrinkles.

Ques. Do we understand that your sheep are unconfined at the present time?

Ans. Yes, just as they were in the summer. I put up a sheep shed, made so that I can move it, and they can go there if they like. It makes a good wind-break, at least, and is always placed so that the water will drain away, it must not drain towards the shed. Except in driving storms I have never seen the sheep go under cover; in driving storms they will escape them if they can, by going anywhere, even to the extent of smothering each other in large flocks.

Ques. Would you use the same shelter and management with all kinds of sheep as with yours?

Ans. Only the middle wool sheep. The sheep with wool that parts on the back must be sheltered in all storms, ought to be in summer, even. I apprehend that all breeders of coarse wool sheep would stop haying to go and drive their sheep in, in summer, should they require to be under cover. In the middle wool sheep the wool never parts, and there is density enough and grease enough so that rain never touches the sheep and does them no harm. Still, if they lie in water, it soaks in to the sheep and is bad for them.

Ques. Do you practice keeping your sheep in the same place in winter as in summer?

Ans. Mostly. My sheds are in the pasture, and they run in the same pasture the year around. I have a hay barn convenient to the sheds, and a root cellar under the hay barn, so that they are fed in the pasture all winter.

Ques. Do you consider that the Shropshires and Southdowns are sufficiently protected to stand a storm that would give an inch or an inch and a half of rain?

Ans. Yes, sir; I never saw a middle wool sheep wet from overhead.

Ques. Do you have to drive your sheep in, in any storm, or will they go in themselves?

Ans. We never pay any attention to that. They know what they want to do, in regard to getting out of a driving storm. If they choose to go under cover they go; if not, they stay out.

Ques. This at all seasons of the year?

Ans. At all seasons of the year. We have more snow than you do, and the mercury goes ten or twelve degrees lower in the cold nights, but the sheep are perfectly comfortable. They have an immense fleece of wool that is very warm in its natural condition, warmer than it is after it is cleansed and spun, and they require the open air, and enjoy being under the sky instead of under a roof.

Ques. Will you give us your idea in regard to the time of having lambs dropped?

Ans. When I can, I have my lambs commence to come the last week in January. I like that best. They get a start, if you take care of them, that you cannot quite catch up with, with a later lamb; although for market lambs, I should advise a man just starting in the business to have his lambs come after there had come a good bite of grass, so the sheep could lamb on the grass. I like to have mine begin coming the last week in January. I keep them in these same sheds, but I take the ewes up. After the lambs are four or five days old, I would rather they would be back in the field, if they are all right. Then I make a little creep, and keep crushed oats constantly where the lambs can get in and get all they want, before they are a week old; and I keep that before them, whittling down the creep so that the lambs can get through and the ewes cannot, until they go to pasture. I have never practiced feeding any after the grass was well up.

Ques. Suppose you have a rough winter, with rain storms following. Will they keep under the shelter sufficiently?

Ans. Yes, I have never seen a lamb pinched in that way. They will stand any rain. We almost always have one severe rain storm.

Ques. Doesn't the snow cover up the creep?

Ans. I use one of the sheds for the purpose. I put strips of board up and down around the shed, and the snow does not blow in there to any great extent, because the shed is backed to the north.

Ques. How many times a day do you feed your ewes?

Ans. I feed always twice a day; and I feed as early as it is light and before it is dark. I do not like to feed sheep after dark. I have an idea that the sheep like to get all through eating before it is dark. I should not object to one feed a day. If I had a sheep barn where I had to go three-fourths of a mile to feed, I should feed but once a day, and I would be a good long time in doing it. I would shake them down a little fodder, and then if I had some work which I could do I would attend to that, and then I would shake down a little more. I would be sure that they got their twenty-four hours' ration, and I apprehend that they would do as well as if they were fed oftener.

Ques. Do we understand that you have 100 breeding ewes, having them drop their lambs in January, and they are in one field, with these little houses set about the field?

Ans. Yes, only I set the houses in a row, generally, as one helps the other. It makes a continuous shed, facing the east.

Ques. Are these houses closed on three sides and open on one?

Ans. No; each house is closed on the back, so that when they come together it makes a continuous shed. It has no apartments, but one apartment. I do not think that is the best way, but it is the way I happened to adopt.

Ques. How many sheep do you have run together in a flock?

Ans. That varies. When I am feeding wethers, the wethers run by themselves, although I feed them the same as I do the lambs, because they are stronger and will crowd the lambs back. My breeding ewes I do not want to give the heavy feed that the wethers have, and I put them in a flock by themselves. If I had 20 breeding ewes I would not allow that 20 to be in with the main flock, but with sheep of the same strength I would have as big a flock as I owned. I would not care how many I had in a flock if I had room for them. But it would not do to put 50 strong sheep with 25 lambs. The lambs would all die; not because there were 75 sheep together, but because there were 50 sheep that could lick the other 25. They are more selfish than men.

Ques. Do you keep your sheep fleshy?

Ans. I try to. The first time I see them I begin, and I try never to let them go back for an instant. You know how a wether lamb is on the back, what a nice rounded form it has. If you once get that settled down so the back bone looks through I do not think it is possible to get the lean back again, though you may cover it with fat.

Ques. Which eats the most, a poor sheep or a fleshy one?

Ans. A poor sheep may have an unhealthy appetite. My ewes, I should judge, would weigh about 160 pounds, the regular breeding flock. I do not think they would eat as much as the same sheep would down to 90 pounds. I have never experimented so I cannot give you the figures, but that is my idea. I feed what I call my yearlings, my yearling ewes the first winter, a good ration until they drop their first lambs.

Ques. What would you call a good liberal ration?

Ans. Not only the 2½ pounds of good feed but part of it must be grain. If I could feed a yearling ewe just as I wanted to I would give her about 9 pounds of turnips a day and one pound of hay, without any grain. If I hadn't the turnips I would feed grain the first winter.

Ques. How do you manage to feed without crowding?

Ans. If I have 100 sheep to eat at one dish I make room for at least 200. If you have 25 sheep you must certainly make space for 50 to stand in a row without any discomfort. If you do not, the weakest sheep will get discouraged and will not feed. And then I like to feed, when I can, so that a sheep will dodge back and go in another direction, and not run down the line. I really feed my hay in a circle all winter, and the circle grows larger until a storm comes, and then another circle is made.

Ques. Do we understand that you do not feed your ewes any grain when they are suckling lambs?

Ans. I do sometimes, but if I had plenty of turnips I should not do it. While they are up, a few days before lambing time, I would add a grain ration, and feed this until they go to pasture, but with plenty of turnips that is not necessary.

Ques. How is it about water?

Ans. A sheep will perish quicker for want of water than any animal that lives, that is not a water animal, and still my sheep have not had water for 12 years. I speak of this in that positive way because I want you all to understand that if it happens that your sheep do not have access to roots or grass that has dew on it, or the cleanest, whitest snow, you do them a great injury not to give them fresh pure water at once. But with roots I have never been able to make sheep drink. In my youth I had watering places in the sheds, but now I have none whatever. But if the turnips were to run short for a day it would be a great cruelty not to get water to them at once. On the plains, for instance, if you water your sheep this morning, you must water them again to-morrow night, and never let them go any longer than that. If you do, your sheep will perish. You may let them go two days and one night, or two nights and one day, but never two days and two nights or your sheep will perish. While steers really do not suffer very much to be driven several days without water, sheep must have a sufficient amount. I do not think that sheep ever drink water in a country where the dew falls, if the grass is clean and nice. I think the dew is sufficient.

Ques. Do you think a pasture in this section of the country would need to have water for sheep?

Ans. I should not pay any attention to that, as I understand it.

Ques. If the pasture was fed very closely wouldn't that make some difference with the quantity of water?

Ans. I do not think so. I think the dew is sufficient under all circumstances.

Ques. Do you keep salt before your sheep all the time?

Ans. I always keep salt before my sheep, I think that is the best way. And still I do not think it is important enough so that it should be done under all circumstances. If I had a back pasture and could go to it only once a week, I should probably salt them once a week, and call them to me in this way; but this is not the right way to do. I keep salt before them in troughs, and climb around my pasture and find my sheep instead of asking them to come to me. I think it is important to have salt always before the sheep.

Ques. How closely do you feed your pastures down?

Ans. Sheep like to get very close to the ground. They will nibble wonderfully short grass. I run nine sheep to the acre in my home pasture, and of course they keep it down very close.

Ques. Do you mean to say that one acre maintains nine sheep from spring until fall?

Ans. At home, on land that is in the very best cultivation it will about do this. In the back pasture, I keep about one sheep to the acre.

Ques. How do you build your fences for sheep?

Ans. I use only wire fences. I build an eight wire fence, making them close at the bottom, and quite far apart at the top, and I have an idea that it will turn dogs mostly.

Ques. Do you use barbed wire?

Ans. Yes, I do not think there is any other that is safe. I have never had an animal injured on that kind of a fence. Your country here is so level that I want to give you an idea, which is that where ground is level you may put your posts 50 feet apart if you like, and have a good fence, putting cleats with staples every 8 feet. There is something about a wire fence that gives that will turn sheep quicker than one that is rigid. A fence with posts 50 feet apart will turn sheep better than one with posts 8 feet apart. There is something about it they do not like.

Ques. In your 8-strand wire fence your bottom strand would be how far from the ground?

Ans. Perhaps four inches. It should be as close as you can get it. The next should be four inches above that, and the next perhaps five more, and the next six, and then you have got up so that you can have four wires for four feet.

Ques. Have you an idea of about how much this would cost a rod?

Ans. I can buy good cedar posts for four cents apiece, and I think you can here. I think 45 cents a rod would do it.

Ques. You would prefer that to a more expensive woven wire fence?

Ans. I should. I like a barbed wire fence better than any other, if wires enough are put in to build it well.

Ques. At your estimate of 9 sheep to an acre, 11 acres would carry 99 sheep. Would you feel satisfied to put 100 sheep into an eleven acre pasture of your best land and carry them several years?

Ans. No; that would not be the best way to do, although I practically do it. If the land is well drained you will not get any bad results. Bowen Jones, the president of the Shropshire Association, always does that. I think he averages more than that to the acre. But if the land was clayey there might be some little difficulty, and sheep like to be shifted from one pasture to another.

Ques. Please give us your method of feeding, particularly your method of growing and feeding turnips?

Ans. Of course if you are rich, and just want to do something to show off, that is one thing; but if you want to pay your mortgage and taxes and educate your children, you had better raise what you feed. That will require labor, if you keep many sheep, and you can put the money that you would put into grain into labor and raise turnips, and you will have much more feed, and better feed than you can buy. There is no feed that equals turnips for sheep, and I can raise turnips on my land, charging the land with the dressing that I put onto it at what I have to pay, as I buy a great deal, but not charging anything for interest on the land or on the plant, for four cents a bushel, or a slight fraction under four cents. Then I have the tops, which is quite a factor. Leave the tops where they are, do not try to cart them around. The sheep will get to them if you let down the bars, and they are worth something. Then in the turnips you have a feed that cannot be equalled for winter feeding. You will make more money than you will to attempt to buy grain. But if you feed grain, I would always feed whole grain. Experiments show that whole wheat is the safest grain feed for sheep. The next is oats, and the next whole corn. I have fed a great deal of whole corn and I have never experienced any bad results, and I have never met anyone who has had bad results from feeding whole corn that could be traced to the whole corn so that it was indisputable. Of course, if you want to keep up the fertility of your land, you will have to buy feed, probably. Oil cake (and I like the new process fully as well as I do the old) is not only a great food for sheep, but is very valuable in keeping up the fertility of the soil. Clover is an excellent feed; I cannot say too much in favor of clover as a feed for sheep. Any kind of weeds, cut early, they like very much, also bean pods. Sheep would not eat bean pods fed to them to-day, because they are roaming in the fields and get what they require, but a month later they would consume a pound a day each, to great advantage to themselves; and the same with pea vines. Any of those plants are very valuable for sheep.

Ques. How many bushels of turnips to an acre do you consider a good yield, and when do you plant them?

Ans. You should never plant your turnips early. Get your ground ready as much as you can in the fall, and as much as you can in the spring, and then you will not have any too many turnips. Make your ground as rich as you can. You can never get a piece of ground too rich for turnips, or so rich that they will not take it all out the first crop. When you have done the very best you can with the land, you may get 1,400 bushels. Eight hundred bushels is a good crop, but 1,400 bushels of Swedes is a possibility on good turnip land. And I never heard of a bad year for turnips. They grow well in the cold weather, when the summer is gone, and if you plant them early they will not keep as well, and they are woody also. Sometimes I have planted 10 or 15 acres after the Fourth of July, and had a bountiful crop. That is a little late, perhaps, but they should never be planted before June 20th. This gives you all the spring to kill the weeds.

Ques. How near together do you leave the plants?

Ans. I sow the plants with a drill, far enough apart so that I can cultivate with a horse, I cannot tell the number of inches; and then I single them down to 14 inches. It is not best to leave two turnips so they will touch each other. With carrots, or onions, or beets, it is all right to leave three plants near together, but with turnips, never. You will always have to go over them once with a hoe, and that is the only hand work you need to do until you get ready to pull them. When you pull them, do not try to pull them out with a hoe or a manure fork, or plow them out. Take hold with your left hand and pull them up and hit the tap root and let them fall. When I speak of turnips, you will understand that I mean a Swede, a rutabaga. They should have two days' sun after they are pulled, if possible. Throw them into little piles, and throw the tops over them if the weather is dangerous, and give them two days' sun, and then they should be piled 7 to 9 days without uncovering. There is a little sweating process, and when that is over you will never lose a turnip. If the weather is catching and you are obliged to get them in, you can pitch them over with a fork in about ten days. The danger from this sweating is that it will moisten the dirt that has fallen in amongst the turnips, and make a large decayed place. But if you handle them over some rainy day in the course of a week or ten days you can feel perfectly safe that they will keep until the first of April. I plan to have mangels to take the place of turnips after that time, but never feed mangels before the first of January, as a mangel is not fit to eat the first of the winter.

Ques. How large do you let your plants grow before you thin them?

Ans. I do not think I can tell you. I thin them any time after there are four leaves before they interlock.

Ques. Do you feed any turnips in the field where they grow?

Ans. Yes. I have a flock of sheep now, about 85 wethers, on a rutabaga piece. It will last them three weeks yet.

Ques. Is there very much waste?

Ans. Not any. The sheep will eat them down until the tap root is not larger than one's thumb. There is less waste than when they are cut.

Ques. When your sheep go on to that turnip field is there any difficulty in their scouring from eating too freely?

Ans. No, and still you might say yes. It is a hard question to answer. If the sheep had been in the habit of having turnips, and had been taken away for a week and then brought back again, they would eat enough to cause harm, but taking them from good feed they will nibble on the tops the first few days, and go onto them very gradually.

Ques. Do you like the rutabaga as well as rape for fall feeding?

Ans. No. Rape is the best for fall feeding, there is no doubt about that. I happened to have a field of turnips that I could not store and I turned the sheep into it.

Ques. Will you explain about the raising of rape for fall feed for sheep?

Ans. Rape belongs to the same family as the turnip. It is a turnip without any root. It should be sown the same as turnips, or broadcast. It grows very quickly, and the ground should be as rich as for turnips. The lambs can be put upon it early or late, as you like. It is not like Scotch kale in that respect. It will make more mutton than any other feed that is known. I think there is no way of compounding a grain ration that will for the months of October, November and December, make as much mutton as rape.

Ques. Do you let your sheep run in the field?

Ans. I let them into the field, and they go onto it slowly. You can let them on for twenty minutes the first day, if you like. I do not apprehend that there will be any trouble unless the sheep have been eating rape and have been kept away from it for a few days and come back very hungry.

Ques. Is there any limit to the age at which you keep them?

Ans. I never would let an old ewe go, under any circumstances. They are the best breeders, they raise the best lambs and know how to take care of them best. While you read in the papers and books that you must go around and look at their teeth, I like the "no-tooth" sheep best. I do not have to watch her, she knows better how to take care of the lambs than I do. I had a sheep that gave me 16 pairs of twins, and she did not have any teeth the last eight years of her life. She dressed 103 pounds when I made mutton of her.

Ques. Did you give that sheep any different feed or care than the rest?

Ans. I will tell you the story of that sheep, as she was a great friend of mine. She was one of the old sort of Shropshires, they have changed their habits a little in the last few years. I bought her of a man by the name of Crane in Shropshire. After she lost her front teeth she would stand around when the rest got their turnips, as innocent as could be, and not do a thing but look. You know I feed turnips whole and the sheep eat out the inside and leave a great shell. She would watch and when she saw one that had got down where she thought she could manage it with her grinders (you know sheep never lose their grinders) she would bunt against the sheep and take that shell and eat it. And there wasn't a sheep that she could not lick. Then she would go around and take the next biggest one.

Ques. Do you believe it possible to keep up the fertility of the farm with sheep?

Ans. I would not dare to attempt to keep up the fertility of the farm in any other way, because I do not know how to run a dairy, or a stock farm. But with sheep I know I can make the farm grow better every year, but it takes eternal vigilance.

Ques. Do you think you could still keep up the fertility of the farm with sheep if you could not buy dressing? We think we cannot.

Ans. It is because the manure is wasted. I think sheep will keep up the farm better than any other stock. The trouble lies in getting the manure and putting it in a heap. While your cow and horse manure will not heat, do not ever pile up sheep manure. Take it and put it onto the ground. That saves once handling, and you get it where the great earth, which is a sponge ready to absorb anything and everything, is ready to take care of it.

Ques. Do you think it will injure a mowing field to put sheep into it in the fall?

Ans. No; I always put mine in. It will make the grass grow thicker but not quite as tall. If you were to drive your sheep in and not drive them out again, but let them lie in the field all night it might hurt it, but if you turn them in during the day I think they will add as much to the fertility of the field as they will take off from it.

Ques. Do you think turnips are better than carrots for sheep?

Ans. Unquestionably. I would rather have a bushel of carrots than a bushel of turnips for many things, but carrots are very dangerous to feed to males, and I should expect it would kill my entire wether flock if I were to feed them all winter. There is some trouble with Swedes in that respect, but never with the white turnip.

Ques. How do you feed your lambs?

Ans. The first winter, the wether lamb is fed liberally all winter. I give him all the turnips I have, and then if he needs more I give him grain. Then he goes onto pasture the second year, and has nothing but grass all summer, but it must be good pasture. In my case it is a large range of very good feed, and they are not shifted all summer. Then before the feed begins to fail in the fall, usually when I am getting ready for the fairs, I get my wethers and put them onto better feed, sometimes it is a clover patch. I hold my rape as long as I can, because I never have enough, but I keep the wethers growing. I do not allow them to stop for a single instant. When snow comes I put them onto two feeds of grain a day, and before snow comes I feed them one feed per day. I feed whole grain, because in my judgment it is much safer than any ground or crushed feed. As the winter goes on their appetites increase; a good feeding animal of that kind will take more to-morrow than it has taken to-day, always. When in my judgment they will dress 100 pounds I kill them. I have commenced already to kill some.

Ques. Do you let these wethers run on the rape, too?

Ans. Oh, yes. Nothing can excel rape to make flesh. Unless I have special orders, when they will dress about 100 pounds I dress them and hang them up. If you are feeding twice a day, you must not feed the night before you kill.

In the old days when man ate man, it was the custom to lay the victim on a stone and cut out his heart and eat it before it stopped beating. That was one system of barbarism. The same barbarism makes us eat flesh to-day in my judgment, and it is barbaric to eat a sheep just killed, more so than one properly cured. You must give it age to be nearer to civil life. I hang mine in the cellar and let them stay 13 weeks, before they are shipped. But it must be a cellar that is well ventilated, a cellar that a woman could keep bread in. I do not care how warm it is, for that matter, because a back yard is better than the cellar, only in practice I cannot use the back yard.

Do not feed the night before killing, and do not feed in the morning. Give them water if you like, but be sure that all the herbs in the stomach are digested before they are killed, or you will get a flavor in the meat. Then dress them in a perfectly plain way. If you see that they are getting moldy, let in a current of air, or four drops of oil of lavender will stop the mold. The best way is to have a current of air. I should think a fruit cellar would be an ideal place to hang the mutton. It is sealed in the fat and the flesh and the fat will become very sweet, and there is no difficulty in selling it for a good price. The carcasses must hang absolutely free, as if they touch each other or touch anything, they will spoil. You can let them hang indefinitely. Try it; hang up a leg of mutton in your cellar on a spike, and do not touch it again until Decoration day, and it will be a very delicious piece of meat. It will lose the rank mutton smell but there will be no bad odor to it at all.

Ques. You think it is practically sealed in the fat?

Ans. I think it is. The fat is closer grained than that of other animals, and I think the meat is practically hermetically sealed.

Ques. You would not allow the meat to freeze?

Ans. I would not. And it is a strange thing to me that it does not freeze easily. We live in a cold place and I ship my mutton in the morning, and when it is cold weather by freight. We take it to the train and put it on top of other goods, frequently when the thermometer is 30 degrees below zero, and I have never had any complaint that the mutton was in bad order. Perhaps its being so sealed has something to do with it.

Ques. Do you wrap your carcasses?

Ans. Yes, I wrap them in two thicknesses of thin clean cloth, and then in burlaps.

Ques. To what market do you ship your mutton?

Ans. I sent my mutton away back to Thurlow Weed, but he has been dead for many years. Then for 15 years I sent it to John Chamberlain in Washington. At present I ship to the Waldorf Hotel. I never sold a carcass by weight, I always sell by the carcass. I get $12.50, and there is usually 16 pounds of wool.

Ques. Would the Faneuil Hall or Quincy markets take mutton of that kind?

Ans. There is one man in Faneuil Hall, by the name of Benjamin Johnson, who takes all he can get of it. I think he pays nine or ten cents a pound. What he would pay if he could be sure of having it every week so that certain places could put it on the bill of fare, I do not know.

Ques. What proportion of your mutton is lean meat?

Ans. I suppose in a carcass weighing 100 pounds there would be 50 pounds of fat. It is the lean meat that sells, although you cannot get the lean meat without the fat.

Ques. Do you increase the proportion of lean meat by your method of feeding?

Ans. Unquestionably turnips will make more lean meat than any other feed. Any sort of weeds are good—pig weeds will make excellent mutton. In nine weeks you can put all the fat onto the sheep that is needed for mutton, with grain, but it puts almost no lean meat on. That must be done with those coarse feeds and not with grain. Peas and beans make lean meat, but corn does not make much.

Ques. Are these carcasses very fat when you slaughter?

Ans. Yes, but they are not blubbery. They are very even, whereas if the sheep had had grain instead of turnips they would be blubbery and would not cut up as well.

Ques. This matter of rape comes home very closely to us, as we have the moist, cool climate. Do you manure highly, and can you raise a satisfactory crop on superphosphate alone?

Ans. No, rape cannot be raised on superphosphate alone, you must have lots of manure under it. If you feed it on the ground and do not drive your sheep up, your land is in good trim for corn.

Ques. Do you use chemical fertilizers with turnips?

Ans. I do not. When I was quite young I experimented with chemical fertilizers; and on my land, if I am tempted to use chemical fertilizers for a piece of ground, I hoe it once more, and I think I come out ahead. With turnips a few wood ashes, not more than 60 pounds to the acre, sown broadcast, will have a wonderful effect; but the land must be rich for turnips, too.

Ques. Can rape be grown successfully as a catch crop in the corn field?

Ans. No, sir; you have to give rape the best possible chance. You will fail if you attempt to sow it amongst corn.

Ques. Which do you prefer, sowing broadcast or drilling?

Ans. I do not know that there is any difference. I have one man who always sows the rape, and he does just as he likes. One year he will sow it one way and another, another. If you sow broadcast you must harrow it very lightly after you have sown it. If you put it in drills you have a chance to work amongst it if you wish. It ought to grow so high that a Jersey cow would be out of sight in it. I induced a man in New Hampshire to plant eight acres of rape, and he had one stalk that weighed 40 pounds. Of course he had to give it lots of room.

Ques. Would a stalk of that size be readily eaten?

Ans. Yes; it is as good as any part of it. Be careful about your seed; they are likely to send you mustard seed or anything else if you cannot tell the difference. I have known lots of people to get mustard seed when they would order rape. I use the dwarf Essex.

Ques. How large a piece of rape would be enough for 25 sheep, commencing the first of October?

Ans. I should say that an acre, well manured, would carry 15 sheep two months and a half. In the experiments made in Canada, where lambs were shipped to England, the lambs fed on rape alone dressed better than the lambs fed on their ideal ration of grain.

Ques. How do you feed oats?

Ans. I should feed oats on the straw, always. I cut them when dead ripe, as I think they shell less when they are ripe than when they are green. The sheep like the straw, but you must not give sheep straw without turnips; with turnips it is a most excellent feed. I cannot thresh my oats, when I have figured all the expenses, short of giving one bushel in every five, and I think the sheep will eat them better on the straw than after they are threshed.

Ques. Where you feed a ration of oats, how does it compare with the hay, in bulk?

Ans. About the same. I would feed them just as though I were feeding hay, but I think you must have some roots with them.

Ques. In your heavy feeding of roots have you had any difficulty in getting too large lambs, so there was difficulty at delivery?

Ans. No, sir; I have never had any trouble.

Ques. Have you ever had any trouble in heavy grain feeding?

Ans. No, I never had any difficulty of that kind. I raise about 180 per cent. of lambs.

Ques. Do you ever get your ewes too fat for breeding purposes?

Ans. No, I never have had any; but it is easy to get a ewe too fat. If you shut her up and fill her full of grain she will not be good for anything. But I do not care how fat they get on turnips where they have to work for them, themselves.

Ques. Do you try for the production of twins?

Ans. I never breed my ewes until I have put them on a patch of clover eight or ten days. I like to get twins or triplets when I can, and then I take a little better care of them in the fall.

Ques. From what you have seen of our conditions would you recommend about the same feeding in producing a high priced mutton?

Ans. I should. There are so many weeds in your pastures that, if they are not wet, I think they must be an elegant place for sheep. If these old pastures that are going to waste could be fenced up they would be valuable as sheep pastures, and in a few years I think they would be pure grass. There might be some weeds that would have to be mowed, but they would clean the pastures very quickly, and the weeds are the best of feed for sheep.

FARM FERTILIZERS.

Lecture delivered at institutes in Androscoggin and Penobscot counties, by Secretary B. W. McKEEN.

The question of the fertilization of our land is one of great importance. It is one that has not commanded the attention of our farmers which it should, as an infertile soil can never be cultivated with profit or satisfaction. The farmer is, I fear, in many instances the most prodigal of his resources of any class, and is too apt to value lightly much that is essential to good work. Many of the apparently insignificant objects which he casts deliberately away or passes indifferently by, are really among the greatest essentials for successful work, when properly understood. This is particularly true of fertilization, and I am very glad to note an increased interest manifest along these lines by the majority of our farmers.

Agriculture is now known as a science, or rather as a combination of sciences, as well as an art. When considered as a science it explains the growth of plants and animals, as well as the principles upon which the operations of the farm depend. As an art, of course it teaches how to cultivate the soil, the use of fertilizers, the care of live stock, and the general work upon a well organized and economically conducted farm.

It will, therefore, be seen at once that the art of agriculture consists in knowing how and what to do, as well as the proper seasons for all work, and the science of agriculture offers the reasons for what is done. Like all other branches of industry, agriculture was pursued first as an art, and there are still many people tilling the soil and making a fair success of their work, without understanding much of the reasons why certain processes produce certain results, simply because they understand, more or less thoroughly, the art of agriculture.

The farmer should know something of zoölogy, the science of animals, that he may know how to select, breed and properly care for his animals. He should, of course, have some knowledge of botany, the science of plants, that he may understand the needs and the habits of growth of plants, and thus be prepared to adapt his methods of cultivation, and the fertilization of his soil, to the peculiar needs of each. He ought not to be ignorant of the science of physics, because it treats of the general properties of bodies, such as light, heat, force, electricity, and the causes which modify them.

He ought also to have a definite knowledge of geology, the science which treats of the structure and formation of the earth, its rocks and its soils. It is true that the character of any soil may be quite accurately judged by observing the nature of the rocks from which it was originally formed.

And, lastly, there comes in a necessity for a knowledge of chemistry. Of all the sciences relating to agriculture, I believe the most important results and improvements have come from chemistry. Chemistry makes known the composition of soils, plants, and fertilizers, and thereby enables us to adapt the one to the needs and wants of the other. It may be said that

(1) It acquaints us with the variety and quality of the food that different plants require for healthy growth.

(2) It brings to our attention the action of light, heat, and other agencies of plant growth.

(3) It familiarizes us with the manufacture of fertilizers, and tells us how to utilize various refuse matter in preparing wholesome food for plants.

And, by the way, did you ever notice that nearly everything used for fertilization, either natural or artificial, is refuse, the by-product of some other manufacture?

(4) It reveals all the conditions essential to fertility.

THE SOIL.

What we usually call soil is the earthy matter in which plants grow. It consists of different proportions of organic, vegetable matter, mixed with very finely pulverized rock. What we are more particularly interested in is the thin upper surface; this, because of its becoming filled with decaying vegetable matter, assumes a dark color. This vegetable mold, or humus, plays a conspicuous part in the growth of plants, and any system of fertilization, either natural or artificial, which does not contemplate the maintaining of a liberal amount of humus, must ultimately fail.

In addition to its fertilizing qualities it works mechanically in maintaining the soil in an open, friable condition, so that it can be easily penetrated by light, air, heat and moisture, all of which are essential to plant growth. Any soil fairly rich in humus, and underlaid with a subsoil stratum of a somewhat compact nature must necessarily be a fertile soil, if well tilled. If the subsoil is porous, there will be danger of a loss of fertility, particularly of the nitrogen.

MECHANICAL CLASSIFICATION OF SOILS.

Owing to the fact that different kinds of soil require different treatment in fertilization, it may not be out of place to spend a little time in classifying them, which we will do somewhat as follows:

(1) Pure clay, from which no sand can be removed by washing. This is the character of much of the soil in the lower river valleys of Maine, much of our own farm being entirely free from sand, except such as has been carried on in fertilizers. For years we used sand as an absorbent in our cow stables, noting a marked change for the better on soils where the resultant manures were quite liberally applied. We have seen good corn grown on artificially drained clay lands in our town by farmers who plowed out shallow furrows after the seed bed had been prepared, and strewed clean sand therein.

(2) Strong clay, from which as much as five to twenty per cent of sand can be washed.

(3) Clay loam, from which can be washed from twenty to forty per cent of sand.

(4) Loam, which will contain from forty to seventy per cent of sand.

(5) Sandy loam, from which from seventy to ninety per cent of sand can be washed.

(6) Light sand, containing more than ninety per cent of sand.

When a soil is found to contain a very large per cent of organic or vegetable matter, it is generally known as *peat,* or as vegetable mold. Perhaps it need not be mentioned that clay soils are termed *heavy,* and sandy soils *light.* Although a cubic foot of sandy soil will weigh more than a like amount of clay, still because the sand works up better it is called light soil.

WHAT IS MANURE?

Answering this question on general principles it might be said that manure is anything which may be placed in the soil that will increase its fertility, or capacity to grow crops.

In common use it may simply imply the droppings of farm animals. These droppings all thoughtful farmers will be careful to save and to use intelligently. They may be said to contain the ash elements of the plants, because the same process goes on in the animal system, in digestion, as when plants are burned, and the ash elements are nearly all that we need to supply to our soil to maintain its fertility.

VALUE OF HOME-MADE MANURE.

Of course every one knows that there is a vast difference in the value of common barn dressing; the difference coming largely from the kinds of food eaten and from the treatment of the manure. The droppings of a half starved animal have but little fertilizing value, while those from an animal generously fed on rich nitrogenous foods, like cottonseed meal, wheat bran, and the like, may be of more money value, calculated from the basis of the values attached to the various ingredients of commercial fertilizers, than was the food itself when bought in the markets. In fact, I believe it to be possible to feed our stock and care for the manure so as to secure a good revenue from the profits of the manure alone.

HOW TO PRESERVE MANURE.

If animal manures are allowed to remain in the fields or open yards in small heaps they soon depreciate in value. On the other hand, if they are kept too close and dry there will be a still greater loss by heating, which drives off the ammonia. The most reasonable plan, in my judgment, for Maine farmers, is first to be prepared with a good room for storing all manures, and then to mix that from all the animals as far as possible. I would emphasize the necessity for plenty of absorbents, manures well mixed, and the heaps kept level. In this way all the liquid will be retained and there will be no heating.

The liquids from our domestic animals should be most carefully preserved, because of their high content of available plant food. I will give you a few figures showing the comparison between the liquids and the solids.

	Nitrogen.	Potash.	Phosphoric Acid.	Value per ton.
Cattle (Solids, fresh)............	0.29	0.10	0.17	$1.22
Cattle (Urine, fresh)............	0.58	0.49		2.35
Horse (Solids, fresh)............	0.44	0.35	0.17	1.94
Horse (Urine, fresh)............	1.55	1.50		6.47
Sheep (Solids, fresh)............	0.55	0.15	0.31	2.26
Sheep (Urine, fresh)............	1.95	2.26	0.01	8.47
Swine (Solids, fresh)............	0.60	0.13	0.41	2.50
Swine (Urine, fresh)............	0.43	0.83	0.07	2.24
Stable Manure, (mixed).........	0.50	0.60	0.30	2.49

As so many of our Maine farmers are directly interested in dairying, and as the matter of fertilizing our land is regulated largely by crops or products sold off the farm, I will add a few figures showing the amount and value of fertilizing materials in some dairy products and in the flesh of some farm animals, together with the usual selling price of some of the articles.

Dairy Products.	Selling price per ton.	Nitrogen.	Potash.	Phosphoric Acid.	Value per ton.
Milk	$48	0.58	0.17	0.30	$2.36
Cream	120	0.58	0.09	0.15	2.14
Skim-milk	24	0.58	0.19	0.34	2.42
Butter	400	0.12			.40
Buttermilk	20	0.64	0.09	0.15	2.34
Cheese	200	4.05	0.29	0.80	14.43
Flesh of Farm Animals.					
Beef	100	3.60	0.52	0.43	12.78
Calf (whole animal)	160	2.50	0.24	1.38	9.85
Pig	100	2.00	0.90	0.44	7.85
Sheep	200	2.24	0.15	1.23	8.76

COMMERCIAL FERTILIZERS.

Having considered the barn manures so far, it may be well now to consider the question of commercial fertilizers, their combinations and best methods of use. I am quite sure, however, that no one can afford to purchase these goods in any form until he knows he has saved all the plant food in his home-made manures and utilized all the available sources at command for adding to it. Having answered these two questions satisfactorily to himself, and having also further satisfied himself that he needs more plant food and cannot judiciously feed a larger amount of grain to his animals, and thus "fertilize by feeding," then comes the necessity for purchasing commercial fertilizers.

Before starting out to purchase, it may be interesting to note the elements needed in these goods, why they are needed, and from what source they are obtained. Chemistry has shown that there are but fourteen elements of plant food necessary to vegetable life. These fourteen essential elements naturally are divided into two distinct classes, according to their sources:

(1) Air-derived elements (water, organic matter, and nitrogen).

(2) Soil-derived elements (ash, or inorganic matter).

The air-derived elements comprise nearly ninety-five per cent of the weight of the vegetable kingdom, and come directly or indirectly from the air, not through the leaves but through the roots. This shows the necessity for clean culture, and for placing the soil in good condition to receive the heat, light and water which fall upon it. The soil-derived elements are of soil origin only, and are left as ash after the plant is burned.

The composition of mixed grasses from an acre, assuming them to weigh 10,000 pounds green, or one and one-half tons dry, will be about as follows: Water, 7,500 pounds; organic matter, 2,300 pounds; inorganic matter, 200 pounds. Thus it will be seen that the air-derived elements are about 98 per cent, while the soil-derived elements, including the nitrogen, form but 2 per cent. While these figures show the paramount importance of the air elements, including water, we should not infer that the soil-derived elements are not of great importance. Soils usually contain enough of all the ingredients necessary to grow a plant except nitrogen, phosphoric acid and potash. These are therefore called the deficient essential elements of plant food. They are the elements which we desire in any fertilizer, natural or artificial, and we will therefore consider them at some length.

NITROGEN.

Nitrogen occurs in nature as a constituent of the air, in the form of nitrates in various salts, in the form of ammonia, and in several forms of animal and vegetable matter, as the fibrin of blood and flesh, casein of milk, whites of eggs, etc.

PHOSPHORIC ACID.

Phosphoric acid occurs in nature, combined with oxygen, in animal bones, in various mineral deposits, and in soils and some ores.

POTASH.

Potassium, which combines with oxygen to form potash, is not found uncombined in nature, but occurs as a constituent of some minerals, in vegetable matters and their ashes. It comes in fertilization as chloride, in muriate of potash, kainit, etc.; as sulphate, in sulphate of potash, double manure salts, etc.; as carbonate, in wood ashes, etc.; as organic potash, in cottonseed meal, tobacco stems, castor pomace, etc. The first three forms are soluble in water, and consequently more readily available for plants. The fourth is only partially soluble but is available when decomposed.

MATERIALS USED IN THE MANUFACTURE OF COMMERCIAL FERTILIZERS.

All genuine commercial fertilizers owe their value to the kind, quality and amount of nitrogen, phosphoric acid and potash which they contain. They are, of course, made by mixing crude stock as a source of these various ingredients in varying proportions, including sulphuric acid to dissolve the phosphate and make it soluble. A brief description of the various kinds of crude stock most commonly used by fertilizer manufacturers, may be of interest.

NITROGENOUS CRUDE STOCK.

Furnishing nitric nitrogen, nitrate of soda (Chili salt peter), a heavy, white, crystalline salt, mined in the rainless regions of northern Chili. This is readily soluble, and immediately available, but may be lost by leaching if applied too far in advance of the growing season and in too large quantities. If used alone, it should be applied on the growing crop after the roots are ready to go to work upon it. At present it is the cheapest of the better forms of nitrogen. Furnishing ammoniacal nitrogen, sulphate of ammonia, a heavy, dirty, white salt, the refuse of coal gas manufacture, readily soluble, but does not act so quickly as nitrate of soda. It has been found to be positively detrimental to plant growth on some soils. This was proven quite conclusively by the Rhode Island experiment station in 1893, in various plot experiments. It is now the most expensive form of nitrogen. Furnishing organic nitrogen (animal), ground meat, dried blood, dry ground fish, fish scraps, meat scraps, tankage (dried and ground slaughter-house refuse, first thrown into tanks and then dried and finely ground). Prof. Jordan used to say that the term tankage covered a multitude of sins, as the material was so uncertain in its composition that no one could know just what he was getting. Next comes hair, horn dust and wool waste, all by-products but slowly available and rated at lower prices. Then comes leather scrap, another by-product, practically useless as a fertilizer, and its use forbidden by law in many states. Furnishing organic nitrogen (vegetable), cotton-seed meal and castor pomace.

PHOSPHATIC CRUDE STOCK.

Furnishing insoluble phosphoric acid (animal), bone ash, residue from burning bone, produced mostly in the Argentine Republic. The nitrogen is driven off but the phosphoric acid remains. Then bone black, spent bone black from sugar refineries, where it is used to clarify sugar. It is made by burning bones without access of air, in much the same way as charcoal is made. The nitrogen is driven off but the phosphoric acid remains. Ground bone, containing some nitrogen and valuable in proportion to its analysis and fineness.

Furnishing insoluble phosphoric acid (mineral), apatite, a hard green or brown rock mined in Canada, but little used in phosphates in this country; phosphate rock, found in many places in various parts of the world. That used in this country comes mainly from Florida, South Carolina, Tennessee and the West Indies. The Florida and South Carolina deposits contain many animal remains, teeth, bones, etc. Thomas slag (odorless phosphate), a waste or by-product from the basic Bessemer process of manufacturing steel.

FURNISHING POTASH AS CHLORIDE.

Muriate of potash, a fine white salt, soluble in water and readily available, mined in Strassfurt, Northern Germany. Kainit, coarser than muriate, soluble in water, a natural product of the Strassfurt mines.

FURNISHING POTASH AS SULPHATE.

Sulphate of potash; this, too, comes from Strassfurt, is soluble in water and readily available; and double manure salts, really the same as sulphate of potash.

FURNISHING POTASH AS CARBONATE.

Wood ashes; these are of very variable composition, according to the wood from which they are burned, and the manner in which they are handled. Unleached hard wood ashes will usually contain from four to eight per cent of potash, which is usually readily available. Ashes can now be purchased under a guarantee, and when sold for ten dollars or more per ton our State law requires analysis and such guarantee. Cottonseed hull ashes, these hulls being largely used as fuel in southern cottonseed oil factories.

SPECIFIC ACTION OF NITROGEN, PHOSPHORIC ACID AND POTASH ON PLANT GROWTH.

Having briefly considered the various deficient essential elements of plant food, and their sources, we may, perhaps, find it interesting to note their effects upon the growing plants. Nitrogen favors the growth of stem and leaf, sometimes even at the expense of bud, flower and fruit, and the formation of green coloring matter, thus deepening the color of plants. It adds to the nitrogen of the plant and consequently to its feeding value as a producer of bone, muscle, blood and milk. Phosphoric acid favors plant nutrition, particularly in early life. It aids in the assimilation of the mineral ingredients, improves the development and hastens the maturity of fruit and seed. Potash aids in the development of woody structure, improves the flavor, and texture, of the fleshy parts of fruits, and favors the dissemination of starch through the growing plant.

The question which the farmer may here ask himself is: In what form shall I buy nitrogen, phosphoric acid and potash? Shall I buy the mixed goods or the crude stock and mix it myself? He should, of course, ascertain as far as possible which of these constituents are most needed. It has been thought by farmers, and chemists as well, that soil analyses would disclose soil needs. This belief, though natural, is erroneous. Soil analyses fail because no chemical solvent yet discovered can distinguish between available and insoluble soil ingredients. The chemists' acids act on both alike, while water will not dissolve all that soil and root acids will take up. Since soil analysis is not available to ascertain the ingredients needed for fertilization, the analysis of plants has been taken by many as a substitute. Most of our special fertilizers are compounded along this line, and, as far as I have been able to observe, have met the requirements of the several plants for which they were intended fairly well. Still, these analyses cannot be taken as an infallible rule, nor as necessarily showing how much fertilizer to use. The farmer may form some estimate of the needs of the soil by watching his growing crops. A pale green leaf indicates a probable lack of nitrogen, a failure to form sound, heavy grain indicates a lack of phosphoric acid. The failure of the plant to build a strong, healthy frame, a good growth of cellular tissue, indicates a lack of potash. Plat tests with the different elements of plant food are often helpful. But still, with all this data at hand, he may find it best to buy a complete fertilizer, but will usually purchase with better judgment.

THE FORM IN WHICH TO BUY NITROGEN, PHOSPHORIC ACID AND POTASH.

I consider this one of the most important points for the farmer to study, as much depends upon the condition of the soil and crop and upon the objects in mind. For rapid effects we should use nitrate of soda or sulphate of ammonia as a source of nitrogen, acid phosphate or bone black for the phosphoric acid and muriate or sulphate of potash for the potash.

For less rapid growth we can use the better forms of organic nitrogen, acid phosphate or Thomas slag; while for still slower and more lasting effects, we may use bone, or fish scrap, and wood ashes. I believe that the success of certain grass and grain fertilizers has come largely from the fact that these slower acting and less soluble crude ingredients have been used.

A lesson comes in here—it is that a high priced fertilizer may not always be as economical as a lower priced one, if the only difference is in the solubility of the ingredients. The lower priced goods may, and probably will, be better for grain or grass than the higher priced ones, because they will be more lasting. For hoed crops the quick acting goods are always to be desired. This is not to be construed, either, as an argument in favor of low grade goods. I believe in the wisdom of using high grade goods always. The economy of this is manifest, but for the grain and grass crops quick action may well give place to a larger number of pounds of actual plant food.

The use of certain forms of fertilizing ingredients is desirable with certain crops. Potatoes and sugar beets do better on sulphate of potash than with the muriate, while with peaches the reverse has proved true. Nitrate of soda is particularly adapted to top dressing wheat, and for tomatoes. If a complete fertilizer is bought for potatoes, the purchaser should note particularly the source of potash claimed.

HOME MIXING.

This consists simply of buying the various fertilizing ingredients in crude form and mixing them at the farm. These crude articles are for sale and may be bought of any dealer in agricultural chemicals or fertilizer manufacturer. There are advantages and disadvantages to the system, and under many conditions it is not practicable. Some of the advantages are, reduced cost of fertilizers, accurate knowledge of the nature of the plant food used, and indirect education in farm practice. This latter is of much value, because it leads to study, investigation, and inquiry, and therefore to more intelligent and profitable work.

The disadvantages are, close prices are seldom quoted on small quantities, farmers largely engaged in dairying are not heavy buyers of commercial fertilizers, and farmers may not make as even or fine a mixture as manufacturers.

Taking the advantages in the order named, we may say that the New Jersey experiment station bulletins 93 and 102 show that home mixtures representing 800 tons, cost on an average $30.85 per ton, which was 10.7 per cent less than the station valuation. The average manufacturers' mixture made in the same year sold at point of consumption for $34.16 or 37.6 per cent more than the station valuation. The fact was noted, also, that the home mixtures were as fine and as evenly mixed as those made at the factories. Of course it will be understood that the cost of mixing, bagging and freight was not included in the home mixtures. Fifty-five farmers in that state estimate the cost of mixing at seventy-five cents per ton. Another important matter is that each purchaser, or his experiment station, may examine each ingredient separately and determine its quality, thus excluding leather, shoddy, wool-waste or other inferior material. The adaptation of a special mixture to a certain soil or for certain crops may also be of decided advantage.

HOW HOME MIXING IS DONE.

A tight barn floor, platform scales, screen, shovel and hoe are the only utensils necessary. With these the mixture may be thoroughly made. It may then be screened if desired. As our farmers are not large purchasers of these goods, it may be advantageous, if the plan is thought well of, for farmers' clubs and granges to buy crude stock in car lots and mix it to suit the needs of members. I give a form, with slight changes, which was sent to dealers in fertilizing chemicals by a New Jersey grange. It may be of value to those who contemplate home mixing in this State.

"Wanted: To buy the materials to make——— tons or more of fertilizer. The materials to consist of nitrate of soda, sulphate of ammonia, ground fish scrap, muriate of potash and sulphate of potash. All materials to be in good mechanical condition; in good bags; to run even weights or be plainly marked what each bag contains net, and to be delivered at———— early in March next. All materials to be guaranteed to contain certain percentages of nitrogen, potash or available phosphoric acid, as the case may be; one-half of the bill to be paid within ten days after receipt of goods; on the other half a credit of sixty days to be allowed, within which time samples will be sent to the Maine Experiment Station for analysis, and if they are found to contain as large percentages as guaranteed the balance of the bill will be paid within the sixty days, but if any are found to contain a less percentage than guaranteed, then a discount is to be allowed on the bill, equal to the loss in money value caused by such deficiency for the first one per cent or fraction thereof, and twice the loss in money value for all deficiencies in excess of one per cent, and balance of bill within sixty days. Samples to be taken by an agent of the station or other disinterested party."

What is called the "unit system" will be found a very satisfactory method of purchasing on guarantee. A unit means one per cent on a basis of a ton and is twenty pounds. For instance, any material having fourteen per cent of available phosphoric acid is said to contain fourteen units to the ton. Dr. Dabney, when assistant secretary of agriculture, made a most sensible suggestion in an article in the American Fertilizer (November, 1894). He proposed a basal mixture of certain per cents of nitrogen, phosphoric acid and potash, to which for special crops and needs definite amounts of definite kinds of crude stock may be added.

I will give a few formulas which were prepared by practical farmers of Connecticut and New Jersey, and which, as a rule, appear to have given satisfaction. They should not be followed blindly but may be of help. They appear to me to contain a higher content of nitrogen than would be needed on our dairy farms where much nitrogenous feeds are used.

FOR GENERAL USES.

Two hundred pounds nitrate of soda, 200 pounds sulphate of ammonia, 400 pounds bone, 400 pounds bone black, 600 pounds S. C. rock, 200 pounds muriate of potash.

FOR CORN.

Five hundred pounds ground bone, 200 pounds muriate of potash, 600 pounds dissolved bone black, 500 pounds tankage, 200 pounds nitrate of soda.

FOR POTATOES.

One hundred pounds nitrate of soda, 400 pounds dissolved bone, 400 pounds ground bone, 700 pounds bone black, 400 pounds high grade sulphate of potash.

These formulas analyze as follows:

No. 1. Nitrogen from nitrates, 1.72 per cent; from ammonia salts, 1.98 per cent: from organic matter, .28 per cent; total, 3.98. Phosphoric acid, soluble, 7.90 per cent; total available, 11.66 per cent; potash, 5.11 per cent.

No. 2. Nitrogen in the form of nitrates, .67 per cent; from organic matter, 1.22 per cent; total, 1.89 per cent. Phosphoric acid, soluble, 7.80 per cent; total available, 14.62 per cent; potash, 10.79 per cent.

No. 3. Nitrogen from nitrates, 1.45 per cent; from organic matter, 2.78 per cent; total, 4.23 per cent. Phosphoric acid, soluble, 5.60 per cent; total available, 10.32 per cent; potash, 5.32 per cent.

While the average farmer may not be ready to mix his own fertilizers at present, I am convinced that a study along these lines will be of benefit to all, and it may be that in the near future a large proportion of the commercial fertilizers sold in our State will be sold in this way. When this time does come we shall find ourselves freed from a system of trade which, as now conducted, is expensive to both manufacturer and consumer, and which, with its extensive branches of trade and long credits is unsatisfactory to all.

I have used the last formula with excellent results. The cost of mixing did not exceed sixty cents per ton, and it was well mixed, and in good shape for the planters.

BEST METHOD OF APPLYING COMMERCIAL FERTILIZERS.

Commercial fertilizers, in my judgment, can best be used in connection with and as supplementary to farm manures. Except for some crops on light soil their continuous use alone has never in my practice or under my observation proved satisfactory. They should be used to grow crops which in turn may be used to increase the stock carrying capacity of the farm, and the amount of humus in its soil by the return of the resultant manure. They can, generally, be best used on hoed crops, and may be used profitably to extend their acreage in many instances. If hoed crops do not enter into the rotation, the land must be plowed frequently so that a liberal amount of vegetable matter may be added to the soil, often.

Under these conditions I am quite sure that our farm operations may be increased, our business extended, and the productiveness of our land enhanced by a liberal use of commercial fertilizers. These conclusions come largely from my experience on a clay soil, what may be termed a good grass soil. We have used commercial fertilizers alone for corn, potatoes, grain and grass, and have carefully noted results. In every instance they have not proved as lasting used in this way as when combined with farm manure. Our practice now is, therefore, to extend the farm manures as far as possible, and add to them by the use of commercial fertilizers for all hoed crops. If we were to plow and reseed land at once to grass, we would, with a manure spreader, put on a light coat of barn dressing, and in connection with this use some brand of grass fertilizer, or wood ashes either alone or with bone meal. We have found an application of as small a quantity of ashes, as fifty bushels per acre, used in this way, to show perceptibly in the grass for five years. No soil, in my judgment, can ever be permanently enriched by the exclusive use of commercial fertilizers in any form.

Live stock husbandry is the sheet anchor of New England agriculture to-day, and we must all fully grasp this fact. Let not the glamor of easy culture, cheap application of fertilizers, or any other consideration, blind our eyes to the necessity for good, honest labor along some line of stock production. Let us grasp the aids which science has given us, adapt them to our wants, and profit by them. But there is no panacea for the ills of our agriculture to-day but persistent, thoughtful labor, accompanied by the open hand, the ready eye, and the receptive mind. We must be liberal that we may save. We must give of our very best, and when we do we shall find the true reward which we all so earnestly desire; productive fields, abundant crops, valuable live stock, and, last but not least, comfortable, pleasant homes where happiness will abound and true manhood and womanhood preside.

ABSTRACT

OF

CATTLE COMMISSIONERS' REPORT.

A summary of the work of our commission for 1898 shows that we have attended one hundred and sixty-nine inspections. During the year, one hundred and seven farms have been visited, and sixty-two stables have been inspected, forty-eight cattle have been condemned and destroyed at an appraisal of $1,520.00 and thirty-four horses have also been condemned and destroyed at an appraisal of $1,421.00, the total appraisals of the year amounting to $2,941.00.

Among the cases of especial interest that have occurred the past year, was the destruction of thirty-four cases of glanders, the major part of them being western horses, that, owing to the low price such horses command, have been brought into Maine in large numbers within the past few years; the discovery of several cases of tuberculosis among swine, which can all be traced to drinking the milk from tuberculous cows; the inspection of a Short-horn bull affected with tuberculosis, that had been brought from New Hampshire without any permit, and was sent out of the State again to the party who bred and sold him, also the discovery of two diseased registered Guernseys from Connecticut, that had been admitted into Maine to exhibit at the New England Fair in 1897, and were sold without the knowledge of our commission to parties in this State, both of which were condemned and destroyed. We have also had several cases reported the past year of swine plague and hog cholera; and Dr. Salmon reports, "The infectious diseases of swine have long caused such enormous losses that swine growers have been discouraged and many of them financially ruined, while the Federal government has been greatly concerned on account of the destruction of property and the menace to an important item of the food supply and of the export trade. Veterinary science has had much to contend with before it could offer a practical and efficient solution of the problem of preventing these losses. It was necessary to consider the vast number of animals liable to the disease and the great extent of territory over which they are distributed; also the relatively small value of each individual and the fact that the losses are caused by two distinct diseases, each of which requires its own specific treatment, while the symptoms are so obscure that it is difficult in the field to distinguish one from the other."

There remains but one resource to which we can turn with hope of relief. That is the use of anti-toxic serum. The researches made in this direction have shown that it is possible to produce a serum that will immunize animals of both of these diseases, and that will also cure both. This treatment was first tried with small animals such as rabbits and guinea pigs in the laboratory, and, being successful there, was tested late last year with herds of infected swine. Of about 250 animals in infected herds, over 75% were saved, while in herds not treated 85% died. This year, the results, with about the same number of animals have been even better and the prospects are that over 80% of the animals in infected herds may be saved by this method.

In anti-toxic serum we have a most valuable agent for the control of swine diseases, but it can best be used under professional supervision. The State should regard it as an invaluable addition to its resources for eradicating the disease from our territory. If the State adopts it and provides for its systematic use wherever the infection appears, it will not be long before swine can be raised with more safety and profit, and the fifty or one hundred millions which are now annually blotted out by this scourge will go into the pockets of our farmers increasing the wealth and prosperity of the nation.

A permit was issued in October to bring into Maine two carloads of milch cows from Canada to be tested with tuberculin upon their arrival upon the premises of the owner at Lewiston, Maine. These cows arrived at Vanceboro, where they were stopped by the United States inspector at that point, and tested before being released, and in correspondence with the director of the "Bureau of Animal Industry" at Washington, D. C., we were furnished with a copy of the law of 1897, which we publish for the benefit of future shippers.

UNITED STATES DEPARTMENT OF AGRICULTURE.

OFFICE OF THE SECRETARY.

Washington, D. C., January 23, 1897.

REGULATIONS FOR THE INSPECTION AND QUARANTINE OF ANIMALS IMPORTED FROM CANADA INTO THE UNITED STATES.

In pursuance of sections 7, 8, and 10 of the act of Congress entitled "An act providing for the inspection of meats for exportation, and prohibiting the importation of adulterated articles of food or drink, and authorizing the President to make proclamation in certain cases, and for other purposes," approved August 30, 1890, and of an act of Congress entitled "An act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1897," the following regulations, to take effect from and after February 1, 1897, are hereby prescribed for the inspection and quarantine of animals imported from Canada into the United States, and all orders and regulations or parts thereof inconsistent with these regulations are hereby revoked in so far as applies to inspection and quarantine of animals imported from Canada:

1. With the approval of the Secretary of the Treasury, the following-named ports along the border or boundary line between the United States and Canada have been designated as quarantine stations, and all animals imported from Canada into the United States for which inspection is required by these regulations must be entered through these ports, viz: Vanceboro and Houlton, Maine; Beechers Falls, Island Pond, New-

port, Richford, and St. Albans, Vermont; Rouses Point, Ogdensburg, Charlotte, Suspension Bridge, and Buffalo, New York; Port Huron and Detroit, Michigan; Duluth and St. Vincent, Minnesota; and Port Townsend, Washington.

2. The word "animals" when used in these regulations refers to and includes all or any of the following kinds: Horses, neat cattle, sheep, and other ruminants, and swine. The term "contagious diseases" when used in these regulations includes farcy, maladie du coit, anthrax, contagious pleuro-pneumonia, Texas or splenetic fever, tuberculosis, actinomycosis, foot-and-mouth disease, rinderpest, sheep pox, foot-rot, sheep scab, hog cholera, swine plague, and erysipelas. Animals found affected with any one of these contagious diseases must be returned to Canada or killed without compensation.

3. All animals imported into the United States from Canada must be accompanied by an affidavit made by the owner or importer, declaring clearly the purpose for which said animals are imported, viz: whether for breeding purposes, for milk production, for work animals, for grazing, feeding, or slaughter, or whether they form part of settlers' effects, or whether they are horses entered for temporary stay, as provided in section 7 of these regulations. Said affidavit must be presented to the collector of customs at the port of entry, who will decide whether the animals are entitled to entry under these regulations, and who will notify the inspector of the Bureau of Animal Industry in all cases where these regulations require an inspection to be made.

4. All animals imported into the United States for breeding purposes, for milk production, for grazing or feeding, horses for work, and swine for slaughter must be inspected by an inspector of the Bureau of Animal Industry at the port of entry. All animals covered by this section except horses, and swine for slaughter, must be accompanied with a certificate signed by a Canadian official veterinarian, stating that no contagious disease except tuberculosis and actinomycosis in cattle, affecting the species of animals imported, has existed in the district in which the animals have been kept for six months preceding the date of importation, excepting animals which are part of settlers' effects, or belonging to Indian tribes, which may be entered without cer-

tification or inspection. The owner or importer must present an affidavit that said certificate refers to the animal or animals imported. The certificate for cattle for breeding and for milch cows must also show that they have been submitted to the tuberculin test and found free from tuberculosis, giving the date of testing, with the chart of reaction, and a description of the cattle, with age and markings. All animals imported for breeding purposes, milk production, grazing or feeding, when not accompanied by the required affidavits and certificates, must be detained in quarantine for one week, at the expense of the owner or importer, under the supervision of the inspector in charge. During this detention a rigid inspection will be made, and cattle for breeding or milk production will be *tested with tuberculin.* Animals found free from disease at the end of this period will be released. Cattle and sheep for grazing or feeding, if accompanied by the required affidavits and certificates, need not be unloaded for inspection, but all other animals covered by this section must be unloaded and carefully inspected.

5. All Canadian animals will be admitted at any port of the United States for transit in bond to any Canadian port without inspection.

6. Cattle and sheep in bond for export will be admitted without inspection at any of the ports named in section 1, in transit to and for export from Portland, Me., Boston, Mass., and New York, N. Y. Horses will be admitted in bond at any port of the United States without inspection for export from any part of the United States. All animals admitted for export will be subject to inspection at port of export.

7. Horses for temporary stay, whether for pleasure driving, teaming, exhibition, racing, or used in connection with stock raising or mining, cattle and sheep for slaughter, and animals belonging to Indian tribes or forming part of settlers' effects will be admitted through any port without inspection or certification.

8. The railroad cars used in the transportation of animals specified by these regulations must be thoroughly cleaned and disinfected before said animals are placed therein. All litter from previous shipments must be removed, and the car whitewashed with lime and carbolic acid, one pound of commercial carbolic acid to five gallons of lime wash. Unless this regulation

is complied with Canadian animals will not be allowed entry into the United States, and animals from the United States will not be admitted into Canada. Shippers should see that cars are properly cleaned and disinfected before animals are loaded.

J. STERLING MORTON,
Secretary.

APPENDIX.

A SUMMARY OF INFORMATION ON VARIOUS SUBJECTS OF INTEREST TO THE FARMER COMPILED FROM THE YEAR BOOK OF THE DEPARTMENT OF AGRICULTURE FOR 1898.

APPENDIX.

ORGANIZATION OF THE DEPARTMENT OF AGRICULTURE, DECEMBER 31, 1898.

SECRETARY OF AGRICULTURE, James Wilson.

The Secretary of Agriculture is charged with the supervision of all public business relating to the agricultural industry. He appoints all the officers and employees of the Department, with the exception of the Assistant Secretary and the Chief of the Weather Bureau, who are appointed by the President, and directs the management of all the divisions, offices, and bureaus embraced in the Department. He exercises advisory supervision over the agricultural experiment stations deriving support from the National Treasury, and has control of the quarantine stations for imported cattle, and of interstate quarantine rendered necessary by contagious cattle diseases.

ASSISTANT SECRETARY OF AGRICULTURE, Joseph H. Brigham.

The Assistant Secretary performs such duties as may be required by law or prescribed by the Secretary. He also becomes Acting Secretary of Agriculture in the absence of the Secretary.

CHIEF CLERK, Andrew Geddes.

The Chief Clerk has the general supervision of the Clerks and and employees; of the order of business, records, and correspondence of the Secretary's office; of all expenditures from appropriations for contingent expenses, stationery, etc.; of the enforcement of the general regulations of the Department; and of the buildings occupied by the Department of Agriculture.

APPOINTMENT CLERK, Joseph B. Bennett.

The Appointment Clerk is charged by the Secretary with the preparation of all papers involved in making appointments, transfers, promotions, reductions, furloughs, or dismissals, and has charge of all correspondence of the Department with the United States Civil Service Commission. He deals with all questions as to positions in the Department which are under civil-service rules.

CHIEF OF SUPPLY DIVISION, Cyrus B. Lower.

The Supply Division has charge of purchases of supplies and materials paid for from the general funds of the Department.

BUREAUS, DIVISIONS, AND OFFICES.

WEATHER BUREAU (corner Twenty-fourth and M. streets NW.).—*Chief,* Willis L. Moore; *Chief Clerk,* Henry E. Williams; *Professors of Meteorology,* Cleveland Abbe, F. H. Bigelow, Henry A. Hazen, Charles F. Marvin, Edward B. Garriott.

The Weather Bureau has charge of the forecasting of weather; the issue of storm warnings; the display of weather and flood signals for the benefit of agriculture, commerce, and navigation; the gauging and reporting of rivers; the maintenance and operation of seacoast telegraph lines, and the collection and transmission of marine intelligence for the benefit of commerce and navigation; the reporting of temperature and rainfall conditions for the cotton, rice, sugar, and other interests; the display of frost and cold-wave signals; the distribution of meteorological information in the interests of agriculture and commerce; and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or as are essential for the proper execution of the foregoing duties.

BUREAU OF ANIMAL INDUSTRY.—*Chief,* D. E. Salmon; *Assistant Chief,* A. D. Melvin; *Chief Clerk,* S. R. Burch; *Chief of Inspection Division,* A. M. Farrington; *Chief of Miscellaneous Division,* Tooie A. Geddes; *Chief of Pathological Division,* Victor A. Nörgaard; *Chief of Biochemic Division,* E. A. de Schweinitz; *Chief of Dairy Division,* Henry E. Alvord; *Zoölogist,* Ch. Wardwell Stiles; *In charge of Experiment Station,* E. C. Schroeder.

The Bureau of Animal Industry makes investigations as to the existence of contagious pleuro-pneumonia and other dangerous communicable diseases of live stock, superintends the measures for their extirpation, makes original investigations as to the nature and prevention of such diseases, and reports on the condition and means of improving the animal industries of the country. It also has charge of the inspection of import and export animals, of the inspection of vessels for the transportation of export cattle, and of the quarantine stations for imported neat cattle; supervises the interstate movement of cattle; and inspects live stock and their products slaughtered for food consumption.

DIVISION OF STATISTICS.—*Statistician,* John Hyde; *Assistant Statistician,* George K. Holmes.

The Division of Statistics collects information as to the condition, prospects, and harvests of the principal crops, and of the numbers and status of farm animals, through a corps of county correspondents and the aid of a supplementary organization under the direction of State agents, and obtains similar information from European countries monthly through the deputy consul-general at London, assisted by consular, agricultural, and commercial authorities. It records, tabulates, and coördinates statistics of agricultural productions, distribution, and consumption, the authorized data of governments, institutes, societies, boards of trade, and individual experts, and issues a monthly crop report and occasional bulletins for the information of producers and consumers, and for their protection against combination and extortion in the handling of the products of agriculture.

SECTION OF FOREIGN MARKETS. *Chief,* Frank H. Hitchcock.

The Section of Foreign Markets makes investigations and disseminates information "concerning the feasibility of extending the demands of foreign markets for the agricultural products of the United States."

OFFICE OF EXPERIMENT STATIONS. *Director,* A. C. True; *Assistant Director,* E. W. Allen.

The Office of Experiment Stations represents the Department in its relations to the experiment stations which are now in operation in all the States and Territories. It seeks to promote the interests of agricultural education and investigation throughout the United States. It collects and disseminates general information regarding the colleges and stations, and publishes accounts of agricultural investigations at home and abroad. It also indicates lines of inquiry of the stations, aids in the conduct of coöperative experiments, reports upon their expenditures and work, and in general furnishes them with such advice and assistance as will best promote the purposes for which they were established. It is also charged with investigations on the nutritive value and economy of human foods. The collection of valuable matter on irrigation from agricultural colleges and other sources, as provided in the appropriation bill, is conducted by this office.

DIVISION OF CHEMISTRY.—*Chemist,* Harvey W. Wiley; *Assistant Chemist,* Ervin E. Ewell.

The Division of Chemistry makes investigations of the methods proposed for the analyses of soils, fertilizers, and agricultural products, and such analyses as pertain in general to the interests of agriculture. It can not undertake the analyses of samples of the above articles of a miscellaneous nature, but application for such analyses should be made to the directors of the agricultural experiment stations of the different States. The division does not make assays of ores nor analyses of minerals except when related to general agricultural interests, nor analyses of water.

DIVISION OF ENTOMOLOGY.—*Entomologist,* L. O. Howard; *Assistant Entomologist,* C. L. Marlatt.

The Division of Entomology obtains and disseminates information regarding insects injurious to vegetation; investigates insects sent to the division in order to give appropriate remedies; conducts investigations of this character in different parts of the country; and mounts and arranges specimens for illustrative and museum purposes.

DIVISION OF BIOLOGICAL SURVEY.—*Chief,* C. Hart Merriam; *Assistant Chief,* T. S. Palmer.

The Division of Biological Survey studies the geographic distribution of animals and plants, and maps the natural life zones of the country; it also investigates the economic relations of birds and mammals, and recommends measures for the preservation of beneficial and the destruction of injurious species.

Division of Forestry.—*Forester,* Gifford Pinchot; *Superintendent of Working Plans,* Henry S. Graves.

The Division of Forestry is occupied with experiments, investigations, and reports dealing with the subject of forestry, and with the dissemination of information upon forestry matters.

Division of Botany.—*Botanist,* Frederick V. Coville; *Chief of Section of Seed and Plant Introduction.* O. F. Cook.

The Division of Botany investigates botanical agricultural problems, including the purity and value of agricultural seeds; methods of controlling the spread of weeds or preventing their introduction into this country; the dangers, effects, and antidotes for poisonous plants, the native plant resources of the country, and other subjects of economic botany.

Division of Vegetable Physiology and Pathology.—*Pathologist,* B. T. Galloway; *Assistant Pathologist,* Albert F. Woods.

The Division of Vegetable Physiology and Pathology has for its object a study of the normal and abnormal life processes of plants. It seeks by investigations in the field and experiments in the laboratory to determine the causes of disease and the best means of preventing the same. It studies plant physiology in its bearing on pathology.

Division of Agrostology.—*Agrostologist,* F. Lamson-Scribner; *Assistant Chief,* Jared G. Smith.

The Division of Agrostology is charged with the investigation of the natural history, geographical distribution, and uses of grasses and forage plants, their adaptation to special soils and climates, the introduction of promising native and foreign kinds into cultivation, and the preparation of publications and correspondence relative to these plants.

Division of Pomology.—*Pomologist,* Gustavus B. Brackett; *Assistant Pomologist,* W. A. Taylor.

The Division of Pomology collects and distributes information in regard to the fruit interests of the United States; investigates the habits and peculiar qualities of fruits, their adaptability to various soils and climates, and conditions of culture, and introduces new and untried fruits from foreign countries.

Division of Soils.—*Chief,* Milton Whitney; *Assistant Chief,* Lyman J. Briggs.

The Division of Soils has for its object the investigation of the texture and other physical properties of soils and their relation to crop production.

OFFICE OF PUBLIC ROAD INQUIRIES.—*Director,* Roy Stone.*

The Office of Public Road Inquiries collects information concerning the systems of road management throughout the United States, conducts investigations regarding the best method of road making, and prepares publications on this subject.

DIVISION OF GARDENS AND GROUNDS.—*Horticulturist and Superintendent of Gardens and Grounds,* William Saunders.

The Division of Gardens and Grounds is charged with the care and ornamentation of the park surrounding the Department buildings, and with the duties connected with the conservatories and gardens for testing and propagating economic plants.

DIVISION OF PUBLICATIONS.—*Chief,* Geo. Wm. Hill; *Assistant Chief,* Joseph A. Arnold; *Assistant in Charge of Document Section,* R. B. Handy.

The Division of Publications exercises general Supervision of the Department printing and illustrations, edits all publications of the Department, has charge of the printing and Farmers' Bulletin funds, and distributes all Department publications with the exception of those turned over by law to the Superintendent of Documents for sale at the price affixed by him; it issues, in the form of press notices, official information of interest to agriculturists, and distributes to agricultural publications and writers synopses of Department publications.

DIVISION OF SEEDS. *Chief,* Robert J. Whittleton.

The Division of Seeds is charged with the purchase and distribution of valuable seeds, a certain portion of which are collected and purchased from foreign countries for experiments with reference to their introduction into this country. They are distributed in allotments to Senators, Representatives, Delegates in Congress, agricultural experiment stations, and by the Secretary of Agriculture, as provided by law.

---

* Hon. Martin Dodge was Director for six months in 1898, when General Stone was absent as a Brigadier-General of Volunteers in the United States Army.

LIBRARY.—*Librarian,* W. P. Cutter.

The Librarian has charge of the Library and supervises the arrangement and cataloguing of books, the preparation of bibliographies and similar publications, and the purchases of new books.

APPROPRIATIONS FOR THE DEPARTMENT OF AGRICULTURE FOR THE FISCAL YEAR ENDING JUNE 30, 1899.

Salaries, Department of Agriculture	$319,300
Furniture, cases, and repairs, Department of Agriculture	9,000
Library, Department of Agriculture	6,000
Museum, Department of Agriculture	1,500
Postage, Department of Agriculture	2,000
Contingent expenses, Department of Agriculture	25,000
Animal quarantine stations	12,000
Collecting agricultural statistics	105,000
Botanical investigations and experiments	20,000
Entomological investigations	20,000
Vegetable pathological investigations	20,000
Biological investigations	17,500
Pomological investigations	9,500
Laboratory, Department of Agriculture	12,400
Forestry investigations	20,000
Experimental gardens and grounds, Department of Agriculture	20,000
Soil investigations	10,000
Grass and forage plant investigations	10,000
Agricultural experiment stations	*760,000
Nutrition investigations	15,000
Public road inquiries	8,000
Publications, Department of Agriculture	65,000
Sugar investigations	7,000
Purchase and distribution of valuable seeds	130,000
Salaries and expenses, Bureau of Animal Industry,	900,000
Irrigation information	10,000
Total	$2,534,200

* Of this amount $720,000 is annually paid directly to the experiment stations by the United States Treasury.

Weather Bureau.

Salaries, Weather Bureau	$153,340
Fuel, lights, and repairs, Weather Bureau	8,000
Contingent expenses, Weather Bureau	8,000
General expenses, Weather Bureau	765,162
Meteorological observation stations	75,000
Erection of building at Sault Ste. Marie, Mich.	3,000
Repairs to buildings and grounds, Bismarck, N. Dak.,	3,000
Total for Weather Bureau	$1,015,502
Grand total	$3,549,702

There are forty-eight Agricultural Colleges and other institutions in the United States having courses in agriculture. There are fifty-four Experiment Stations in the United States. Connecticut, New Jersey, and New York have two Experiment Stations, Louisiana has three.

NOTES REGARDING DEPARTMENT PUBLICATIONS.

The publications of the U. S. Department of Agriculture are of three classes: (1) Serial publications, (2) scientific and technical reports, and (3) popular bulletins. The first two classes are issued in limited editions and are distributed free only to persons coöperating with or rendering the Department some service. Sample copies will be sent if requested, but generally applicants must apply to the Superintendent of Documents, Union Building, Washington, D. C., to whom all publications not needed for official use, except circulars and bulletins printed by law for free distribution, are turned over. They are disposed of by him at cost of printing.

The popular circulars and bulletins treat in a practical way of subjects of particular interest to farmers, are issued in large editions, and are for free distribution. The Farmers' Bulletins are of this class. Some of them are out of print. A list of such as are available for distribution at any time will be forwarded upon request.

There is no list of persons to whom all publications are sent. The Monthly List of Publications, issued the first of each month, will be mailed regularly to all who apply for it. In it are given the titles of all publications issued during the previous month, with a note explanatory of the character of each, thus enabling the reader to make intelligent application for such bulletins and reports as are likely to be of interest to him.

For the maps and bulletins of the Weather Bureau, requests and remittances should be directed to the Chief of that Bureau. Also the index (card form) of experiment-station literature is sold direct to applicants by the Office of Experiment Stations. For all other publications to which a price is affixed, application must be made to the Superintendent of Documents, Union Building, Washington, D. C., accompanied by the price thereof; and all remittances should be made to him, and not to the Department of Agriculture. Such remittances should be made by postal money order, and not by private check or postage stamps. The Superintendent of Documents is not permitted to sell more than one copy of any public document to the same person. The Public Printer may sell to one person any number not to exceed 250 copies, if ordered before the publication goes to press.

STATE OFFICIALS IN CHARGE OF AGRICULTURE.

Of the state officials in charge of agriculture, one state (Pennsylvania) has a Secretary of Agriculture, fifteen states have Commissioners of Agriculture, twenty-one states have Secretaries of State Boards of Agriculture, and twelve states have Secretaries of State Agricultural Societies.

FARMERS' INSTITUTE MANAGERS.

There is a National Association of Farmers' Institute Managers with John Hamilton of Harrisburg, Pa., president, and F. W. Taylor, Lincoln, Neb., secretary.

PROTECTION AGAINST CONTAGION FROM FOREIGN CATTLE.

An act of Congress of August 28, 1894, prohibits the importation of cattle and cattle hides, but by the act of March 2, 1895, making appropriations for the Department of Agriculture, it is provided that the prohibition may be suspended by the President whenever the Secretary of Agriculture shall certify to the President what countries or parts of countries are free from contagious or infectious diseases of domestic animals. The President, by proclamation of November 8, 1895, lifted the embargo with reference to Norway, Sweden, Holland, Great Britain, Ireland, the Channel Islands, and the countries of North, Central, and South America so as to admit cattle under sanitary regulations prescribed by the Secretary of Agriculture; also from all countries so as to admit hides under regulations prescribed by the Secretary of the Treasury.

CATTLE BREEDERS' ASSOCIATIONS.*

American Aberdeen-Angus Breeders' Association.—Thomas McFarlane, Harvey, Ill., secretary.

American Devon Cattle Club.—L. P. Sission, Wheeling, W. Va., secretary.

American Galloway Breeders' Association.—Frank B. Hearne, Independence, Mo., secretary.

American Guernsey Cattle Club.—Prof. William H. Caldwell, Peterboro, N. H., secretary.

American Hereford Cattle Breeders' Association.—C. R. Thomas, Independence, Mo., secretary.

American Jersey Cattle Club.—J. J. Hemingway, No. 8 West Seventeenth street, New York, N. Y., secretary.

American Polled Durham Breeders' Association.—J. H. Miller, Mexico, Ind., secretary.

American Shorthorn Breeders' Association.—J. H. Pickrell, Springfield, Ill., secretary.

American Sussex Association.—Overton Lea, Nashville, Tenn., secretary.

Ayrshire Breeders' Association.—C. M. Winslow, Brandon, Vt., secretary.

Brown Swiss Cattle Breeders' Association.—N. S. Fish, Groton, Conn., secretary.

* Under the provisions of paragraph 473 of the act of July 24, 1897, any animal imported specially for breeding purposes shall be admitted free, provided that no such animal be admitted free unless pure bred, of a recognized breed, and duly registered in the book of record established for that breed.

The Secretary of the Treasury, upon the advice of the Secretary of Agriculture, issued, on August 19, 1898, regulations for the importation of animals under this law, and designated the recognized breeds and the books of record established for these breeds.

Dutch Belted Cattle Association.—H. B. Richards, Easton, Pa., secretary.

Holstein-Friesian Association of America.—Frederick L. Houghton, Brattleboro, Vt., secretary.

Red Polled Cattle Club of America (incorporated).—J. McLain Smith, Dayton, Ohio, secretary.

SHEEP BREEDERS' ASSOCIATIONS.

National Cheviot Sheep Society.—Howard H. Keim, Ladoga, Ind., secretary.

American Cotswold Association.—George Harding, Waukesha, Wis., secretary.

American Leicester Breeders' Association.—A. J. Temple, Cameron, Ill., secretary.

American Lincoln Breeders' Association.—L. C. Graham, Cameron, Ill., secretary.

American Merino Sheep Register.—A. H. Craig, Waukesha, Wis., secretary.

American Oxford-Down Sheep Association.—W. A. Shafor, Middletown, Ohio, secretary.

American South-Down Association.—John G. Springer, Springfield, Ill., secretary.

American Shropshire Registry Association.—Mortimer Levering, Lafayette, Ind., secretary.

American Rambouillet Sheep Breeders' Association.—E. V. Burnham, Woodstock, Ohio, secretary.

Delaine Merino Sheep Breeders' Association.—J. C. McNary, Houstonville, Pa., recording secretary; J. H. Hamilton, Canonsburg, Pa., corresponding secretary.

Dorset Horn Sheep Breeders' Association of America.—M. A. Cooper, Washington, Pa., secretary.

Hampshire-Down Breeders' Association of America.—John I. Gordon, Mercer, Pa., secretary.

Improved Black-Top Merino Sheep Breeders' Association.—L. M. Crothers, Crothers, Pa., secretary.

Standard American Merino Register Association.—John P. Ray, Hemlock Lake, N. Y., secretary.

SWINE BREEDERS' ASSOCIATIONS.

American Berkshire Association.—Charles F. Mills, 512 East Monroe street, Springfield, Ill., secretary.

American Duroc-Jersey Swine Breeders' Association.—A. V. Bradrick, Connersville, Ind., secretary.

American Essex Association.—F. M. Srout, McLean, Ill., secretary.

American Small Yorkshire Club.—George W. Harris, 3409 Third avenue, New York, N. Y., secretary.

Cheshire Swine Breeders' Association.—E. W. Davis, Oneida, N. Y., secretary.

American Chester White Record Association.—Carl Freigau, Dayton, Ohio, editor.

American Poland-China Record Company.—W. M. McFadden, West Liberty, Iowa, secretary.

Ohio Poland-China Record Company.—Carl Freigau, Dayton, Ohio, secretary.

Standard Poland-China Record Company.—Ira K. Alderman, Maryville, Mo., secretary.

Victoria Swine Breeders' Association.—H. Davis, Dyer, Ind., secretary.

Suffolk Swine Association.—W. F. Watson, Winchester, Ind., secretary.

The American Tamworth Swine Record Association.—Edwin O. Wood, Flint, Mich., secretary.

The American Yorkshire Club.—William F. Wilcox, Benson, Minn., secretary.

POULTRY ASSOCIATIONS.

National and Interstate Organizations.

Name of Association.	Secretary.	Post Office.
American Barred Plymouth Rock Club	F. J. Marshall	Middletown, Ohio.
American Dorking Club	F. H. Prentice	North Grafton, Mass.
American Buff Leghorn Club	E. P. Shepherd	Croton Falls, N. Y.
American Buff Plymouth Rock Club	W. C. Denny	Rochester, N. Y.
American Black Minorca Club	John A. Gamewell	Hackensack, N. J.
American Cochin Club	Arthur R. Sharp	Taunton, Mass.
American Cochin Bantam Club	H. S. Ball	Shrewsbury, Mass.
American Dominique Club	R. W. Roberts	Camroden, N. Y.
American Exhibition Game and Game Bantam Club	S. Ward Doubleday	44 Wall Street, New York City.
American Langshan Club	R. T. Nettle	Peoria, Ill.
American Leghorn Club	Ezra Cornell	Ithaca, N. Y.
American Minorca Association	Ed Ellis	Santa Rosa, Cal.
American Poultry Association	Theodore Sternberg	Ellsworth, Kan.
American White Wonder Club	A. P. Roscoe	Newhaven, Vt.
Eastern White Wyandotte Club	W. E. Mock	Woodstock, Vt.
Indian Game Club of America	Adam Thompson	Amity, Mo.
New England Light Brahma Club	G. W. Cromack	Stoneham, Mass.

PATRONS OF HUSBANDRY.

National Officers.

Master, Aaron Jones, South Bend, Ind.; overseer, O. H. Hale, North Stockholm, N. Y.; lecturer, Alpha Messer, Rochester, Vt.; treasurer, Mrs. E. S. McDowell, Columbus, Ohio; secretary, John Trimble, No. 514 F street NW., Washington, D. C.; executive committee, N. J. Bachelder, Concord, N. H.; J. J. Woodman, Paw Paw, Mich.; S. H. Messick, Bridgeville, Del.; ex officio, Aaron Jones, South Bend, Ind.

MASTER AND OTHER OFFICERS OF MAINE STATE GRANGE.

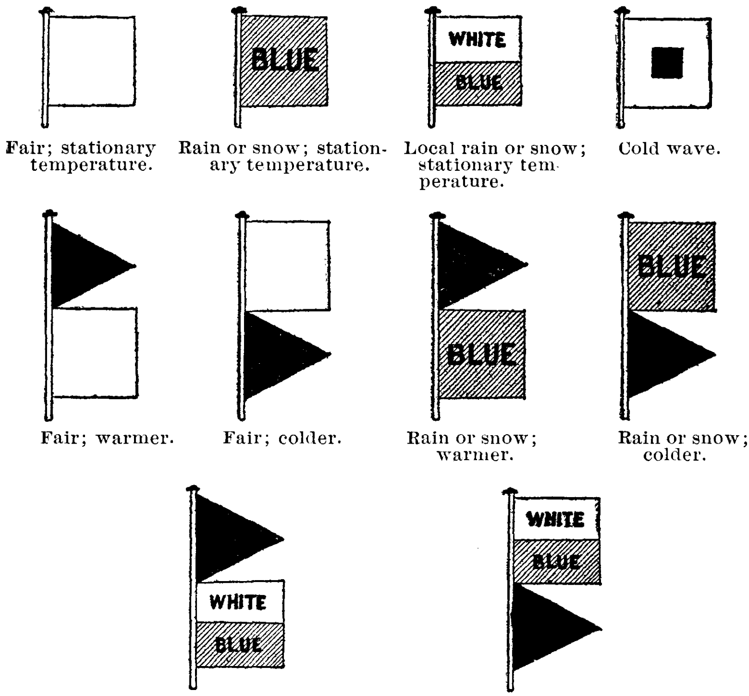
Obadiah Gardner, Rockland, Master; Elijah Cook, Vassalboro, Lecturer; M. B. Hunt, Center Belmont, Treasurer; E. H. Libby, Dirigo, Secretary. Date of annual meeting, third Tuesday in December.

FARMERS' NATIONAL CONGRESS.

President, Hon. W. D. Hoard, Fort Atkinson, Wis.; Secretary, John Stahl, 4328, Langley Ave., Chicago, Ill.

WEATHER BUREAU SIGNALS.

The following illustrations (Fig. 135) show how flags are used in the weather service to convey information of forecasts. They are self-explanatory.



Fair; stationary temperature. Rain or snow; stationary temperature. Local rain or snow; stationary temperature. Cold wave.

Fair; warmer. Fair; colder. Rain or snow; warmer. Rain or snow; colder.

Local rain or snow; warmer. Local rain or snow; colder.

FIG. 135.—Temperature and rainfall signals.

Recent extension of the publication of United States weather forecasts has been largely through coöperation with the post-offices of the country. An arrangement was made in 1895 by which daily telegraph reports of weather forecasts began to be sent to postmasters at distributing offices. The forecasts were bulletined in these offices and sent out by cards to outlying post-offices. This plan has been taken up extensively by postmasters and weather forecasts are now sent to several hundred post offices that are reached by wire.

Weather forecasts can be obtained anywhere that wires run by payment for transmission of dispatches and for material for signaling or other method of announcement. Where evidence is supplied that value of the service to the public will warrant the expense, flags will be supplied and telegraph service paid for by the Weather Bureau. Where such an extension of the service is desired a letter should be addressed to the Chief of the Weather Bureau in Washington or to the chief office of the section in which the new station is desired, and each case will be considered and disposed of on its merits.

Another method of supplying information as to weather probabilities is by means of whistle signals. One long whistle, fifteen to twenty seconds, calls attention to the fact that a weather signal is about to be given. Then very short blasts, one to three seconds each, indicate the probable change in temperature; while a series of long whistles, four to six seconds each, tell whether it will be fair or "falling" weather. One short blast means colder; two, warmer; three, cold wave. One long blast means fair weather; two, rain or snow; three, local rain or snow. By repeating each combination a few times at intervals of ten seconds possibility of error from failure to hear the warning signal or other cause may be avoided.

A system of whistle signals is in use at present by the Florida Central Railroad through the truck-growing section of that state. It has been found to be very useful in giving warning of cold waves and frosts.

ACREAGE, PRODUCTION, VALUE AND DISPOSITION OF SOME CROPS GROWN IN MAINE IN 1898.

Corn, acres, 10,893; bushels, 435,720; value, $209,146. All retained and consumed in the county where grown.

Wheat, acres, 1,808; bushels, 35,256; value, $31,378. All retained and consumed in county where grown.

Oats, acres, 140,217; bushels, 5,047,812; value, $1,716,256; 4,795,421 bushels retained and consumed in county where grown, 252,391 bushels shipped out of county where grown.

AVERAGE YIELD PER ACRE OF SOME CROPS GROWN IN MAINE IN 1898.

Corn, 40 bushels; *wheat,* 19.5 bushels; *oats,* 36 bushels; *barley,* 27 bushels; *hay,* 1.20 tons.

NUMBER, AVERAGE PRICE, AND TOTAL VALUE OF FARM ANIMALS IN MAINE ON JANUARY 1, 1899.

Horses, number, 111,987; average price, $52.29; value, $5,855,722; *Cows,* number, 197,878; average price, $30.50; value, $6,035,279. *All cattle other than cows,* number, 109,440; average price, $25.84; value, $2,827,762. *Sheep,* number, 246,-628; average price, $3.07; value, $758,381. *Swine,* number, 75,306; average price, $8.20; value, $617,509. Total value of all live stock, $16,094,653.

FOURTEENTH ANNUAL REPORT

OF THE

Maine Agricultural Experiment Station

ORONO, MAINE

1898.

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 Fourteenth Annual Report of the Maine Agricultural Experiment Station for the year ending December 31, 1898.

CHARLES D. WOODS,
Director.

ORONO, Maine, December 31, 1898.

MAINE

AGRICULTURAL EXPERIMENT STATION

ORONO, MAINE.

THE STATION COUNCIL.

THE STATION STAFF.

THE PRESIDENT OF THE UNIVERSITY.

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, 1887, Congress passed an act establishing experiment stations in the several states. The Maine Legislature of 1887 accepted this grant and made the Maine Agricultural Experiment Station as it now is.

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.

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. Visitors to the Station can take the electric cars at Bangor and Old Town.

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.*

ACKOWLEDGMENTS.

Acknowledgment is hereby made for the following gifts to the Station during 1898:

Corn Germs—Glucose Sugar Refining Co., Chicago, Ill.

Gluten Feed—Glucose Sugar Refining Co., Chicago, Ill.

Seeds of Vetch, Peas, and Sunflower; Cherry Pits; Scions, Plants and Apple Trees; Currant and Raspberry Cuttings,—Cook's Inlet, Alaska; Cranberry Plants from Sitka, Alaska—United States Dept. of Agriculture.

"Sample" Strawberry Plants—C. S. Pratt, Reading, Mass.

Apple Scions—Jules Lagacé, Upper Frenchville, Me.

Scythes—Nolin Manufacturing Co.

Green Arsenite—Adler Color & Chemical Works, New York City.

Laurel Green—Nichols Chemical Company, Syracuse, N. Y.

Skabcura—Skabcura Dip Co., St. Louis, Mo.

Nikoteen—Skabcura Dip Co., St. Louis, Mo.

Silicate and Muriate of Potash—German Kali Works, New York City.

"Diamond Crystal" Salt—Genesee Salt Company.

Champion Milk Cooler and Aerator.

Facile Babcock Apparatus.

Excelsior Incubator.—J. H. Stahl, Quincy, Ill.

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 Dairyman, New York City.

American Fertilizer, Philadelphia, Pa.

American Florist, Chicago, Ill.

American Grange Bulletin, Cincinnati, Ohio.

American Grocer, New York City.

American Miller, Chicago, Ill.

Baltimore Weekly Sun, Baltimore, Md.

Bangor Weekly Commercial, 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, Furnace and Factory, Roanoke, Va.
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 Home, Springfield, Ill.
Farmers' Tribune, Des Moines, Iowa.
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 Friesian Register, Brattleboro, Vt.
Homestead, Des Moines, Iowa.
Horticultural Visitor, Kinmundy, Ill.
Independent Democrat, Morgan City, La.
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.
Mark Lane's Express, London, England.
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 Farmer and Stock Grower, National Stock Yards, Ill.
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.
Northwestern Miller, Minneapolis, Minn.
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.
Ruralist, Gluckheim, Md.
Rural Californian, Los Angeles, Cal.
Rural Canadian, Toronto, Ont.
Rural Helper, York, Nebraska.
Rural New-Yorker, New York City.
Southern Farm Magazine, Baltimore, Md.
Southern Farmer, New Orleans, La.
Southern Planter, Richmond, Va.
Southern States, Baltimore, Md.
Southwestern Farmer, Wichita, Kans.
Strawberry Specialist, Kittrell, N. C.
Sugar Beet, Philadelphia, Pa.
Turf, Farm and Home, Waterville, Me.
Vick's Magazine, Rochester, N. Y.
Wallace's Farmer, Des Moines, Iowa.
Western Agriculturist, Chicago, Ill.
Western Creamery, San Francisco, Cal.
Western Fruit Grower, St. Joseph, Mo.
The World, Vancouver, B. C.

[Reprints of Bulletins issued in 1898.]

BULLETIN NO. 41.

DEHORNING COWS.

G. M. GOWELL AND F. L. RUSSELL.

In this country dehorning of cattle has been practiced to a considerable extent for about ten years and in England for a longer time. At first the methods used were very crude. The animal had to be closely confined and the horns were removed with a saw, which required considerable time and must have been very painful to the animal. Occasionally even now horns are removed with a saw but the common practice is to use specially constructed clippers, which do the work better in every way. Almost no apparatus is required to confine the animals and one stroke of the clippers removes a horn, frequently in a single second of time and with comparatively little pain. The operation has become so simple, that, in view of the very manifest advantages resulting from it, it is not strange that it is coming to be very generally adopted. Horns are no longer needed by cattle as weapons of defence against natural enemies and serve no good purpose.

EXPERT OPINION OF DEHORNING.

Dehorning is practiced at several experiment stations in this country and the published results indicate that the pain suffered by the animals is not to be compared with injuries which cattle inflict on each other with their horns. The Texas Station finds "that a drove of the wildest dehorned cattle may run loose together in a building like a flock of sheep, and they will fatten faster after dehorning than before."

In Bulletin 54 of the Cornell Station, Professor Roberts gives quite a full account of the history of dehorning. He says it has been found to be of great practical utility in rendering animals more docile and quiet, in rendering them much less capable of injuring each other or mankind, and in reducing the space necessary for safe housing and shipping.

The following is quoted from the above named bulletin: "In Canada the Ontario government appointed a commission 'To obtain the fullest information in reference to the practice recently introduced into this province of dehorning cattle, and to make full inquiry into and report the reasons for and against the practice.'

"Evidence was received from the representatives of all the interests affected by the practice, including farmers, dairymen, drovers, exporters, wholesale and retail butchers, cattle market attendants, tanners, hide merchants, veterinary surgeons, medical practitioners and members of humane societies,—ninety-eight in all.

"Of the farmers examined, nearly seventy in number, all who had either performed or seen the operation performed, with three or four exceptions, were strongely in favor of it, the majority stating that they were prejudiced against it on the grounds of cruelty until they gained a practical knowledge of it. Of the farmers opposed to the practice, not more than three or four had ever seen the operation, but they thought it cruel and unnecessary.

"Evidence as to the loss caused by animals using their horns upon each other was given by cattle buyers and others in frequent attendance at the cattle market, and also by butchers and tanners.

"Among veterinary surgeons a considerable conflict of opinion was found to exist. As in the case of the farmers, those who had seen the operation and observed its effects were in favor of it, while those who had not seen it were opposed to it.

"Indeed, as regards all the evidence received by the commission, it might almost be given as the rule that where the operation was properly and skillfully performed, those witnessing it, however prejudiced before, became converts to it, while the great bulk of the opposition came from parties not acquainted with the operation, and who entertained exaggerated ideas as to its severity.

"In no case were witnesses able to refer to an instance where a farmer was dissatisfied with the results or willing to give up his right to continue the practice, after having performed the operation.

"In addition to the evidence as to the amount of pain involved in the operation, much evidence was received as to the commercial advantages accruing from the operation, and emphasizing the point that a great deal of suffering is prevented by the removal of the horns."

As a result of the inquiry the commission unanimously recommended that the practice of dehorning be permitted and encouraged.

DEHORNING AT THE MAINE STATION.

Part of the Station herd were hornless; the remainder were dehorned to secure a greater degree of quiet among the animals when all alike were dehorned, and to lessen the danger of injury to each other and the attendants.

While the Station has never lost an animal from goring, we have at several different times had animals severely injured, and not a season passes but some of the herd are marked by the sharp horns of their companions. In winter, when the animals are turned into the yards for exercise, their exuberance of spirits and love of frolic sometimes carry them so far as to cause them to chastise each other severely. The most serious trouble occurs during fly time when animals, desperate from the annoyance of the winged pests, rush among their mates, hooking right and left, and showing no mercy in their momentary frenzy.

For the last three years the calves born in the Station herd have been dehorned when young by the use of caustic potash. The dehorning has been done as soon as the buttons could be felt, and not later than twenty days from birth. Calves dehorned at this age have never yet shown any horns. One, dehorned when thirty-five days old, developed dwarfed horns an inch or an inch and a half long.

Dehorning with potash is done by clipping the hair away from around the buttons, moistening the end of the potash slightly, and rubbing one embryo horn for four or five seconds, then moistening the potash again and rubbing the other horn in the same manner. Each horn should be thus treated four or five times. Four or five minutes' time is required in dehorning a calf. Care should be taken not to have too much moisture about the potash as it might spread and remove the hair from too large a surface. The calf should be kept from getting wet during the next few days for the same reason. Healing soon follows the operation and smooth polls have resulted in every case except the one mentioned as having been done at too late an age.

The eleventh of last June, all of the cows in the herd with horns were dehorned. All the wounds bled at the time of the operation. Two bled considerably for about an hour and slightly for another hour, but no animal gave evidence of suffering from loss of blood. The operation was evidently painful to the animals. The period of pain appeared to be limited to the time when the clipper was in process of closing, which was at most but a few seconds in each case. After being released the animals went about the paddock as usual, and an hour or two later, when they were put into the barn, they ate their dinner as though nothing unusual had taken place.

The milk yield showed no appreciable decrease, even on the days immediately following the operation. As it was not intended, at the time, to prepare a bulletin upon the subject, the daily milk records were destroyed after being credited upon the monthly account, consequently they cannot be presented here.

On page 17 are presented the monthly milk and fat yields of all the cows from May to August, inclusive, that the reader may have the data relative to the thrift and condition of the animals since the operation. As will be seen in the table, most of the animals were well advanced in the period of lactation. The shrinkage in milk flow and butter yield is for the most part less than would be usually expected from advancement in period of lactation. The dehorning apparently had no effect upon either milk flow or yield of butter fat.

Our experience is in accord with that elsewhere. The Minnesota Station compared the yield of milk and butter fat of nine cows for three milkings before dehorning with the yield of the same cows for three milkings after dehorning. A very slight decrease was noticed. That even this small decrease was due to other causes than dehorning is indicated from the fact that the relative decrease in the milk and fat yield was greater in the case of six cows that were not dehorned.

Yields of milk and butter fat for two months before and two months after dehorning, and for the month of June in which the cows were dehorned.

	Breed.	Age—years.	Months since last calf.	Months till due to calve.	April—lbs.	May—lbs.	June—lbs.	July—lbs.	August—lbs.
LOBLITOP	Jersey	9	9	4					
Milk yield					637	672	713	643	559
Butter fat					27.4	28.2	34.2	30.9	26.3
ROSE	Jersey	10	9	5					
Milk yield					584	598	587	567	555
Butter fat					28.7	23.9	28.7	26.7	26.7
ADDIE S	Jersey	8	9	4					
Milk yield					464	452	465	262	163
Butter fat					23.2	18.1	23.3	12.3	3.1
HOPE	Jersey	6	8	4					
Milk yield					399	400	343	334	293
Butter fat					21.6	20.8	18.8	18.4	16.8
TULIP	Jersey	6	5	7					
Milk yield					826	789	759	693	640
Butter fat					45.5	39.4	42.5	34.6	32.0
RUTH	Jersey	5	8	6					
Milk yield					567	577	582	534	472
Butter fat					26.1	28.3	30.8	33.7	26.4
PANSY	Jersey	7	3	10					
Milk yield					268	719	673	644	645
Butter fat					9.4	25.2	33.6	30.9	33.5
ORLETTA	Jersey	10	8	5					
Milk yield					522	560	552	502	420
Butter fat					25.6	25.8	26.5	26.1	23.5
LOBTY	Jersey	4	13	5					
Milk yield					236	237	236	198	120
Butter fat					10.4	13.2	13.0	11.5	7.1
DUDLEY	Jersey	7	19	*					
Milk yield					487	485	355	19	720
Butter fat					24.9	24.3	19.2	.7	28.8
TURNER	Jersey	8	7	5					
Milk yield					531	563	543	453	401
Butter fat					22.3	23.7	23.9	21.7	18.5
ADLE	Jersey	5	2	10					
Milk yield					56	653	709	676	682
Butter fat					4.2	33.3	41.1	36.5	38.2
LOTTIE	Jersey	10	8	†					
Milk yield					548	546	554	516	579
Butter fat					31.7	30.6	32.1	28.9	31.9
MADALINE	Jersey	9	3	10					
Milk yield					1,108	975	879	840	825
Butter fat					46.6	41.0	35.0	33.6	31.3
HUNTON	Holstein	9	4	†					
Milk yield					513	972	880	846	798
Butter fat					18.0	33.0	35.2	33.9	33.5
FATAMIE	Holstein	9	3	†					
Milk yield					1,095	926	765	812	852
Butter fat					38.3	31.4	26.0	29.2	30.7
DUPLICATE	Jersey	2	3	†					
Milk yield					513	486	455	432	378
Butter fat					23.6	25.3	21.8	20.3	18.5

*Calved July 27, 1897. †Not with calf.

In Bulletin No. 37 of the Cornell Experiment Station the statement is made that with an experience of six or seven years in dehorning, although the operation has usually been performed by inexperienced persons, no ill effects have followed. A comparison of the milk yield of five dehorned cows and seven cows not dehorned indicates that the dehorning did not reduce the yield.

CONCLUSIONS IN REGARD TO DEHORNING CATTLE.

1. Dehorning is to be recommended because dehorned cattle are more easily cared for than those with horns, and because dehorned cattle enjoy life better. "A great deal of suffering is prevented by the removal of horns."

2. The best time to dehorn cattle is during cold weather when there will be no trouble from flies.

3. To dehorn mature animals, clippers should be used that will remove the horn perfectly at a single stroke and in a moment of time.

4. With suitable clippers properly used, the operation is simple and very quickly performed.

5. When it is skillfully performed, animals do not give evidence of great suffering as an effect of dehorning. The tissues injured in dehorning are not very well supplied with nerves and they are quickly cut through. Good evidence that dehorning is not very painful is the fact that cattle will resume feeding immediately after being operated on, and the yield of milk in cows is not preceptibly affected. Compared with castration of colts and calves, dehorning may be considered painless.

6. Those who are familiar with the operation of dehorning and the results of it are its most enthusiastic advocates.

7. To prevent the growth of horns, calves under three weeks of age can have the embryo horns removed with one stroke of a sharp knife, or they can be treated with a caustic sufficiently powerful to destroy them.

8. In the past, efforts have frequently been made to prevent the practice of dehorning on the ground that it caused needless pain. It would seem to us that efforts can now better be expended by endeavoring to have the last relic of a horn removed from our domestic cattle, who ceased to need them when they

came under the protection of man. Horns may sometimes be ornamental, but it is evident that they are usually useless, expensive and dangerous luxuries.

BULLETIN NO. 42.

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.

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 wind breaks, 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.

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, but a very good machine can be procured for $5, and the labor of mowing in this way is very light.

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. I go to one place and the blaze of color is enough to blind one. Red reigns supreme! Geraniums, salvias and coleus vie with hollyhocks, phlox and poppies in the effort to dazzle the beholder, while possibly nasturtiums and zinnias endeavor to add color to the scene.

A neighbor may be of a sunny nature; in which case the yellows predominate. Buttercups, marigolds and sunflowers hold sway. Perhaps to please an odd fancy, yellow sweet sultan holds a place in one corner and golden button timidly holds up its head in the background, while tiger lily and hemerocallis dispute the right to exclusiveness.

Possibly a third neighbor is inclined to have the "blues," and then we find asters and larkspurs, bachelor's buttons, day lilies, irises and tradescantia galore.

How much better the effect would be if these different colors could be united and toned down, not thrown together in crazy patchwork, but harmonized. In general the "flower garden" should be at one side and a little to the rear of the house rather than directly in front. One suggestion with reference to the display of taste in arranging flowers should be made. 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 over-dressed 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, the 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 spiræas—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 spiræas—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, hyacinth, 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.

In removing plants from the nursery, many of the roots will necessarily be injured, rendering the plant unable to supply the moisture lost by evaporation from the leaf surface. Hence the top of the tree or shrub should be severely cut back at the time of transplanting.

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 about 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.

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.

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 Canadenis*, 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 augustifolia*, 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 (*Virburnum acerifolium*, L.).
Dogwood, Red Osier (*Cornus stolonifera*, Michx.).
Elder, Common or Black E. (*Sambucus Canadenis*, L.).
Red E. (*Sambucus racemosus*, L.). (?)
High-bush Cranberry (*Viburnum Opulus*, L.).
Hobble-bush (*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.).

BULLETIN NO. 43.
FERTILIZER INSPECTION, 1898.

The bulletin gave an outline 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. 44.
FEEDING STUFF INSPECTION.

This bulletin gave the analyses of samples of feeding stuffs coming under the law, collected during January and March, 1898. The figures, so far as they are of permanent value, will be found under "Inspection for 1898" beyond.

BULLETIN NO. 45.
FERTILIZER INSPECTION, 1897.

The bulletin gave the manufacturer's guarantees and the analyses of samples collected by the Station, but as these figures are of only passing value they are omitted here. Under "Inspections for 1898," beyond, the requirements of the law and the way it was observed during the year are given.

BULLETIN No. 46.

SOME ORNAMENTAL PLANTS FOR MAINE.

W. M. MUNSON.

The ornamentation of rural homes is of the highest importance to the people of Maine, not only as a means of adding to the comfort and pleasure of the home life, but as an attraction for the increasing numbers of summer visitors and as a means of enhancing the value of farm property.

Concerning methods of planting and culture of trees and shrubs, but little need be said at this time. Some notes have been published by the Station in Bulletin 42.

In general it may be said that to get satisfactory results, shrubs and other flowering plants should receive as good treatment as corn and potatoes. When once established, shrubs and perennial herbs require much less care than do annuals, but during the first year or so, careful attention will be well repaid.

In determining what to plant, several points must be considered: First of all, the plant must be hardy. Some of the finest shrubs of Massachusetts and New York are utterly unsuited for the climate of Maine. For this reason the use of native plants is to be recommended so far as possible, and few exotics are superior to the common viburnums, dogwoods, elders, sumachs and laurels. Other points to be considered are: season, habit, beauty of foliage, flower and fruit. If possible, such a selection should be made as will afford a succession of bloom or other attractive qualities through the season. For instance, among flowering shrubs, the earlier spiræas, may be followed by double flowering plum, Tartarian honeysuckle, and Japan quince, these in turn by lilacs, weigela, and later by roses, mock orange and hydrangea. To this list may be added the common high bush cranberry and the dwarf Juneberry or shadbush from the pasture.

For beauty of foliage, the golden elder and the golden syringa are unsurpassed. Purple berberry, (*Spiræa Thunbergii,*) and the common staghorn sumach are also to be recommended. The last is specially valuable for its rich coloring in the fall. For the best effects it should be planted in masses, on rich soil, and cut to the ground each year. It will then grow up six to eight feet each season, and give a rich tropical effect. Other native plants which may be mentioned in this connection, are the thimble berry (*Rubus odoratus*), valuable alike for flower and foliage; hobblebush (*Viburnum lantanoides*), with its large, rich, green leaves; dogwood or red osier (*Cornus stolonifera*), which is specially valuable in winter for the contrast afforded by the bright red shoots.

Of shrubs valuable for their fruit, we may name Tartarian honeysuckle, the strawberry bush (*Euonymus*), *Rosa rugosa*, snowberry (*Symphoricarpus*), high-bush cranberry (*Viburnum opulus*), black alder or winterberry (*Ilex verticillata*). The last two may be obtained from the woods and swamps in many sections of the State.

SOME OF THE BEST TREES.

The trees named below have been growing on the University campus for several years and have proved reliable in this section of the State.

The Elm: Several species of elms are found in New England but the most valuable for ornamental purposes is the native white or American elm, (*Ulmus Americana*), which has justly been called "Queen of American Trees." A somewhat moist location is best suited for this species, which, where uninjured, grows very rapidly and is of most attractive form and habit. The English elm (*Ulmus campestris*), is somewhat larger than the American species and is of very different habit—in this respect resembling the oaks. The leaves are smaller, more regularly cut, and darker; the bark is also darker colored. The Scotch or Wych elm (*Ulmus montana*), is one of the most valuable of the foreign species, but it is little known in this country. There are on the University campus some interesting hybrids between this and the American species.

The Maple: The maples are among the most valuable and popular of trees for ornamental planting. The sugar maple (*Acer saccharinum*) is too well known to require description. It is most at home, and grows most rapidly, on gravelly soil. The white or silver maple (*Acer dasycarpum*) is not quite as early in leaf as the sugar maple, nor is the general appearance so pleasing. It is, however, of very rapid growth and will thrive in a variety of soils. A variety of this species, Wier's cut leaved weeping maple, is also valuable. The red or scarlet maple (*Acer rubrum*) is not so widely planted as its merits deserve. Like the silver maple, it grows naturally on low wet ground, but it will thrive in any soil or situation. Its bright red buds in spring and its scarlet foliage in fall, combine to make it specially desirable. All of the maples named, except Wier's, are to be found growing wild in the forests throughout the State.

The Beech: Although of very different style, the beech (*Fagus ferruginea*) ranks with the elm as a hardy and attractive ornamental tree. Its roots grow near the surface and it will thrive in rocky soil.

The Chestnut: The native chestnut (*Castanea Americana*), one of the glories of the rocky hill-sides of Southern New England, is perfectly hardy in Maine and is well worthy of attention. It is particularly adapted to rocky situations or loose gravelly soils. The horse chestnut (*Æsculus Hippocastanum*) is hardy and grows rapidly. It is valuable for planting by the roadside.

The Linden: The American linden or basswood, (*Tilia Americana*), is valuable for use where an immediate effect is desired. It is hardy, of good form, and grows rapidly. The European species (*Tilia Europæa*), is of smaller size and has smaller, darker foliage than the other.

The Birch: The lightness, grace and delicacy of the birches commend them to the attention of every planter. The cut-leaved weeping birch (*Betula Alba* var.) is a general favorite wherever planted. The American species start into leaf very early in the spring and many of them will grow under the most untoward circumstances. The best are the black or cherry birch (*Betula lenta*), the yellow (*B. lutea*), and the gray (*B. populifolia.*)

The Poplars: The poplars are all rapid growers and are valuable for giving an immediate effect—some species often making a growth of six feet in a single year. All are short lived, however, and their greatest beauty is attained while young.

The Oak: While oaks which have attained large size are among the most attractive of trees, the finest species are late in leaf and of slow growth. The most valuable native species are the white oak, *Quercus alba,* and the scarlet oak, *Quercus coccinea.*

THE MOST VALUABLE SHRUBS.

The number of flowering shrubs which will thrive in Maine is comparatively limited. The following have proved satisfactory on the grounds of the University for several years. It is worthy of note that the shrubs which are the most commonly known, and that may be obtained the cheapest, are generally the best, or have the greatest number of good qualities.

The Spiræa: Of the spiræas, the best are *S. Thunbergii* and *S. Van Houttei.* The first has narrow yellowish green leaves and blossoms very early in the spring, before the leaves are fully out. The other blooms about the middle of June and is specially valuable. The flowers are white and appear in great profusion. *S. Reevesii* is similar to the Van Houttei, but a little earlier. *S. Bumalda* is one of the best pink varieties. It commences to bloom about the middle of June and continues all summer. *S. Prunifolia,* "Bridal Wreath," is another very good white variety; one of the earliest.

The Lilac: This old favorite is again popular. Some of the newer named varieties which are specially good are the following: *Syringa vulgaris,* the true old garden lilac, has varied greatly under cultivation and there are now more than twenty-five named varieties of this species. Some of the best of these are Charles X, Louis Spath, Princess Marie and Senator Vollard, among the purples; and Marie Legraye, and Dr. Stockhardt among the whites. *Syringa Persica,* the Persian lilac, has loose graceful heads of flowers in great profusion. The habit of the plant, as well as of the flower cluster, is more open and graceful than that of the common lilac. The white form is specially valuable. *Syringa Josikæa* is a very distinct species with large, shining foliage and dark, lilac colored flowers. It blooms after many others are out of flower. *Syringa Rothmagensis* is similar in habit to the Persian lilac, but the flowers are dark, reddish purple. It is said to be a cross between *Syringa vulgaris* and *Syringa Persica.*

The Viburnum: Besides the old fashioned snowball, *Viburnum opulus,* var. *sterilis,* which is always popular and needs no description, the best are: *Viburnum Nepalense,* which is a strong grower, though of compact form, and having large, thick leaves; *Viburnum prunifolium,* "black haw," a large growing shrub, bearing flat clusters of white flowers early in June, followed by black fruit in the fall; also the maple leaved virburnum (*V. acerifolium*), a low growing shrub, bearing flat heads of white flowers about the middle of June. The last is excellent for growing in masses, especially in shady places. The Japanese snowball (*Viburnum plicatum*) is one of the best of shrubs. Of upright bushy growth, firm dark foliage, and bearing its white flowers in great profusion, it well deserves a place in every collection. It is in many ways much superior to the old snowball, one special point in its favor being its freedom from lice.

The Mock Orange: The mock orange or "syringa" (*Philadelphus*) is one of the finest of shrubs, whether grown singly or in masses. It is hardy, early in leaf, and graceful in habit. *Philadelphus coronarius* is the one most commonly grown, and it has fragrant orange-like flowers, which appear late in June in this locality. *P. Zeyheri* is more vigorous and has larger, but less fragrant and less abundant flowers than the preceding. Gordon's syringa, *P. Gordonii,* somewhat smaller and more slender than the others, blooms a month later but its flowers, though large, are scentless.

Some other shrubs which have proved valuable at the University are: bladder senna (*Colutea*), flowering currant (*Ribes aureum* and *R. Gordonii*), Japanese rose (*Rosa rugosa*), golden elder, (*Sambucus canadensis aurea*), thimble berry (*Rubus odoratus*), tartarian honeysuckle (*Lonicera Tartarica*), weigela (*Diervilla florida*), white fringe (*Chionanthus Virginica*), and the hydrangeas (*H. paniculata grandiflora* and *H. vestita*).

TRIED AND FOUND WANTING, OR OF DOUBTFUL VALUE.

Among the trees and shrubs which thus far have proved unsatisfactory in Eastern Maine, the following may be mentioned: green ash (*Fraxinus viridis*); the magnolias, except *Magnolia Soulangeana;* the Japanese chestnuts; tamarisk (*Tamarix Africana* (?); cornelian cherry (*Cornus mas*); (Deutzia) (*Deutzia scabra* and *D. gracilis*); golden bell (*Forsythia*); burning bush (*Rhus cotinus*).

A FEW HERBACEOUS PERENNIALS.

The number of herbaceous perennials commonly grown in this State is comparatively limited; some of the most valuable, however, are the peony, iris, lily-of-the-valley, bleeding heart (*Dicentra*), and foxglove.

The peony, *Pæonia officinalis,* is specially valuable when planted in masses. It gives a profusion of bloom about the middle of June, and is perfectly hardy. It is valuable alike for landscape effects and for cut flowers. There are more than a hundred named varieties, but for ordinary purposes unnamed sorts answer very well and are much less expensive.

For a short time in early June, before the peonies appear, the varieties of *Iris Kæmpferi* are specially valuable. Like the peony, and most other herbaceous perennials, this should be planted in September.

Among the plants which bloom very early in the spring, Christmas rose (*Helleborus niger*), and "bleeding heart" (*Dicentra*), should not be forgotten. Feverfew or pyrethrum, (*Chrysanthemum Parthenium,*) is another plant that should be in every collection. Its pure white double flowers, contrasting with the delicately cut foliage, add much to the border. The tall pyrethrum, (*Chrysanthemum uliginosum* or *Pyrethrum uliginosum*), which blooms in September, is also a valuable plant. It grows about three or four feet high and its large daisy-like flowers are very conspicuous. It is a vigorous grower and may readily be propagated by dividing the clump.

The gas plant (*Fraxinella*) should not be omitted from the list of useful perennials. The handsome ash-like foliage is attractive at all seasons. Golden columbine, (*Aquilegia Chrysantha,*) is one of the most valuable yellow flowering plants for summer. The double sunflower, (*Helianthus Multiflorus,*) which grows about three or four feet high, is also valuable. Later in the season the Japanese anemones with their single dahlia-like flowers are valuable. In this connection the dahlia may also be mentioned. Though the roots must be taken up each year, this plant is justly popular. Lily-of-the-valley, foxglove, phlox, larkspur, and some other old garden favorites, easy of culture and prolific of bloom have not been mentioned, nor has anything been said of the numerous species and varieties of lilies. These, however, may well be included in every collection.

BULLETIN No. 47.

WHEAT OFFALS SOLD IN MAINE IN 1898.

CHAS. D. WOODS.

The refuse products in the milling of wheat are very important cattle foods. With the exception of Indian corn, whole and ground, there is probably no other class of foods used so largely in this State as food for dairy stock. All of the milling products of wheat are, under the law, exempt from inspection. In order that the character of these feeds might be investigated, the Station inspectors were directed in January and again in November, 1898, to take samples of all the distinct brands of brans, middlings, mixed feeds, and kindred substances they might find exposed for sale. About 150 samples were collected. As this class of feeds are, in addition to their mineral matters, of chief importance as a source of nitrogen, only the protein was determined in them. All suspicious samples were examined under the microscope, but in no instance was foreign matter found that indicated adulteration. In a few cases oat and barley hulls were observed but in no greater amount than sometimes occurs in wheat.

The class of mill products that are particularly deceptive and which seem to be the "catch all" are the so-called middlings. From poorer in protein than the poorest brans, they are in some instances better than the high grade feed flours. Some of these are apparently mixed with nearly worthless refuse materials while others are strictly high grade goods. No one can afford to buy this class of goods unless their quality is guaranteed. Middlings that carry 18 to 20 per cent of protein are very desirable as a feed, but those that carry only 12 or 13 are little better than oat hulls. Unfortunately there seems to be no relation between the price asked and the true feeding value. The dealers in these goods profess to know nothing of their composition. The protection alike of dealers and consumers seems to demand that this class of feeds be placed under the requirements of the feeding stuff law.

ANALYSES OF BRANS, ETC., COLLECTED IN 1898.

Station number.	Manufacturer or Dealer.	Sampled at	Date of sampling.	Name of Feed.	Protein—per cent.
			1898		
8207	Albion Milling Co.	Bucksport	Jan.	Winter Wheat Bran	13.9
8246	Albion Milling Co.	West Minot	Jan.	Winter Wheat Bran	13.6
8446	Albion Milling Co.	Farmington	Oct.	Winter Wheat Bran	13.9
8258	Stott's Flour Mills.	Richmond	Jan.	Stott's Pure Winter Wheat Bran	14.6
8203	Stott's Flour Mills.	Dexter	Jan.	Stott's Pure Winter Wheat Bran	15.1
8222	Valley City Milling Company	Guilford	Jan.	Winter Wheat Bran	15.7
8248	J. L. Briggs	Poland	Jan.	Pure Winter Wheat Bran	14.3
8405	Wm. A. Coombs.	Dexter	Sept.	Winter Wheat Bran	15.2
8444	C. P. Chapman	Dover	Oct.	Winter Wheat Bran	14.9
8253	C. A. Whitehouse	North Leeds	Feb.	Spring Wheat Bran	16.2
8224	Albion Milling Co.	Foxcroft	Jan.	Bran	15.2
8260	Acme Milling Co.	Bath	Jan.	Acme Bran	15.3
8198	Pillsbury's Mill	Belfast	Jan.	Pillsbury's Bran	15.5
8233	Pillsbury's Mill	Norway	Jan.	Pillsbury's Bran	15.6
8263	Pillsbury's Mill	Bowdoinham	Jan.	Pillsbury's Bran	15.6
8264	Pillsbury's Mill	Houlton	Jan.	Pillsbury's Bran	15.9
8411	Pillsbury's Mill	Bangor	Sept.	Pillsbury's Bran	15.3
8421	Pillsbury's Mill	Damarisc'ta M'ls	Oct.	Pillsbury's Bran	15.3
8454	Pillsbury's Mill	Eastport	Oct.	Pillsbury's Wheat Bran	15.1
8205	F. W. Stock	Newport	Jan.	Bran	14.9
8230	F. W. Stock	Hiram	Jan.	Bran	15.2
8239	F. W. Stock	Canton	Jan.	Bran	14.8
8427	F. W. Stock	Wiscasset	Oct.	Bran	15.4
8439	F. W. Stock	Canton	Oct.	Bran	15.0
8201	North Dakota Milling Association	Orrington	Jan.	Bran	16.2
8208	Washburn Crosby Company	Bucksport	Jan.	Coarse Bran	15.6
8220	Washburn Crosby Company	Damariscotta	Feb.	Coarse Bran	15.7
8213	D. B. Gardner & Co.	West Pembroke	Jan.	Wheat Bran	15.5
8216	L. H. Phelan	Calais	Jan.	Wheat Bran	15.5
8227	E. A. Ireland	Dover	Jan.	Bran	17.4
8231	Wm. Listman Milling Company	Cornish	Jan.	Hiawatha Bran	16.5
8237	Wm. Listman Milling Company	Norway Lake	Jan.	Hiawatha Bran	15.1
8244	Voigt Milling Co.	Mechanic Falls	Jan.	Choice Bran	16.1
8416	Voigt Milling Co.	Pittsfield	Sept.	Choice Bran	16.6
8441	Voigt Milling Co.	West Paris	Oct.	Choice Bran	15.7
8265	Voigt Milling Co.	Presque Isle	Jan.	Wheat Bran	13.9
8442	Voigt Milling Co.	Milo	Oct.	Bran	15.0
8250	Anchor Milling Co.	Hollis Center	Jan.	Bran	16.4
8249	E. S. Woodworth & Company	South Paris	Jan.	Snow's Flaky Bran.	16.3

ANALYSES OF BRANS, ETC.—CONTINUED.

Station number.	Manufacturer or Dealer.	Sampled at	Date of sampling.	Name of Feed.	Protein—per cent.
8414	E. S. Woodworth & Company	Bucksport	Sept.	Snow's Flaky Bran.	15.6
8433	E. S. Woodworth & Company	Sebago Lake	Oct.	Snow's Flaky Bran.	16.1
8457	E. S. Woodworth & Company	Island Falls	Oct.	Snow's Flaky Bran.	15.6
8406	Stott's Flour Mills.	Corinna	Sept.	Stott's Bran	14.7
8410	Stott's Flour Mills.	Orrington	Oct.	Stott's Bran	15.1
8425	Vannah & Chute	Waldoboro	Oct.	Wheat Bran	15.1
8431	E. D. Walker	East Brownfield.	Oct.	Kansas Wheat Bran	15.2
8432	Shelby & Senior	East Brownfield.	Oct.	Shelby Mill Bran	15.9
8435	Milford Roll Mills.	Buxton Center	Oct.	Pure Bran	14.6
8436	So. Paris Grain Co.	South Paris	Oct.	C. Bran	15.8
8448	F. L. Butler	Farmington	Oct.	Bran	17.9
8450	No. West. Consolidated Milling Co.	Eastport	Oct.	Wheat Bran	14.3
8266	A. Cox	Presque Isle	Jan.	Buckwheat Bran	14.7
8267	H. A. Edwards	Caribou	Jan.	Buckwheat Bran (Roller Process)	16.1
8193	Blish's Milling Co.	Winterport	Jan.	Blish's Mixed Feed.	16.1
8197	Blish's Milling Co.	Belfast	Jan.	Blish's Mixed Feed.	15.5
8415	Blish's Milling Co.	Pittsfield	Sept.	Blish's Mixed Feed.	16.7
8219	Bliss Milling Co	Damariscotta	Feb.	Bliss Mixed Feed	15.8
8254	Bliss Milling Co	North Leeds	Feb.	Bliss Winter Wheat Mixed Feed	15.8
8194	J. Jenks & Co	Hampden	Jan.	Winter Wheat Mixed Feed.	14.9
8261	J. Jenks & Co	Bath	Jan.	Winter Wheat Mixed Feed	14.5
8434	J. Jenks & Co	Hiram	Oct.	Mixed Feed	14.3
8195	Doten Grain Co.	Hampden	Jan.	Eagle Mixed Feed	17.4
8196	Anchor Milling Co.	Bangor	Jan.	Anchor Mixed Feed	17.1
8202	F. W. Stock	Orrington	Jan.	M. F. Mixed Feed	15.1
8229	F. W. Stock	Hiram	Jan.	M. F. Mixed Feed	14.7
8429	F. W. Stock	Wiscasset	Oct.	Mixed Feed	15.3
8255	Stott's Flour Mills.	Livermore Falls.	Feb.	Stott's Mixed Feed.	15.1
8206	Lake Superior Mills	Newport	Jan.	Superior Mixed Feed	16.6
8209	Washburn Crosby Company	Bucksport	Jan.	Superior Mixed Feed	16.7
8238	Washburn Crosby Company.	Canton	Jan.	Superior Mixed Feed	16.7
8066	Eldred Mill Co.	Dexter	Jan.	Pure Mill Feed	14.6
8210	Paris Flouring Co.	Corinna	Jan.	Royal Mixed Feed	17.5
8236	Wm. Listman Milling Company	Norway Lake	Jan.	Hiawatha Mixed Feed	16.6
8241	Voigt Milling Co	Bethel	Jan.	Mixed Feed	15.8
8251	Minkota Milling Co	Kennebunk	Jan.	Minkota Mixed Feed	16.8

ANALYSES OF BRANS, ETC.—CONTINUED.

Station number.	Manufacturer or Dealer.	Sampled at	Date of sampling.	Name of Feed.	Protein—per cent.
8199	Acme Milling Co ..	Belfast	Jan..	Acme Feed	16.1
8252	Acme Milling Co ..	Lewiston.........	Feb .	Acme Feed	16.6
8262	Acme Milling Co ..	Bowdoinham	Jan..	Acme Feed	15.6
8426	Acme Milling Co ..	Rockland.........	Oct..	Acme Feed	16.8
8449	Acme Milling Co ..	Farmington......	Oct..	Acme Feed	16.8
8200	R. P. Moore Milling Company.........	Belfast	Jan..	King Feed	16.1
8217	R. P. Moore Milling Company.... ...	Nobleboro.......	Jan..	King Feed	16.6
8420	R. P. Moore Milling Company.........	Damarisc'ta M'ls	Oct..	King Mixed Feed ..	16.2
8409	R. P. Moore Milling Company.........	Newport..........	Oct..	Mixed Feed.........	16.4
8404	Wm. A. Coombs ...	Dexter...........	Sept.	Winter Wheat Mixed Feed......	15.0
8407	Chapin & Co	Bangor	Sept.	Sterling Mixed Feed......	16.6
8445	Chapin & Co	Guilford	Oct..	Sterling Mixed Feed..............	16.2
8412	Miles & Son	Bangor	Sept.	Mixed Feed.........	14.9
8413	Miles & Son	Bucksport.......	Sept.	Mixed Feed.........	14.9
8276	Saginaw Milling Co	Orrington	Oct..	Mixed Feed.........	14.9
8417	Kent & Senior Co..	Pittsfield	Sept.	Shelby Mills Mixed Feed..............	14.8
8418	Amer. Cereal Co...	Bucksport........	Sept.	Buckeye Wheat Feed.	16.0
8452	Amer. Cereal Co...	Eastport........ .	Oct..	Buckeye Wheat Feed.	15.9
8419	Rex Mill Co	Belfast	Sept.	Mixed Feed.........	16.0
8430	E. L. Dillingham ..	Thomaston.	Oct..	Gold Dust Mixed Feed...............	15.9
8438	So. Paris Grain Co.	South Paris	Oct..	Mixed Feed.........	16.4
8447	P. M. Company	Farmington	Oct..	Michigan Mixed Feed.......	16.1
8211	D. B. Gardner Co ..	West Pembroke .	Jan..	White Middlings...	19.0
8235	J. Jenks & Co......	Norway....	Jan..	Fine White Middlings	12.4
8408	J. Jenks & Co......	Hampden	Oct..	Fine White Middlings	13.5
8423	J. Jenks & Co......	Waldoboro	Oct..	Fine White Middlings	13.6
8277	Saginaw Milling Co	Orrington	Oct..	White Middlings ...	13.1
8437	So. Paris Grain Co.	South Paris	Oct..	White Middlings ...	21.5
8212	D. B. Gardner.. ..	West Pembroke .	Jan..	Brown Middlings ..	18.9
8451	No. West. Consolidated Milling Co.	Eastport....	Oct..	Brown Middlings ..	17.4
8453	No. West. Consolidated Milling Co.	....	Oct..	Brown Middlings ..	17.6
8214	L. H. Phelan	Calais............	Jan..	Brown Middlings ..	18.5
8204	Pillsbury's Mills...	Newport	Jan..	Pillsbury's Middlings	16.9

ANALYSES OF BRANS, ETC.—CONCLUDED.

Station number.	Manufacturer or Dealer.	Sampled at	Date of sampling.	Name of Feed.	Protein—per cent.
8218	F. W. Stock	Waldoboro	Jan..	(M) Middlings......	16.3
8228	F. W. Stock	Hiram	Jan..	Coarse Middlings ..	15.6
8428	F. W. Stock	Wiscasset	Oct..	Middlings	15.4
8440	F. W. Stock	Canton	Oct..	Middlings...........	16.0
8225	Stott's Milling Co..	Foxcroft	Jan..	Middlings...........	17.4
8226	Stott's Milling Co..	Dover	Jan..	Middlings..........	17.2
8223	Valley City Milling Company........	Guilford	Jan..	Winter Wheat Middlings	16.6
8232	Washburn Crosby Company.........	Norway......	Jan..	Flour Middlings....	17.4
8259	Washburn Crosby Company.	Richmond......	Jan..	Standard Middlings	16.9
8240	Voigt Milling Co ..	Bethel	Jan..	Choice Middlings ..	17.3
8245	Keeler Bros.......	West Minot	Jan..	Red Winter Middlings	17.4
8422	The Walsh De Roo Milling Company	Waldoboro.......	Oct..	Middlings.	17.2
8424	Wm. A. Coombs ...	Waldoboro	Oct..	Winter Wheat Middlings.........	15.6
8443	Austed & Burke ...	Milo	Oct..	Middlings...........	16.2
8458	Minkota Milling Co	Houlton	Oct..	Middlings "Athlete" Brand.......	16.6
8221	Pillsbury's Mill....	Damariscotta....	Feb..	Pillsbury's XX Daisy Feed Flour.	19.5
8247	Pillsbury's Mill....	Poland	Jan..	Pillsbury's XX Daisy Feed Flour.	19.8
8257	Pillsbury's Mill....	Richmond........	Jan..	Pillsbury's XX Daisy Feed Flour.	19.1
8215	Pillsbury's Mill....	Calais.............	Jan..	Pillsbury's XX Daisy Feed Flour.	19.2
8256	No. West. Consolidated Milling Co.	Richmond........	Jan..	XXX Comet.........	20.9

SUMMARY OF ANALYSES OF BRANS, ETC.

	Number of analyses.		Protein—per cent.
Stott's Flour Mills Stott's Bran	4	Highest. Lowest Average	15.1 14.6 14.9
Pillsbury's Mills Pillsbury's Bran	7	Highest. Lowest Average	15.9 15.1 15.4
F. W. Stock's Bran	5	Highest Lowest Average	15.4 14.8 15.1
Voigt Milling Company's Choice Bran	5	Highest Lowest Average	16.6 13.9 15.5
E. S. Woodworth & Company's Snow's Flaky Bran	4	Highest Lowest Average	16.3 15.6 15.9
Winter Wheat Brans All analyses	9	Highest Lowest Average	15.7 13.6 14.6
All Brans not Marked Winter Wheat Brans	42	Highest Lowest Average	17.9 13.9 15.6
Blish's Milling Company's Mixed Feed	5	Highest Lowest Average	16.7 15.5 16.0
F. W. Stock Mixed Feed	3	Highest Lowest Average	15.3 14.7 15.0
Acme Milling Company's Acme Feed	5	Highest Lowest Average	16.8 15.6 16.4
R. P. Moore Milling Company's King Mixed Feed	4	Highest Lowest Average	16.6 16.1 16.3
All Mixed Feeds Resembling Brans	44	Highest Lowest Average	17.5 14.3 15.9
White Middlings	6	Highest Lowest Average	21.5 12.4 15.5
Brown Middlings	4	Highest Lowest. Average	18.9 17.4 18.1
Middlings, all kinds	26	Highest Lowest Average	21.5 12.4 16.6
Pillsbury's XX Daisy Feed Flour	4	Highest Lowest Average	19.8 19.1 19.4

INSPECTIONS FOR 1898.

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.

The use of commercial fertilizers in the State seems to be somewhat on the increase. From information furnished by most of the manufacturers shipping into the State, a conservative estimate places the amount used in 1898 at 17,000 tons. For the most part there is entire harmony between the manufacturers and their agents and the consumers. In no instance this year has the Station received complaints of quality of goods from the consumers. The demand for low priced goods has increased the number of low grade fertilizers in the market. It is not known if the presence of an increased number of low grade goods indicates a corresponding increase in the sale of this class of fertilizers, but even if it does it is probable that in the most instances the purchaser is obtaining that which he pays for. The low grade goods as well as the high class are for the most part up to or above the minimum guarantee.

Requirements of the Law.

The full text of the law regulating the sale and analysis of commercial fertilizers will be sent on application to the Station. 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.

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 between November 15 and December 15 with the Director of the Station.

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 each 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 (43) 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 (45) 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.

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.

NITROGEN.

Manufacturer's samples.	
Number of samples above guarantee	119
Number of samples below guarantee	13
Number of samples .2% or more below guarantee,	4
Station samples.	
Number of samples above guarantee	112
Number of samples below guarantee	37
Number of samples .2% or more below guarantee,	20

AVAILABLE PHOSPHORIC ACID.

Manufacturer's samples.	
Number of samples above guarantee	121
Number of samples below guarantee	20
Number of samples .2% or more below guarantee,	10
Station samples.	
Number of samples above guarantee	152
Number of samples below guarantee	22
Number of samples .2% or more below guarantee,	13

TOTAL PHOSPHORIC ACID.

Manufacturer's samples.	
Number of samples above guarantee	134
Number of samples below guarantee	11
Number of samples .2% or more below guarantee,	6

Station samples.

Number of samples above guarantee............	162
Number of samples below guarantee............	15
Number of samples .2% below guarantee........	11

POTASH.

Manufacturer's samples.

Number of samples above guarantee............	126
Number of samples below guarantee............	12
Number of samples .2% or more below guarantee,	4

Station samples.

Number of samples above guarantee............	138
Number of samples below guarantee............	32
Number of samples .2% or more below guarantee,	19

Comparison of guarantees and station samples for three years.

It is important for the purchaser of fertilizers to know how the goods have compared with the guarantee, not merely for one year but for several years. Formerly we have printed a table comparing the analysis of the manufacturers' and Station samples for the year with the guarantee. In the table which follows there is given a comparison of the analyses of the samples collected by the Station for the years 1896, 1897 and 1898 with the guarantee of the manufacturers. When the guarantee has been changed in 1898 from that of the previous years the fact is indicated by a †, and where more than one analysis of the same brand was made in 1898, this is indicated by a *.

In studying the table of comparison of guarantees of the Station samples for three years, it will be found that many goods run quite uniform year after year. This is particularly true as regards phosphoric acid and is readily understood when it is remembered that the "superphosphate" is the starting point and that the materials furnishing the nitrogen and potash are added to this. The potash and nitrogen are the more expensive substances in fertilizers and greater variations in composition are found in these constituents.

COMPARISON OF GUARANTEES AND STATION SAMPLES FOR 3 YEARS.

Name of Fertilizer.	Nitrogen.				Available Phosphoric Acid.				Potash.			
	Found.			Guaranteed.	Found.			Guaranteed.	Found.			Guaranteed.
	1896.	1897.	1898.		1896.	1897.	1898.		1896.	1897.	1898.	
	%	%	%	%	%	%	%	%	%	%	%	%
Americus Ammoniated Bone Superphosphate	2.85	2.56	*2.50	2.47	9.31	9.21	*9.79	9.0	2.22	2.20	*2.19	2.0
Americus Corn Phosphate	2.21	2.15	2.19	2.06	8.78	8.85	9.11	9.0	2.81	1.81	1.74	1.5
Americus Potato Manure	2.33	2.28	*2.04	2.06	8.83	9.08	*9.11	8.0	3.26	3.32	*2.95	3.0
Baker's Special Complete Potato Manure	......	......	3.73	3.30	......	......	6.43	5.8	......	......	9.37	10.0
Baker's Vegetable, Vine and Potato Manure	......	......	1.80	1.65	......	......	6.81	5.5	......	......	11.13	12.0
Bay State Defiance Phosphate	......	.91	.96	.82	......	8.08	8.12	7.0	......	1.40	1.49	1.0
Bay State Fertilizer	2.67	2.96	*2.42	2.47	9.86	9.29	*9.19	9.0	2.14	2.22	*2.07	2.0
Bay State Fertilizer "G. G."	2.39	2.33	2.00	1.85	8.88	9.95	8.94	8.5	2.07	2.28	2.35	2.0
Bay State Fertilizer for Seeding Down	1.08	1.21	1.30	1.03	9.29	8.19	9.16	8.0	1.93	2.01	2.22	2.0
Bowker's Ammoniated Dissolved Bone	2.03	1.54	1.78	†1.50	7.01	7.66	6.85	8.0	2.25	2.41	2.46	2.0
Bowker's Bone and Wood Ash Fertilizer	......	..	1.65	1.50	......	......	6.82	6.0	......	......	2.60	2.0
Bowker's Corn Phosphate	......	1.58	1.55	1.60	......	7.30	9.85	7.0	......	2.23	2.66	2.0
Bowker's Farm and Garden Phosphate	1.80	1.55	1.71	†1.50	8.35	8.32	8.29	8.0	2.21	2.25	2.45	2.0
Bowker's Fresh Ground Bone	......	......	3.22	2.25	......	......	‡23.07	......	......	......	......	......
Bowker's High Grade Fertilizer	......	2.53	2.24	2.25	......	9.60	8.66	8.0	......	4.62	4.43	4.0
Bowker's Hill and Drill Phosphate	2.43	2.71	2.40	†2.25	10.18	9.94	9.14	9.0	2.34	2.22	2.38	2.0
Bowker's Market and Garden Fertilizer	2.48	......	2.30	†2.25	4.48	......	4.91	6.0	10.11	......	10.07	10.0
Bowker's Potash or Staple Phosphate	......	......	.98	.75	......	......	9.81	8.0	......	......	3.29	3.0
Bowker's Potato and Vegetable Phosphate	......	1.79	1.72	1.50	......	8.15	7.99	8.0	......	2.25	2.41	2.0
Bowker's 6% Potato Fertilizer	1.01	.95	.90	.75	8.50	7.62	7.19	7.0	5.99	6.89	7.30	6.0
Bowker's Special Fertilizer, Potato and Vegetable	......	2.51	2.47	2.25	......	9.10	8.01	8.0	......	4.67	4.29	4.0

Bowker's Square Brand Bone and Potash	1.86	.....	1.71	1.50	5.10	.....	6.03	6.0	2.48	.....	2.50	2.0
Bowker's Superphosphate with Potash for Grass and Grain	.43	.....	.30	.60	10.69	10.01	9.38	10.0	1.60	4.00	2.17	2.0
Bowker's Sure Crop Phosphate	1.09	.....	.98	.75	9.83	.....	9.48	8.0	1.33	.....	1.33	1.0
Bowker's 10% Manure	1.09	.....	.83	.75	5.67	.....	7.26	6.0	9.92	.....	10.16	1.0
Bradley's Complete Manure for Potatoes and Vegetables	3.78	3.75	*3.55	3.73	8.66	8.57	*8.14	8.0	6.06	6.24	*6.35	6.0
Bradley's Complete Manure for Top Dressing Grass and Grain	.....	4.78	4.91	4.95	.....	6.00	5.83	5.0	.....	3.02	2.84	2.5
Bradley's Corn Phosphate	2.16	.....	*2.03	2.05	9.18	.....	*8.93	9.0	2.01	.....	*1.59	1.5
Bradley's Eclipse Phosphate for all Crops	.....	.....	1.61	1.00	.....	.....	9.40	10.0	.....	.....	1.68	1.5
Bradley's Eureka Fertilizer	1.92	1.85	1.65	1.65	8.52	5.27	5.03	5.0	3.46	2.52	2.49	2.0
Bradley's Niagara Phosphate	.....	.....	1.25	1.00	.....	.....	7.68	7.0	.....	.....	1.18	1.1
Bradley's Potato Fertilizer	2.08	2.20	*2.12	2.06	9.51	9.00	*9.64	9.0	3.02	3.07	*3.03	†3.3
Bradley's Potato Manure	2.94	3.21	*2.66	2.50	5.89	6.09	*6.52	6.0	5.98	5.56	*5.59	5.0
Bradley's X L Phosphate	2.64	2.53	*2.47	2.50	9.89	10.37	*9.81	9.0	2.34	2.43	*2.34	2.0
Chittenden's Ammoniated Bone Superphosphate	1.55	2.08	2.04	1.07	9.83	10.21	9.47	†8.0	2.15	2.84	2.26	2.0
Chittenden's Complete Fertilizer	3.04	3.60	3.43	†3.03	9.30	8.95	8.52	8.0	5.32	6.67	6.47	6.0
Chittenden's Market Garden Fertilizer	2.43	2.33	2.39	†2.04	7.42	8.56	7.72	7.0	4.85	6.13	6.38	6.0
Cleveland Bone and Potash	.....	.....	.....	.....	.....	.....	10.23	6.0	.....	.....	3.02	2.5
Cleveland Fertilizer for All Crops	1.30	1.14	1.15	†1.03	7.72	8.35	8.98	8.0	2.07	2.02	2.22	2.0
Cleveland Pioneer Fertilizer	.....	.87	1.07	.82	.....	7.55	7.98	7.0	.....	1.47	1.70	1.0
Cleveland Potato Phosphate	2.19	2.05	*2.00	2.05	9.39	9.96	*9.00	8.0	3.18	3.08	*3.03	3.0
Cleveland Seeding Down Fertilizer	1.96	2.34	*1.48	1.65	8.37	8.24	*8.85	5.0	2.30	1.95	*2.17	2.0
Cleveland Superphosphate	2.33	2.16	2.13	2.05	8.71	8.86	9.17	9.0	2.05	2.06	2.46	2.0
Crocker's Ammoniated Bone Superphosphate	.....	.....	2.93	2.87	.....	.....	10.19	10.0	.....	.....	1.37	1.1
Crocker's Ammoniated Corn Phosphate	2.38	.....	1.92	2.05	10.04	.....	10.26	10.0	1.83	.....	1.67	1.6
Crocker's New Rival Ammoniated Superphosphate	1.46	2.21	1.24	1.23	10.46	9.93	9.94	10.0	1.92	2.00	1.84	†1.6
Crocker's Potato, Hop and Tobacco Phosphate	2.24	2.15	2.12	2.05	10.25	11.00	10.00	10.0	3.68	3.63	3.36	3.2
Crocker's Superior Fertilizer	.....	1.06	.82	.82	.....	9.12	8.22	8.0	.....	2.23	1.93	2.0
Cumberland Bone and Potash	.....	.....	.....	.....	.....	.....	10.01	8.0	.....	.....	2.95	2.5
Cumberland Potato Fertilizer	2.20	2.33	*1.84	2.06	9.62	9.19	*9.28	9.0	3.02	3.26	*2.56	3.0
Cumberland Seeding Down Manure	1.45	1.17	1.14	†1.03	7.78	8.87	9.12	8.0	2.31	2.28	2.44	2.0
Cumberland Superphosphate	2.23	2.18	2.07	2.06	9.08	9.58	8.74	8.0	1.96	2.22	2.05	2.0
Darling's Animal Fertilizer "G" Brand	.....	2.57	2.99	2.06	.....	7.92	7.88	†6.0	.....	4.94	4.20	4.0
Darling's Blood, Bone and Potash	.....	4.08	*3.82	†4.12	.....	8.18	8.39	*7.0	.....	9.55	*7.55	7.0

* Average of two analyses. † Guarantee changed in 1898. ‡ Total.

COMPARISON OF GUARANTEES AND STATION SAMPLES FOR 3 YEARS—CONTINUED.

Name of Fertilizer.	Nitrogen.				Available Phosphoric Acid.				Potash.			
	Found.			Guaranteed.	Found.			Guaranteed.	Found.			Guaranteed.
	1896.	1897.	1898.		1896.	1897.	1898.		1896.	1897.	1898.	
	%	%	%	%	%	%	%	%	%	%	%	%
Darling's Complete Maine Brand for Potatoes, etc.	.....	.....	2.38	3.20	.....	.....	8.57	8.0	.....	.....	12.07	12.0
Dirigo Fertilizer	1.69	3.40	1.71	2.00	7.42	6.52	4.77	†3.0	4.12	4.34	5.77	†4 0
E. Frank Coe's Bay State Ammoniated Bone Superphosphate	.....	1.91	2.30	2.0	.....	9.51	9.45	9.0	.....	1.92	2.31	1.85
E. Frank Coe's Bay State Imperial Superphosphate	.....	1.47	1.63	1.20	.....	10.11	9.47	9.0	.....	1.90	2.13	1.85
E. Frank Coe's Columbian Brand	.....	1.42	1.56	1.20	.....	10.52	9.20	9.0	.....	2.09	2.16	1.9
E. Frank Coe's Columbian Corn Fertilizer	.....	1.36	1.52	†1.00	.....	9.42	10.13	9.0	.....	1.99	2.27	†1.9
E. Frank Coe's Columbian Potato Fertilizer	1.50	1.42	1.51	†1.00	8.58	10.50	9.80	9.0	2.15	1.91	2.11	†1.9
E. Frank Coe's Excelsior Potato Fertilizer	.....	.....	2.46	2.50	.....	.....	7.72	8.0	.....	.....	8.08	8.0
E. Frank Coe's Gold Brand Excelsior Guano	.....	2.16	2.66	2.50	.....	8.73	7.00	8.0	.....	5.43	5.15	6.0
E. Frank Coe's Grass and Grain Fertilizer	1.11	.....	1.07	8.0	9.18	.....	9.14	9.0	1.36	.....	1.70	1.4
E. Frank Coe's High Grade Ammoniated Superphosphate	.....	2.05	2.15	2.0	.....	9.71	9.06	9.0	.....	2.48	2 41	†2.0
E. Frank Coe's High Grade Potato Fertilizer	2.47	2.65	*2.60	†2 40	8.13	8.85	*8.84	†7.0	6.34	5.79	*6.12	†6.5
E. Frank Coe's Original Ammoniated Dissolved Bone Superphosphate	.....	.....	1.42	1.25	.....	.....	9.88	10.0	.....	.....	2.84	2.25
E. Frank Coe's Prize Brand Grain and Grass Fertilizer	.....	.90	.66	†.40	.....	10.82	11.32	10.5	.....	1.43	1.37	†1.3
E. Frank Coe's Red Brand Excelsior Guano for Market Gardening	.....	.....	*3.16	3.50	.....	.....	*8.86	9.0	.....	.....	*6.55	6.0
E. Frank Coe's Seeding Down and Top Dressing Fertilizer	.2	.....	.25	.....	11.77	11.00	11.04	12.0	1.89	2.62	2.49	2.75
E. Frank Coe's Special Potato Fertilizer	1.84	1.70	1.73	1.65	10.96	9.42	8.12	†8.0	3.34	3.84	4.23	†4.0
E. Frank Coe's Standard Grade Ammoniated Bone Superphosphate	1.90	1.71	1.90	1.75	8.97	10.13	9.93	8.0	1.46	1.78	1.82	†1.4
Essex Complete Manure for Corn, Grain and Grass	4.02	4.03	3.82	3.70	7.30	7.61	8.71	†7.0	10.80	11.04	9.78	9.5
Essex Complete Manure for Potatoes, Roots and Vegetables	3.47	4.55	4.12	3.70	6.98	8.08	7.52	7.0	10.03	9.46	9.39	9.5
Essex Dry Ground Fish	.....	.....	7.31	8.13	.....	.....	7.16	.....	.....	.....	.....	.....

Essex High Grade Superphosphate	2.90	2.89	2.57	2.50	9.86	8.61	9.80	9.0	5.91	4.25	5.15	4.0
Essex Odorless Lawn Dressing	.....	4.07	3.68	4.0	.....	4.32	3.19	5.5	.....	7.75	8.45	7.0
Essex Special Cauliflower and Cabbage Manure	.....	.....	4.72	4.99	.....	.....	8.07	7.5	.....	.....	7.95	7.0
Essex XXX Fish and Potash	2.05	2.20	2.46	2.10	8.88	9.97	9.66	†9.0	2.24	2.58	2.18	†2.3
Farrar's Potato Manure	3.00	3.55	*3.85	†2.25	11.36	12.22	*9.60	†9.0	2.01	2.80	*2.77	3.0
Farrar's Superphosphate	2.86	3.44	3.42	†2.50	11.37	13.46	9.74	†9.0	1.71	2.10	2.89	2.0
Foster's Vegetable and Vine	1.73	1.87	1.77	†1.65	6.68	6.57	6.32	6.0	8.42	8.32	7.54	8.0
Gloucester Fish and Potash	.....	1.06	1.12	.75	.....	10.60	9.42	6.0	.....	1.20	1.29	1.0
Great Eastern Dissolved Bone	.....	.....	.....	.....	.....	15.96	15.59	14.0	.....	.....	.36	.....
Great Eastern General Fertilizer	1.31	.94	1.19	.82	8.26	11.18	8.66	8.0	4.46	4.11	4.28	4.0
Great Eastern Grass and Oats Phosphate	.....	.....	.....	.....	12.97	13.63	12.59	11.0	1.97	2.37	2.07	2.0
Great Eastern Northern Corn Special	.....	3.04	*2.99	2.88	.....	8.48	*8.41	8.0	.....	2.13	*2.46	2.0
Great Eastern Potato Manure	2.11	2.03	2.35	†2.06	9.27	9.71	8.61	8.0	4.19	4.0	4.41	4.0
King Philip Alkaline Guano for Potatoes	1.38	1.56	1.40	1.23	7.34	6.99	7.59	6.5	3.15	3.28	3.18	3.0
Lister's Seeding Down Fertilizer	.....	1.64	1.47	1.32	.....	8.51	7.49	7.0	.....	2.72	2.39	2.0
Lister's Special Potato Fertilizer	1.86	1.61	1.78	1.65	8.84	9.79	8.68	8.0	3.25	3.76	3.17	3.0
Lister's Success Fertilizer	1.58	1.54	1.34	1.24	10.63	10.49	10.34	9.5	1.97	2.46	2.20	2.0
Maine State Grange Chemicals	.....	2.52	*2.54	2.50	.....	9.19	*8.23	8.0	.....	4.93	*4.23	4.0
Maine State Grange Potato Manure	.....	1.79	1.47	1.50	.....	9.15	9.83	9.0	.....	12.24	11.27	12.0
Maine State Grange Seeding Down Fertilizer	.....	1.71	1.65	1 50	.....	9.23	6.10	7.0	.....	6.66	5.59	5.5
Nash's Pure Bone Meal	2.26	2.65	1.66	†3.00	‡24.66	‡20.56	‡27.68	‡18.0	.....	.....	.....	.....
Nobsque Guano	1.18	1.25	*1.18	1.15	9.29	8.06	*8.58	†8.0	1.87	2.00	*2.18	2.0
Otis Potato Fertilizer	2.14	2.09	2.33	2.0	9.59	9.44	9.45	9.0	3.47	3.26	2.31	3.0
Otis Seeding Down Fertilizer	.....	1.02	1.43	1.50	.....	8.44	9.36	†8.0	.....	2.29	2.19	†2.0
Otis Superphosphate	.....	2.62	1.76	2.0	.....	9.22	9.23	9.5	.....	2.46	3.06	2.0
Pacific Guano Company Dissolved Bone and Potash	.....	.....	.....	.....	.....	.....	10.23	10.0	.....	.....	2.33	2.0
Pacific Guano Company Grass and Grain Fertilizer	1.19	1.18	1.06	.82	9.44	8.50	9.44	7.0	1.93	2.06	1.80	.....
Pacific Guano Company Potato Special	.....	2.18	*1.98	†2.05	.....	8.70	*9.05	8.0	.....	3.36	*3.0	3.0
Packer's Union High Grade Animal Corn Fertilizer	.....	2.92	*2.45	2.47	.....	9.15	*7.67	8.0	.....	2.71	*2.19	2.0
Packer's Union High Grade Potato Manure	.....	2.00	2.06	2.06	.....	7.05	8.45	8.0	.....	5.03	6.15	6.0
Packer's Union High Grade Wheat, Oats, and Clover Fertilizer	.....	.....	.....	.....	.....	10.73	11.37	11.0	.....	2.22	2.13	2.0
Philbrick's Fertilizer	.....	.....	1.96	2.0	.....	.....	7.58	7.0	.....	.....	4.83	5.0
Portland Rendering Company's Tankage	.....	4.42	5.18	†4.42	.....	8.06	8.98	†8.1	.....	.....	.....	.....

* Average of two analyses. † Guarantee changed in 1898. ‡ Total.

COMPARISON OF GUARANTEES AND STATION SAMPLES FOR 3 YEARS—CONCLUDED.

Name of Fertilizer.	Nitrogen.				Available Phosphoric Acid.				Potash.			
	Found.			Guaranteed.	Found.			Guaranteed.	Found.			Guaranteed.
	1896.	1897.	1898.		1896.	1897.	1898.		1896.	1897.	1898.	
	%	%	%	%	%	%	%	%	%	%	%	%
Quinnipiac Climax Phosphate	......	1.37	1.12	1.03	......	8.84	8.39	8.0	.....	1.72	2.29	2.0
Quinnipiac Dissolved Bone and Potash	.....	......	.....	....	.....	......	10.32	10.0	......	......	2.46	2.0
Quinnipiac Corn Manure	......	2.37	2.16	2.06	......	10.25	9.29	9.0	......	1.43	1.91	1.5
Quinnipiac Mohawk Fertilizer	......	.78	.83	.82	......	8.66	8.27	7.0	.....	1.46	1.49	1.0
Quinnipiac Phosphate	2.38	2.51	*2.53	2.47	9.18	9.11	†9.12	9.0	2.08	2.22	†2.12	2.0
Quinnipiac Potato Manure	2.74	2.59	*2.45	2.47	7.89	8.53	†8.10	6.0	6.00	4.78	†4.37	5.0
Quinnipiac Potato Phosphate	2.06	2.10	2.01	2.05	9.29	9.01	9.17	8.0	2.89	2.82	2.90	3.0
Quinnipiac Seeding Down Manure	1.21	2.17	1.02	.82	8.44	8.37	9.35	9.0	2.10	2.78	2.31	2.0
Read's Practical Potato Special	1.05	.93	1.05	.82	4.83	4.91	4.65	4.0	7.66	8.40	8.36	8.0
Read's Standard	1.14	1.04	1.01	.82	8.38	8.45	8.24	8.0	3.94	4.52	4.04	4 0
Read's Sure Catch	......	......	......	......	5.92	6.98	*6.29	6.0	3.59	4.27	*3.62	4.0
Royal Bone Phosphate	1.22	1.24	1.05	1.03	9.39	8.62	9.20	7.0	2.06	2.16	2.22	2.0
Sagadahoc Low Price Brand	......	......	.72	1.50	......	......	9.84	3.0	......	......	2.38	1.5
Sagadahoc Merrymeeting Brand	.....	......	1.57	1.50	......	......	7.15	5.0	.....	......	2.81	2.0
Sagadahoc Special Potato Fertilizer	2.21	1.89	2.14	†2.75	7.14	7.09	6.96	†6.0	7.05	8.18	7.60	†7.0
Sagadahoc Superphosphate	.....	2.47	1.52	†2.50	. ...	9.01	7.49	†6.0	.....	3.80	4.86	†4.0
Sampson Fertilizer	.....	......	2.72	1.65	......	......	7.79	6.0	......	......	5.66	4.0
Sea Fowl Guano	......	2.34	1.97	2.06	......	8.36	8.62	8.0	......	1.63	1.94	1.5
Soluble Pacific Guano	2.26	2.84	2.33	2.25	9.25	9.56	8.61	8.5	2.11	2.35	2.28	2.0
Standard A Brand	1.28	1.10	1.07	.82	8.79	8.71	8.87	7.0	2.01	2.02	2.41	1.0
Standard Bone and Potash	......	......	......	......	......	......	10.04	8.0	......	......	2.20	2.5

Standard Fertilizer	2.23	2.07	2.17	2.0	6.34	9.51	8.94	8.0	3.14	2.28	2.40	2.0
Standard Guano	1.52	1.36	1.30	1.25	7.84	7.15	7.74	6.5	3.29	3.51	3.06	3.0
Standard Special for Potatoes	......	2.14	2.20	2.05	......	9.09	8.96	8.0	......	3.14	3.08	3.0
Stockbridge Corn and Grain Manure	3.54	3.60	*2.67	3.0	9.47	7.37	*9.31	8.0	4.72	7.11	*7.41	†6.0
Stockbridge Pea and Bean Manure	2.93	2.53	2.27	2.0	7.48	5.74	7.70	6.0	10.04	11.08	9.95	6.0
Stockbridge Potato and Vegetable Manure	2.34	2.96	3.28	3.25	6.11	7.09	6.90	6.0	11.83	10.98	10.06	10.0
Stockbridge Seeding Down Manure	2.55	2.68	2.12	2.50	11.68	6.29	7.48	6.0	9.49	10.46	10.77	10.0
Stockbridge Strawberry Manure	......	2.26	2.40	2.25	.....	8.62	9.03	6.0	.....	5.21	4.32	4.0
Stockbridge Top Dressing Manure	4.21	......	4.47	5.0	5.50	......	5.93	4.0	4.83	......	6.31	6.0
Swift's Lowell Animal Fertilizer	2.78	2.44	2.54	2.46	13.35	10.50	9.52	†9.0	3.96	4.85	4.41	4.0
Swift's Lowell Bone Fertilizer	2.64	1.38	1.88	1.64	7.36	7.72	8.06	†8.0	4.0	3.22	3.42	3.0
Swift's Lowell Dissolved Bone and Potash	2.79	1.49	1.86	1.64	11.74	7.76	9.29	†9.0	2.48	2.47	2.07	2.0
Swift's Lowell Fruit and Vine Fertilizer	3.48	2.89	3.48	†3.28	12.36	10.64	7.38	†7.0	3.55	7.55	6.19	6.0
Swift's Lowell Ground Bone	......	.....	2.26	2.46	......	......	‡27.96	‡23.0	......	......	......	......
Swift's Lowell Market Garden Manure	......	.....	4.16	4.10	......	......	8.20	7.0	.....	.....	5.92	6.0
Swift's Lowell Potato Phosphate	3.29	2.79	2.68	†2.46	12.76	9.07	9.01	†8.0	3.56	5.78	5.97	6.0
Thompson & Edward's Pure Fine Ground Bone	......	1.91	2.74	2.47	......	‡16.00	‡18.16	....	......	......	......	.....
Triumph Bone and Potash	......	......	......	.....	......	.....	9.87	10.0	......	....	3.57	2.0
Tucker's Original Bay State Bone Superphosphate	......	2.19	2.07	2.06	.....	9.58	11.44	9.0	......	2.09	2.12	2.0
Williams and Clark's Dissolved Bone and Potash	....	......	......	.....	......	......	10.41	10.0	.....	.....	2.34	2.0
Williams and Clark's Potato Phosphate	2.97	2.56	*2.42	2.47	7.91	8.24	*8.26	6.0	5.88	4.88	*4.26	5.0
Young's Excelsior Potato Fertilizer	......	.....	2.80	2.88	......	.....	6.59	5.5	......	.....	9.94	10.0

* Average of two analyses. † Guarantee changed in 1898. ‡ Total.

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, which is very similar to the law regulating the sale of commercial fertilizers, went into effect October 1, 1897, 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.

Chief Provisions of the Law.

The full text of the law will be sent on application. 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, cottonseed 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.

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 *which constitute the guarantee* 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.

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 inspection tax tag now in use consists 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 "dead lock fasteners" if desired. Unused tags will be redeemed at any time. Tags will be sent by express, charges for carriage to be collected.

The inspection tag is not a guarantee. It merely shows that the tax has been paid on the package to which it is attached.

Analysis. Whenever the Director of the Station requests, the certificate must be accompanied by a sealed sample of the goods so certified. It also is the duty of the Director to collect 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.

Inspectors.

The following gentlemen have acceptably served the Station as inspectors during 1898.

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 inspectors visited the large dealers in their territory three times during the year, in the month of January, March and November. At least one sample of each kind of feeding stuff coming under the law was taken by each inspector. The results of the analyses were printed as bulletins 44 and 48.* The more important of the figures are here summarized. The discussions are largely taken from the bulletins.

*Bulletin 48 was not distributed until January, 1899.

SUMMARY OF ANALYSES, WINTER 1898.

Kind of Feeding Stuff.	Number of analyses.		Protein. Found—per cent.	Protein. Guaranteed—per cent.	Fat. Found—per cent.	Fat. Guaranteed—per cent.
American Cotton Oil Co.'s		Highest.	50.75	....	16.96	
Prime Cotton Seed Meal......	15	Lowest.	43.12	43.00	8.83	9.00
		Average	46.23	....	12.43	
Southern Cotton Oil Co.'s		Highest.	48.25	....	13.10	
Prime Cotton Seed Meal	14	Lowest.	43.63	43.00	9.39	9.00
		Average	46.29	....	11.07	
F. W. Brodé & Co.'s		Highest.	50.63	....	14.08	
Owl Brand Cotton Seed Meal.	6	Lowest.	43.56	43.00	9.39	9.00
		Average	47.39	....	11.29	
S. W. Thaxter & Co.'s		Highest.	52.63	....	12.04	
Cotton Seed Meal	2	Lowest.	51.25	49.25	11.78	15.62
		Average	51.94	....	11.91	
J. E. Soper & Co.'s		Highest.	49 19	....	12.74	
Cotton Seed Meal.............	2	Lowest.	47.25	43.00	9.81	9.00
		Average	48.22	....	11.28	
Cleveland Linseed Oil Co.'s		Highest.	37.25	....	3.35	
Linseed Oil Meal.............	4	Lowest.	34.63	39.00	1.99	1.50
		Average	36.46	....	2.53	
Cleveland Linseed Oil Co.'s						
Cleveland Flax Meal..........	1	....	41.00	39.00	3.47	1.50
S. A. & J. H. True Co.'s		Highest.	37.13	....	6.84	
Linseed Oil Meal...	2	Lowest.	34.81	36.94	6.32	6.58
		Average	35.87	....	6.58	
Chas. Pope Glucose Co.'s		Highest.	41.31	....	4.41	
Cream Gluten Meal	7	Lowest.	32.06	37.12	2.69	3.20
		Average	34.55	....	3.79	
National Starch Man'fg Co.'s		Highest.	33.75	....	18.37	
King Gluten Meal	5	Lowest.	26.38	34.26	14.60	14.65
		Average	31.49	....	16.66	
The Glucose Sugar Refin'g Co.'s		Highest.	38.38	....	4.15	
Chicago Gluten Meal.........	15	Lowest.	34.00	37.50	2.48	9.00
		Average	35.64	....	3.37	
American Glucose Co.'s		Highest.	29.56	....	4.74	
Buffalo Gluten Feed...........	3	Lowest.	28.69	29.90	3.91	3.38
		Average	29.29	....	4.44	
		Highest.	24.87	....	4.66	
Climax Gluten Feed	2	Lowest.	23.94	24.10	3.07	6.18
		Average	24.41	....	3.86	
Rockford Sugar Refining Co.'s		Highest.	30.06	....	3.74	
Diamond Gluten Feed	6	Lowest.	21.38	24.20	2.84	3.76
		Average	24.01	.. ..	3.17	
The H-O Co.'s		Highest.	13.81	....	4.40	
Horse Feed	3	Lowest.	13.06	12.30	4.15	4.90
		Average	13.52	....	4.25	
The H-O Co.'s						
Poultry Feed	1	....	19.50	16.80	5.62	7.00

SUMMARY OF ANALYSES, WINTER 1898—CONCLUDED.

Kind of Feeding Stuff.	Number of analyses.		Protein. Found—per cent.	Protein. Guaranteed—per cent.	Fat. Found—per cent.	Fat. Guaranteed—per cent.
The H-O Co.'s Dairy Feed	2	Highest. Lowest. Average	21.19 21.19 21.19	.... 18.75	4.71 4.57 4.64	7.25
American Cereal Co.'s Victor Corn and Oat Feed	6	Highest. Lowest. Average	10.69 8.63 9.36	.... 8.21	4.87 3.30 3.79	3.15
American Cereal Co.'s Quaker Oat Feed	6	Highest. Lowest. Average	12.82 7.94 10.51	.... 12.03	4.14 2.82 3.29	3.49
W. H. Haskell & Co.'s Haskell's Oat Feed	1	....	10.56	9.62	7.43	7.66
Chas. M. Cox & Co.'s Oatena	1	....	9.38	10.00	4.25	4.00
Bowker Fertilizer Co.'s Bowker's Animal Meal	2	Highest. Lowest. Average	41.38 39.38 40.35	.... 30.00	12.12 10.60 11.36	5.00
Bradley Fertilizer Co.'s Bradley's Superior Meat Meal	2	Highest. Lowest. Average	44.50 43.56 44.03	.... 40.00	17.22 17.02 17.12	15.00
Nash Manufacturing Co.'s Nash's Beef Scraps	1	....	47.69	52.19	30.26	28.42
Frank S. Farrar & Co.'s Farrar's Meat Scrap	1	....	50.63	42.00	25.20	30.00

SUMMARY OF ANALYSES, FALL 1898.

American Cotton Oil Co.'s Prime Cotton Seed Meal	14	Highest. Lowest. Average	47.81 42.25 45.71	.... 43.00	13.32 8.80 10.75	9.00
Southern Cotton Oil Co.'s Prime Cotton Seed Meal	1	....	46.82	43.00	9.76	9.00
J. E. Soper & Co.'s Cotton Seed Meal	2	Highest. Lowest. Average	46.13 44.75 45.44	.... 43.00	14.72 8.78 11.75	9.00
R. B. Brown Oil Co.'s Prime Cotton Seed Meal	2	Highest. Lowest. Average	47.88 46.75 47.32	.... 43.00	9.97 8.34 9.16	9.00
S. W. Thaxter & Co.'s Cotton Seed Meal	4	Highest. Lowest. Average	51.92 48.69 50.48	.... 49.25	11.25 10.33 10.79	15.62
F. W. Brodé & Co.'s Owl Brand Cotton Seed Meal.	10	Highest. Lowest. Average	46.38 43.31 44.68	.... 43.00	13.13 9.90 11.90	9.00

SUMMARY OF ANALYSES, FALL 1898—CONTINUED.

Kind of Feeding Stuff.	Number of analyses.		Protein. Found—per cent.	Protein. Guaranteed—per cent.	Fat. Found—per cent.	Fat. Guaranteed—per cent.
Sea Island Cotton Seed Meal ...	2	Highest.	25.06	24.31	7.09	5.00
		Lowest.	21.82	20.13	5.83	4.57
		Average	23.44	....	6.46	
Charles Pope Glucose Co.'s Cream Gluten Meal	7	Highest.	35.69	....	5.43	
		Lowest.	30.94	37.12	2.24	3.20
		Average	33.22	....	3.53	
The Glucose Sugar Refin'g Co.'s Chicago Gluten Meal..........	14	Highest.	40.63	38.00	2.79	3.37
		Lowest.	36.13	36.00	1.70	2.00
		Average	38.01	....	2.15	
National Starch Man'fg Co.'s King Gluten Meal	11	Highest.	37.32	....	16.40	
		Lowest.	31.50	32.00	4.28	16.00
		Average	33.62	....	11.72	
Arthur R. Hopkin's Imperial Gluten Meal.........	1	....	20.13	20.00	12.00	11.50
American Glucose Co.'s Buffalo Gluten Feed	1	....	28.25	29.00	4.68	3.00
S. W. Thaxter & Co.'s Gluten Feed	1	....	22.63	....	5.93	.....
The Glucose Sugar Refin'g Co.'s Rockford Diamond Glut. Feed	4	Highest.	25.75	....	4.43	
		Lowest.	24.69	24.20	3.44	3.75
		Average	25.33	....	3.95	
Douglas & Co.'s Old Process Oil Meal	1	....	26.63	36.94	6.45	6.58
Cleveland Linseed Oil Co.'s Cleveland Flax Meal..........	1	....	39.75	39.00	2.28	1.50
Cleveland Linseed Oil Co.'s Linseed Oil Meal..............	1	....	36.81	39.00	2.52	1.50
The American Cereal Co.'s Victor Corn and Oat Feed	11	Highest.	9.94	....	4.92	
		Lowest.	8.12	9.46	2.85	3.92
		Average	9.06	....	3.83	
S. A. & J. H. True Co.'s Corn and Oat Feed	1	....	8.38	9.63	3.44	4.23
The American Cereal Co.'s Quaker Oat Feed	9	Highest.	11.13	....	3.97	
		Lowest.	7.44	12.03	2.57	3.49
		Average	8.96	....	2.96	
The American Cereal Co.'s American Poultry Food	1	....	14.19	....	5.91	......
The American Cereal Co.'s Corn, Oat and Barley Feed ...	1	....	12.75	11.26	5.39	4.15
W. H. Haskell & Co.'s Haskell's Oat Feed	1	....	11.31	9.62	7.91	7.66
Andrew Cullen & Co.'s Crescent Oat Feed.......	1	....	8.63	....	3.72	.....
Monarch Oat Feed	1	....	11.19	10.25	8.79	7.47

SUMMARY OF ANALYSES, FALL 1898—CONCLUDED.

Kind of Feeding Stuff.	Number of analyses.		Protein. Found—per cent.	Protein. Guaranteed—per cent.	Fat. Found—per cent.	Fat. Guaranteed—per cent.
The H-O Co.'s Poultry Feed	3	Highest.	18.31	....	5.92	
		Lowest.	17.81	16.80	5.43	7.00
		Average	18.04	....	5.70	
The H-O Co.'s Standard Dairy Feed	3	Highest.	20.94	....	5.42	
		Lowest.	17.06	18.75	4.24	7.25
		Average	19.46	....	5.02	
The H-O Co.'s Horse Feed	3	Highest.	11.94	....	4.75	
		Lowest.	11.69	12.30	3.81	4.90
		Average	11.81	....	4.36	
E. W. Blatchford's Calf Meal	1	....	33.44	... .	5.23	......
Bowker Fertilizer Co.'s Bowker's Animal Meal	5	Highest.	44.94	....	14.05	
		Lowest.	40.50	30.00	12.05	5.00
		Average	42.51	....	12.95	
Bradley Fertilizer Co.'s Superior Meat Meal	1	....	43.56	40.00	15.95	15.00
Bradley Fertilizer Co.'s Old Fashioned Beef Scraps	1	....	49.13	40.00	19.60	10.00

The figures of the tables explain themselves and little comment is needed. The following brief statements contain, however, some facts not included in the tabular matter, and will help to a better understanding of the workings of the law.

Cottonseed Meal.

Pure cottonseed meal is made by grinding the seed after the white down, which remains upon the seed as it comes from the cotton gin, and the hard hulls have been removed. Thus prepared, cottonseed meal carries from 40 to 53 per cent of protein. At first cottonseed meal was all high grade goods. The temptation to adulterate was too strong for unscrupulous manufacturers to withstand and the market was overrun with cottonseed meal adulterated with finely ground hulls. This made a dark colored meal, the color of which was sometimes "improved" by grinding and mixing a bright yellow clay with the meal. Some of these meals were known in the trade as "Sea Island" cottonseed meal, and others were sold without any brand. The following analyses show how these inferior and adulterated goods run.

ANALYSES OF ADULTERATED COTTON SEED MEALS.

Number.	Protein—per cent.	Fat—per cent.	Number.	Protein—per cent.	Fat—per cent.
8006	26.00	5.63	8022	26.25	....
8009	29.94	6.78	8025	34.00	8.36
8010	26.19	7.14	8028	20.13	4.57
8015	22.00	9.60	8043	21.19	5.88
8016	29.75	10.59	8048	26.94	....
8018	25.63	....	8062	25.13	....

Goods of this type were very abundant in this State in 1897, but there are almost none of them to be found at present. In the spring of 1898 the inspectors reported a few lots of these goods. In November, 1898, only two lots of low grade cottonseed meal were found by the inspectors, and these samples were guaranteed in accordance with their low grade. It would seem as though the inspection law has driven them to other states. The chemist of the Rhode Island Station under date of March 10, 1898, wrote inquiring regarding the working of the law and said, "I regret to say that Rhode Island is becoming the dumping ground of adulterated cottonseed meal, et cetera." This is also indicated by the following received from a large manufacturer of cottonseed meal. "You will please print tags as ordered for x x x x Mill and send same by freight instead of express. We have discovered that the meal we anticipated shipping into Maine market was not of sufficient quality to meet requirements of your State. We have, therefore, concluded not to ship as anticipated. We will, later in the season, have a very nice grade of meal at x x x x Mill at which time we will place same in Maine market."

Occasionally the Station has had sent to it by correspondents samples of suspected meal, but with one exception analyses have shown them to be up to guarantee. Not all dark colored meal is adulterated and not all bright yellow meal is free from adulteration.

The law has proven itself a decided advantage to the manufacturer and dealer in honest cottonseed meal, and is practically prohibitive to adulterated goods. It is gratifying to note that in no case has the percentage of protein fallen materially below the guarantee. From the fact that much of the cottonseed meal carries more protein than the guarantee, it will probably result in grading the cottonseed meals according to their composition. One firm in the winter of 1898 handling unusually good cottonseed did this, guaranteeing the meal to carry 49 per cent protein, instead of the 43 per cent of the other brands.

Linseed Meal.

Linseed meal is made by grinding flaxseed from which the oil has been more or less completely extracted. "Old Process" contains more fat and somewhat less protein than "New Process" linseed meal.

True and Company based their guarantee upon an analysis made for them by the Station in October, 1897. Of the two samples collected, one was a little above, the other a little below, the guarantee. The goods were quite uniform, however.

The Cleveland Linseed Oil Company placed the same guarantee upon their oil meal as on their flax meal. The flax meal proved better and the oil meal poorer than the guarantee. The attention of the company has been called to this, and they will doubtless change their guarantee of protein in the oil meal.

Only three samples of linseed meal were found by the inspectors in November. Its high cost, relative to cottonseed meal had apparently crowded it out of the market. The guarantee of Douglass & Company's oil meal was based upon an analysis of a sample sent to the Station months before by the wholesaler, who writes as follows: "When you analyzed our oil meal we had a large quantity on hand, and we tagged as you directed. It is so high now that very little is sold and we have had a few lots that we have sold and we supposed was of same quality. We have not at present a single sack in our store."

Gluten Meals and Feeds.

Gluten meals and gluten feeds are by-products left in the manufacture of starch and glucose from Indian corn. Corn consists largely of starch. The waste product from the manufacture of starch or sugar is relatively much richer in oil and protein than corn. Many factories are removing part of the corn oil from the waste, so that some gluten meals carry but little oil, e. g., Chicago Gluten Meal, which a few months ago carried 7 to 9 per cent of fat, now has from 2.50 to 4 per cent. This reduction in fat is probably an advantage, as feeding corn oil to dairy animals seems to have a tendency to make the butter soft.

No by-products used for feeding differ more from each other than do these starch and sugar wastes. The manufacturers apparently do not recognize that the composition of these offals change greatly, and some of them have based their guarantees upon old analyses.

Cream gluten meal is not up to the guarantee in protein. It is guaranteed to carry thirty-seven per cent, but from the samples drawn the purchaser can not expect more than thirty-three per cent of protein on the average, and one sample ran as low as thirty-one per cent of protein. The attention of the handlers of this feed has been called to these discrepancies between guarantee and analysis and they will probably be corrected on future shipments.

These samples of Chicago gluten meal represent both old and new goods. The old goods were guaranteed too high in fat. The present guarantee, thirty-eight per cent protein and two per cent fat, fairly well represents the goods on the market. The protein found in the samples examined, agrees as closely as can be expected with the guarantees. The State agents seem to be anxious that their guarantees shall represent the goods as sold.

King gluten meal as sold in Maine comes from two mills, the output of which differ greatly in composition. The goods made at the Des Moines mill are very close with the guarantee, thirty-two per cent protein and sixteen per cent fat; the goods from the Indianapolis mills are higher in protein than the guarantee and are correspondingly low in fat. The Indianapolis goods carry about thirty-four per cent protein and four per cent of fat. The attention of the dealers has been called to this and the goods will be correctly branded in the near future.

Feeds Low in Protein.

Very few farmers can afford to buy feeds low in protein and high in carbohydrates at any price at which they have been or are likely to be offered. The farmer should grow all the coarse feeds that he needs. Oat and similar feeds are very much like corn stalks or oat straw in composition. Some of the feeds have cottonseed or other nitrogenous feeding stuffs added to them so that they carry more protein than straight oat feeds, but these mixtures are always more expensive sources of protein than are the glutens, cottonseed and linseed meals. One hundred pounds of an ordinary oat feed has from eight to eleven pounds protein. At seventy-five cents per hundred the protein costs from seven to nine cents a pound. One hundred pounds of a good gluten meal has from thirty-four to fortv per cent of protein. At $1.10 per hundred the protein costs about three cents a pound and it not only costs less than half as much but it is better digested. As a source of protein, it would be as good economy to pay $60.00 a ton for high grade cottonseed meal as to pay $15.00 a ton for the ordinary oat feed.

A number of samples of different oat feeds have been examined. For the most part guarantees are based upon single analyses of the feeds and the goods usually are not quite as good as the sample upon which the guarantee rests. With the exception of the American Cereal Company's Quaker Oat Feed none of these materials are much below and some run above the guarantee.

Blatchford's Calf Meal.

This is a manufactured food only one lot of which was found by our inspectors. This was not guaranteed but carried 33.44% protein and 5.23% of fat. In some advertising matter connected with Blatchford's calf meal it is claimed that 12.8 pounds of it has three and one-half pounds of protein which is about twenty-seven and one-half per cent. A sample of these goods sent by a dealer to the Station in September analyzed as follows:

Water, 7.70%; ash, 5.46%; protein, 25.63%; crude fiber, 5.28%; starch, 18.24%; undetermined carbohydrates, 32.13%; fat, 5.56%. It will be observed that the goods as evidenced by the official sample and this lot sent to the Station are very uneven in composition;—one sample carrying about 26% and the other about 33% of protein. A large part of the ash is common salt.

These goods were sent to an expert on food mixtures and adulterations at the Connecticut Experiment Station who reports as follows: "I have examined Blatchford's calf meal under the microscope and find it contains linseed meal, some product from the wheat kernel, some product from the bean kernel and a little fenugreek. The linseed meal appears to be the chief constituent. The wheat product is bran, middlings or some similar product consisting of starchy matter mixed with more or less of the seed coats. Bean bran was present in considerable amount and more or less of the starchy matter."

In a letter, Mr. J. W. Barwell, the proprietor of these goods, said: "Regarding the ingredients, I cannot give you the exact constituents of it, but I may say that it is composed mostly of locust bean meal with leguminous seeds such as lentils, etc., and oleaginous seeds such as flaxseed, fenugreek and annis seed, all cleaned, hulled and ground together and thoroughly well cooked. There is no cheap mill food and no low grade feed enters into this composition. I am prepared to go into any court in the United States and make an affidavit that there is no farmer in the United States that can compound Blatchford's calf meal for less than $3.50 per hundred."

Locust bean meal which Mr. Barwell claims to be the chief constituent of Blatchford's calf meal is practically not used in this country as a cattle feed. The average of ten English and German analyses show it to carry:—water, 14.96%; ash, 2.53%; protein, 5.86%; crude fiber, 6.39%; nitrogen-free-extract, 68.98%; fat, 1.28%.

It is evident from the chemical analysis that locust bean meal cannot be the chief constituent of Blatchford's calf meal, but that the microscopist is correct that linseed meal is the chief constituent. Locust bean meal has only six per cent of protein and in order to make a mixture carrying from twenty-six to thirty-three per cent of protein, it would be necessary to add large quantities of goods like linseed meal rich in protein. As seen from the analysis Blatchford's calf meal has a feeding value somewhat inferior to old process linseed meal. Whatever it may cost to manufacture, no man who has sufficient intelligence to mix feeds can afford to buy it at anything like the price ($70 per ton) asked.

The Operation of the Law.

It was and is the belief of the writer that all the principal manufacturers and dealers are reliable men, of strict integrity. The enforcement of the law has been made on this assumption, and we have enjoyed the coöperation of dealers and manufacturers, as well as that of consumers. 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.

The most noticeable thing accomplished by the law is the driving out of the State, the adulterated cottonseed meal which was so largely sold in 1897. The law has come into effect with little friction, and bids fair to run as smoothly and satisfactorily as the fertilizer law. It protects both the dealer and the consumer. It tends toward a more rational use of feeding stuffs, which will be alike beneficial to the feeder and the dealer.

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 will be sent on application.

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, published in August, 1897, contains the law and rules for testing purity of seeds. Copies of this bulletin are still available and will be sent on application.

Since the enactment of a seed inspection law in Maine quite a number of samples have been received by the Station for examination. Five grams of all the seeds submitted (excepting red top of which only two grams were inspected) were examined. The inert matter and foreign seeds were separated by hand and then the foreign seeds classified into harmful and noxious. The inert matter and foreign seeds were weighed and the per cent calculated. The weed seeds were usually counted so as to give the number in a pound and the names of the weeds determined by comparison with sets of named seeds.

The inert matter consisted of sand, fragments of stems and leaves, chaff, whole insects, fragments of insects and insect excreta. The harmless foreign seed consisted mostly of red top and clover in timothy, timothy, red top and clover in alsike and timothy and clover in red top. There were several other species of grass seeds present some of which we were not able to determine. Some were noxious, some indifferent. We think most of the samples examined came from outside the State and were purchased to sell as seed. There were sixty-five kinds of weed seed detected, the most important of which are tabulated below.

The kinds and amount of weed seeds found in the samples examined lead to the belief that seed for planting is not the only source of weeds in the State. A good many of the weed seeds found in the samples would not grow. An examination of whole grain brought in by the car-load and distributed in the State shows that it frequently carries many weed seeds. Interstate and State commerce where packing material is used are also important sources of weeds.

It will be noticed from the appended tables that the per cent of purity of seeds was for the most part high and that a large number of samples contained no weed seeds or only those that were not pernicious.

It is impossible to get a correct idea of the average per cent of purity of seed sold in the State from samples sent for examination, as one sample may represent only a few bags and another a car-load. A statement of the per cent of purity of a seed gives but little idea of its nature, as the impurities may be large and consist of harmless seeds or indifferent weeds, while one showing a low per cent of impurities may contain the vilest weed seeds.

The tables showing the results of the analyses of samples of seeds follow.

TABLE SHOWING THE RESULTS OF SEED ANALYSES INCLUDING PERCENTAGES OF PURITY, TOTAL IMPURITIES, INERT MATTER, FOREIGN AND WEED SEEDS.

	Number of samples examined.	Samples free from inert matter.	Samples free from foreign seed.	Samples free from weed seeds.	Highest per cent of purity.	Lowest per cent of purity.	Average per cent of purity.	Highest per cent of impurity.	Lowest per cent of impurity.	Average per cent of impurity.	Per cent of weed seeds.*	Per cent of inert matter.
Red Clover	45	4	4	4	100	92.2	98.6	7.8	.45	1.4	1.08	.33
White Clover	1	....	....	....	99.7	......	99.7	.3	.90	.3	.20	.10
Alsike	24	....	....	....	99.1	93.4	97.2	6.6	...	2.8	1.85	.58
Peavine Clover	1	....	....	....	98.8	......	98.8	1.2	....	1.2	1.00	.20
Timothy	51	2	....	9	99.9	96	99.2	4.0	.10	.8	.46	.40
Redtop	7	....	....	2	99.5	21.6	85.7	78.4	.55	4.3	4.57	10.63
Orchard Grass	1	....	....	....	96.7	......	96.7	3.3	....	3.3	.80	2.50
Kentucky Bluegrass	1	....	....	....	99.4	......	99.4	.65	....	......	.50	.35
Hungarian	3	....	....	....	99.9	94.5	98.1	5.5	....	1.9	1.80	.70

* Foreign harmless seeds not included.

TABLE SHOWING THE KINDS OF WEED SEEDS FOUND IN SAMPLES OF SEEDS EXAMINED.

		Name of Samples Examined.								
		Red clover.	White clover.	Alsike.	Peavine.	Timothy.	Redtop.	Orchard grass.	Kentucky bluegrass.	Hungarian.
Common Name.	Technical Name.	45	1	24	1	51	7	1	1	3
Hedge Mustard	Sisymbrium officinale.	1	....	....	...	...	....	....	....	....
Black Mustard	Brassica nigra	4	....	....	....	3	....	....		1
Shepherd's Purse	Capsella bursa-pastoris	...	....	7	....	17	...	....	....	....
Wild Peppergrass	Lepidium virginicum.	....	....	1	....	....	3	1	....	....
Wild Peppergrass	Lepidium intermedium	....	...	1	....	....	...	....	....	....
Common Chickweed	Stellaria media	...	1	....	....	8	4	....	....	....
Spurry	Spergula arvensis	....	....	1	....	1	....	....	....	....
Evening Primrose	Œnothera biennis	....	....	1	....	1	....	....	....	....
Five Finger—Cinque Foil	Potentilla monspeliensis	....	...	....	...	3	5	....	....	...
Wild Carrot	Daucus carota	2	....	....	....	....	....	....	...	....
Cone Flower—Yellow Daisy	Rudbeckia hirta	....	....	....	....	10	....	....	....	....
May Weed	Anthemis cotula	1	....	1	..	2	....	....	...	....
Common Bur-Thistle.	Carduus lanceolatus	...	....	3	....	2	....	....	...	....
Spring Sow-Thistle	Sonchus asper	1	....	....	1	2	2	....	....	1
Corn Sow-Thistle	Sonchus arvensis	9	.	....	....	9	....	....	....	...
Roman Wormwood	Ambrosia artemesiæfolia	....	....	...	....	...	....	....	....	1
Ox-eye Daisy	Chrysanthemum leucanthemum	....	....	....	....	1	....	....	...	....
Blue Verbena	Verbena hastata	....	....	1	...	5	....	....	....	....
Catnip	Nepeta cataria	....	....	2	....	2	....	....	....	....
Heal All	Prunella vulgaris	....	....	2	....	2	....	....	....	....
Dooryard Plantain	Plantago major	3	....	2	....	5	....	....	....	...
Rugel's Plantain	Plantago rugelei	....	....	....	....	5	....	....	...	....
English Plantain	Plantago lanceolata	17	...	2	....	1	1	1	....	....
Awned Plantain	Plantago aristata	5	....	4	....	1	....	....	....	1
Prostrate Pigweed	Amaranthus blitoides.	2	....	...	....	...	....	...	....	....
Rough Pigweed	Amaranthus retroflexus	9	....	8	...	4	2	....	...	....
Goosefoot	Chenopodium album	12	1	8	....	14	...	....	....	3
Sorrel	Rumex acetosella	7	1	18	....	2	1	....	....	....
Pennsylvania Smartweed	Polygonum Pennsylvanicum	20	...	....	...	1	....	....	....	3
Lady's Thumb	Polygonum persicariæ	7	...	....	....	1	....	....	....	....
Black Bindweed	Polygonum convolvulus	12	1	13	....	6	....	1	1	....
Yellow Foxtail	Setaria glauca	1	...	....	...	....	....	....	....	....
Green Foxtail	Setaria viridis	6	....	....	...	....	....	....	....	....

BOX EXPERIMENTS WITH PHOSPHORIC ACID FROM DIFFERENT SOURCES.

L. H. MERRILL.

For several years a series of experiments have been in progress at this Station designed to show the relative availability of phosphoric acid as supplied in several common forms, and also the varying ability of some of our common crops to obtain phosphoric acid from the same source. The results obtained up to the close of 1895 were published in the report of this Station for that year, and also in Bulletin 34. While the work cannot be considered complete, yet as it is necessary to leave it for a time, it seems desirable to bring together all the results thus far obtained, including those previously published. In order to make the report complete in itself much of the explanatory matter is also reprinted.

COMMERCIAL PHOSPHATES.

Phosphate of Lime.—Nearly all the phosphoric acid found in our markets and 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 second and third forms described below are derived. Bones 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 finely ground, its phosphoric acid is given up very slowly to the plant. This is the tricalcic phosphate of chemists.

2. Soluble phosphate of lime. When the insoluble phosphate is treated with dilute sulphuric acid a large part of the lime

unites with the acid to form sulphate of lime. The remaining phosphate, containing much less lime than the original, is soluble in water and is hence known as soluble phosphate, or, on account of the excess of phosphoric acid, as "superphosphate." The soluble phosphate is in a condition to be immediately used by the plant. It possesses the additional advantages that by dissolving in the soil waters is becomes quickly and uniformly distributed through the soil, where the plant roots must everywhere come into contact with it. It is the most expensive of the three forms. This is also known as the monocalcic phosphate.

3. Reverted or citrate soluble phosphoric acid. 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 shown that there is but little difference as regards actual availability. In fact, if a soluble phosphate is added to the 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 citrate phosphates are often classed together as available.

The reverted or citrate soluble phosphate may or may not consist of dicalcic phosphate. While the dicalcic phosphate possesses the characters ascribed to the third form mentioned, yet it is found that in some cases the ammonium citrate will dissolve a considerable quantity of the tricalcic phosphate, the amount standing in intimate relation to the degree of fineness to which the phosphate has been reduced. The citrate, then, does not afford us the means of distinguishing sharply between the dicalcic and tricalcic phosphates. This fact, however, in no way affects the assumption that the citrate soluble phosphate is available to the plant.

It should be added also that the so-called insoluble does not strictly correspond to the tricalcic phosphate, for the reason just mentioned—a part of this form may go into solution with the citrate and be reckoned with the available.

In the manufacture of superphosphates the conversion of insoluble into soluble phosphates is never complete, a part being unacted upon by the acid and remaining in the insoluble form. Moreover, as we have seen, a part of the soluble phosphate reverts, especially on long standing. In practice, therefore, we always find a superphosphate to consist of a mixture of the three forms referred to. There must always be present sulphate of lime and the impurities found in the original phosphate.

Redonda Phosphate.—In another class of phosphates, not so generally used, the phosphoric acid is combined with iron and alumina, instead of with lime. These phosphates are not only insoluble in water, and but very slightly soluble in hot ammonium citrate, but they are even less available to the plant than the corresponding phosphates of lime. When treated with sulphuric acid they prove very difficult of management, giving a pasty mass which cannot be readily dried off.

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 the 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.

PHOSPHATES USED IN BOX EXPERIMENTS.

In the experiments here recorded, three forms of phosphates were used:

1. Acid Florida rock. This was prepared by treating a Florida phosphatic rock with sulphuric acid, thereby converting a large part of the phosphate into an available form. At the

beginning of the first experiment this phosphate had the following composition: 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). In the later work it was found that the composition had changed somewhat, but the amount of available phosphate remained about the same.

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" used in this experiment consisted of the sediment deposited from these washings.

3. A phosphate of iron and alumina (Redonda). The first sample used contained 49.58 per cent phosphoric acid, a large part of which, 42.77 per cent, was soluble in ammonium citrate. The Redonda underwent such rapid changes in the intervals between the experiments that it became necessary to prepare fresh quantities at each successive planting. The analysis given above is fairly representative of all.

Twenty grams of the floats, containing 6.58 grams total phosphoric acid, were used for a single box. The other phosphates used were first analyzed and such quantities used for each box that the total quantity present was in each case the same, 6.58 grams. The actual amounts of available phosphoric acid thus supplied to each box by the various phosphates were: by the acid rock, 5.39 grams; by the floats, .49 grams; by the Redonda, 5.67 grams.

DETAILS OF THE EXPERIMENT.

The experiments were conducted in one of the green houses, the plants being grown in wooden boxes, fourteen inches square and twelve inches deep. When filled to within one and one-half inches of the top, these boxes contained 120 pounds of sand. The sand used was taken from a knoll near the river at a depth of three or four feet, and was nearly free from organic matter. Traces of phosphoric acid were present, but as this was in the insoluble form and the quantity in each box was the same, its presence is not considered objectionable. The sand was carefully screened before being used and thoroughly mixed with the phosphates and other plant foods.

In each period twelve boxes were used for each kind of plant. In the first box the acid rock was used; in the second, the untreated Florida rock, or "floats;" in the third, the phosphate of iron and alumina, or Redonda; the fourth box received 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 exactly the same treatment. In addition to the phosphates, each box received ten grams sodium nitrate, five grams potassium chloride and five grams magnesium sulphate. In the boxes where the Redonda was used, ten grams calcium sulphate were also added. It was intended to supply all the elements essential to the healthy development of the plants except that every fourth box received no phosphate. All the other conditions were made as uniform as possible in order that the differences in growth might fairly be attributed to the differences in the phosphates used.

KINDS OF PLANTS GROWN.

Eighteen species of plants were chosen, representing seven orders: peas, horse-beans, clover and alfalfa (Leguminosæ); turnips, ruta-bagas, cauliflower and kohl-rabi (Cruciferæ); barley, corn, oats and timothy (Gramineæ); tomatoes and potatoes (Solanaceæ); carrots and parsnips (Umbelliferæ); buckwheat (Polygonaceæ); sunflowers (Compositæ).

It was intended to carry each plant through three periods of growth, but the clover, the common red species (T. pratense), could not be matured in the time required for the other plants and but two crops were grown. The sunflower and buckwheat did not thrive under the conditions of the experiment and after a single trial were replaced by carrots and parsnips, which were grown for the two following periods. The seed was carefully selected, that only being used which was well formed and of uniform size. Of the larger plants, four or five were grown to each box. The smaller plants were thinned so that the number to each box was uniform for that plant. Such leaves as ripened before the plants matured were removed, dried and added to the plants when harvested. No attempt was made at pollination.

As very few insects were present during the growth of the plants, the fruiting, as might have been expected, was very irregular. As soon as the plants seemed to have attained their maximum development, they were harvested, dried, weighed, and the total amount of dry matter determined for each crop grown. In the diagrams that follow the average production for a single period is shown, the heavy lines representing the relative weights of dry matter, and the last column the weights in grams.

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.		167
	Floats.		122
	Redonda.		94
	No phosphate.		87
Horse beans.	Acid rock.		269
	Floats.		128
	Redonda.		118
	No phosphate.		86
Clover.	Acid rock.		217
	Floats.		169
	Redonda.		126
	No phosphate.		83
Alfalfa.	Acid rock.		107
	Floats.		97
	Redonda.		87
	No phosphate.		90
Turnips.	Acid rock.		222
	Floats.		202
	Redonda.		187
	No phosphate.		119
Ruta-bagas.	Acid rock.		152
	Floats.		145
	Redonda.		122
	No phosphate.		64
Cauli-flower.	Acid rock.		176
	Floats.		167
	Redonda.		107
	No phosphate.		62
Kohl-rabi.	Acid rock.		232
	Floats.		209
	Redonda.		172
	No phosphate.		130
Barley.	Acid rock.		338
	Floats.		171
	Redonda.		186
	No phosphate.		146
Corn.	Acid rock.		218
	Floats.		85
	Redonda.		98
	No phosphate.		31
Oats.*	Acid rock.		662
	Floats.		307
	Redonda.		380
	No phosphate.		319
Timothy.*	Acid rock.		410
	Floats.		329
	Redonda.		346
	No phosphate.		353

*In the case of the oats and timothy the scale has been reduced one-half to accommodate the lines to the space allowed. The *relative* length of the lines for the *same plant* has been maintained.

RELATIVE WEIGHTS OF DRY MATTER OF PLANTS GROWN WITH PHOSPHORIC ACID—CONCLUDED.

Crops.	Phosphate.	Comparative Scale.	Weight.
			Grams.
Tomatoes.	Acid rock.		135
	Floats.		92
	Redonda.		79
	No phosphate.		36
Potatoes.	Acid rock.		260
	Floats.		187
	Redonda.		156
	No phosphate.		151
Carrots.	Acid rock.		214
	Floats.		141
	Redonda.		149
	No phosphate.		135
Parsnips.	Acid rock.		237
	Floats.		151
	Redonda.		155
	No phosphate.		163
Buck-wheat.	Acid rock.		107
	Floats.		54
	Redonda.		51
	No phosphate.		37
Sun-flowers.	Acid rock.		101
	Floats.		14
	Redonda.		15
	No phosphate.		11
Turnips, roots.	Acid rock.		100
	Floats.		70
	Redonda.		90
	No phosphate.		44
Rutabagas roots.	Acid rock.		62
	Floats.		47
	Redonda.		32
	No phosphate.		16
Cauli-flower, edible portion.	Acid rock.		50
	Floats.		19
	Redonda.		—
	No phosphate.		—
Kohl-rabi, edible portion.	Acid rock.		153
	Floats.		129
	Redonda.		92
	No phosphate.		60
Potatoes, tubers.	Acid rock.		185
	Floats.		131
	Redonda.		140
	No phosphate.		115
Carrots, roots.	Acid rock.		173
	Floats.		109
	Redonda.		113
	No phosphate.		102
Parsnips, roots.	Acid rock.		196
	Floats.		115
	Redonda.		114
	No phosphate.		120

RESULTS.

In every case the acid rock gave the best returns. The gain was especially marked with the family Gramineæ, three members of which, the barley, corn and oats, yielded nearly double the amount produced by either the floats or Redonda. The effect upon the sunflowers and buckwheat was equally marked; but if these plants could have been brought to full development it is probable that the gain would have been less apparent.

If we compare the amount of dry matter produced by the acid rock with that produced by the floats for all the crops grown, we find the balance in favor of the acid rock to be 52 per cent. In other words, the effect of the available phosphoric acid as compared with the insoluble phosphate was to increase the product more than one-half.

In nearly every case the floats gave results second only to those obtained with the acid rock. With this phosphate the Cruciferæ gave returns within ten per cent of those obtained by the acid rock. This is not true of the edible portion of these plants, however, for there the good effects of the acid rock were more marked.

Of the three forms of phosphate used, the Redonda proved the least valuable, though supplying a larger amount of available phosphoric acid than the acid rock. In most cases it showed itself inferior even to the floats. The Gramineæ furnished an interesting exception to this rule, yielding results with Redonda above those given by the floats.

The small yield from the boxes in which no phosphate was used is sufficient indication of the extreme poverty of the soil, and confirms the belief that the amount of phosphoric acid thus supplied is not sufficiently large to seriously affect the experiment.

It is interesting to note that plants of the same family show a remarkable agreement in their behavior towards the various phosphates. The striking manner in which the Gramineæ responded to the stimulus of the acid rock has already been alluded to. In no other case is the effect so marked. Another peculiarity of the members of this family is shown in their conduct toward the Redonda. The relative value of this phosphate and floats is here the reverse of that shown by nearly all the other plants. The failure of the Cruciferæ to respond to the acid rock furnishes a good illustration of a similar kind. The Umbelliferæ, though responding to the acid rock, seem to derive no benefit from either the floats or Redonda, since neither of the phosphates increase the yield above that obtained where no phosphate was used. This is true both of the whole plant and the roots.

The alfalfa shows a strange indifference to the precise form in which the phosphoric acid is supplied. The crop was light in every case, and the phosphoric acid already present in the barren soil used, seems to have sufficed for the slender product.

STIMULATING EFFECT OF ACID PHOSPHATE IN THE EARLY STAGES OF GROWTH.

A report of this work would be incomplete if it failed to take note of certain facts observed in the course of the experiment which cannot be shown in the diagram, where only the final results are given.

Throughout the whole series of experiments the effect of the acid rock was marked, the plants receiving it in nearly every case at once taking the lead, and keeping it to the end. This stimulating effect upon the young plant is shown in the accompanying cuts of the immature clover and timothy. The horsebeans furnish a marked exception to this rule, the more nearly equal development being perhaps due to the large amount of nutriment stored in the seed. When this supply was exhausted, the phosphoric acid hunger manifested itself, the effect being shown in the cut of the same plant at a later period.

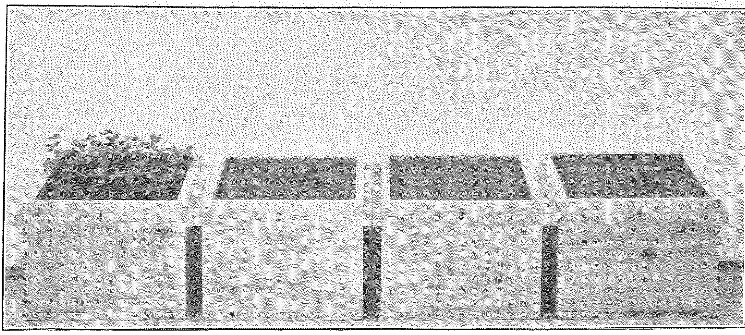
In by far the larger number of cases, especially with the clover, timothy, turnips and ruta-bagas, the good effects of the acid rock were more marked during the first few weeks of growth than at a later stage, when the roots had become more fully developed, and had begun to forage for themselves. This fact, also, is shown in the cuts of the clover and timothy. 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.

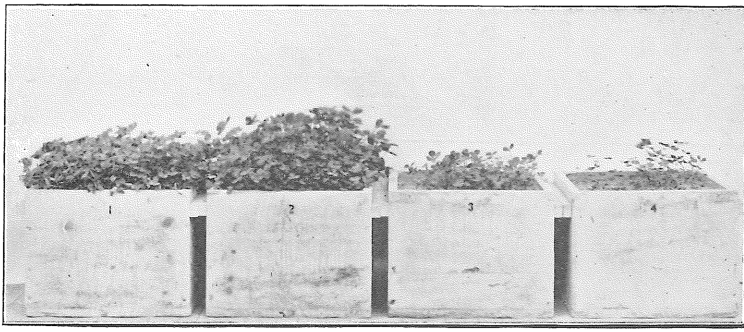
Box experiments were made at the New Hampshire Experiment Station in 1893 with winter rye, the phosphoric acid being supplied by roasted Redonda, ground bone, and basic slag. The result showed that the rye gave nearly as good returns with the roasted Redonda as with the other phosphates. This result confirms the work here reported. It will be seen by reference to the diagram here given that the corn, barley, oats and timothy (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, ruta-bagas, cauliflowers and kohl-rabi gave nearly as good returns with the Florida rock as with the acid rock.
3. In every other case the good effect of the acid rock was very marked.
4. In most cases the crude Florida rock yielded better returns than the Redonda.
5. Barley, corn and oats seem to require an acid phosphate.
6. When early maturity is desired, the acid rock can profitably be used.
7. The largely increased production obtained by the use of the acid rock will often determine the success of the crop.
8. The solubility of a phosphate in ammonium citrate is not always the correct measure of its actual value to the plant.



CLOVER, IMMATURE.



CLOVER, MATURE.

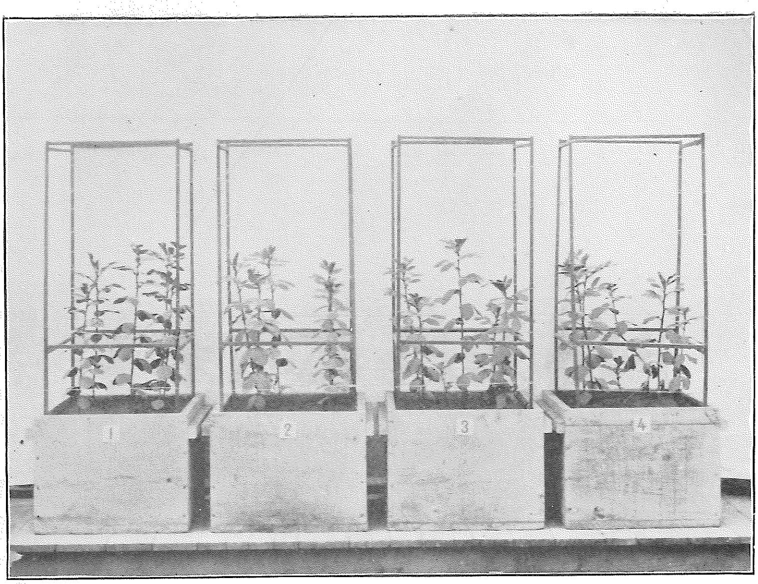
ALFALFA.

Box 1. Soluble phosphoric acid.

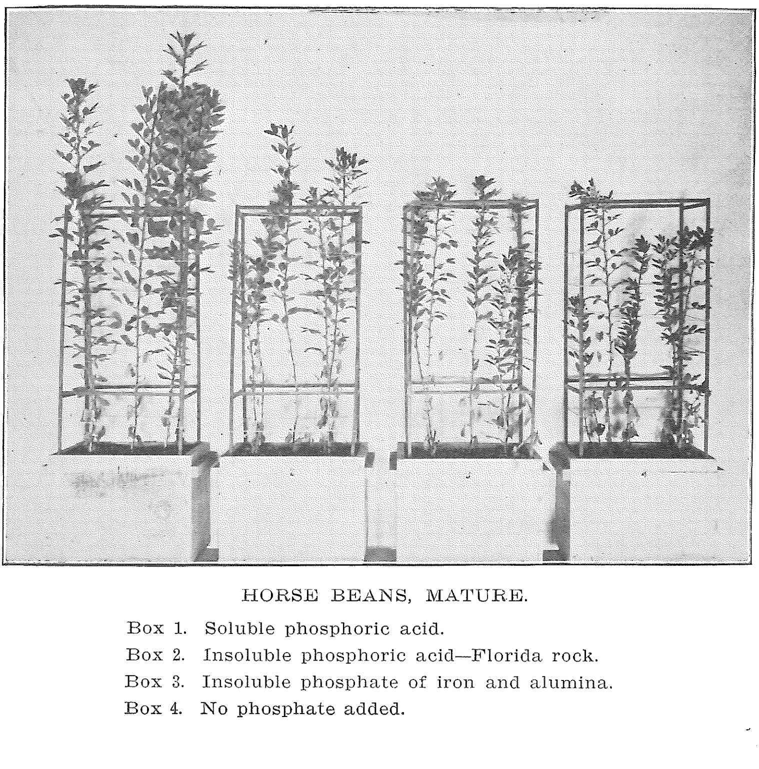
Box 2. Insoluble phosphoric acid—Florida rock.

Box 3. Insoluble phosphate of iron and alumina.

Box 4. No phosphate added.



HORSE BEANS, IMMATURE.



HORSE BEANS, MATURE.

Box 1. Soluble phosphoric acid.
Box 2. Insoluble phosphoric acid—Florida rock.
Box 3. Insoluble phosphate of iron and alumina.
Box 4. No phosphate added.

BARLEY.

OATS.

Box 1. Soluble phosphoric acid.

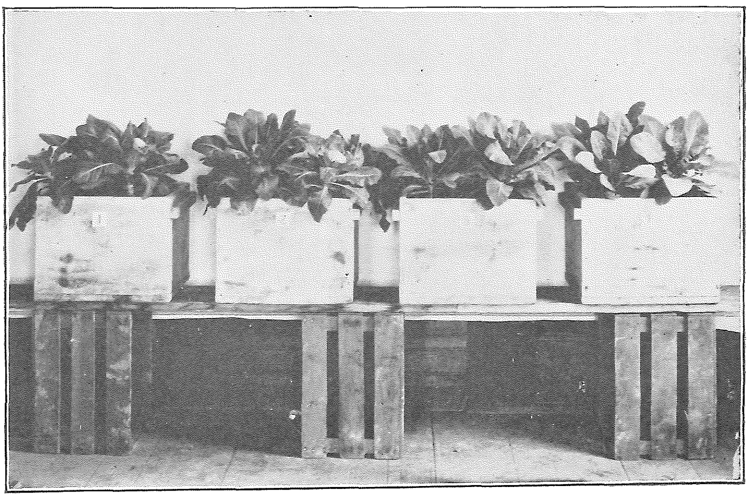
Box 2. Insoluble phosphoric acid—Florida rock.

Box 3. Insoluble phosphate of iron and alumina.

Box 4. No phosphate added.

TURNIPS.

RUTA-BAGAS.



CAULIFLOWER.

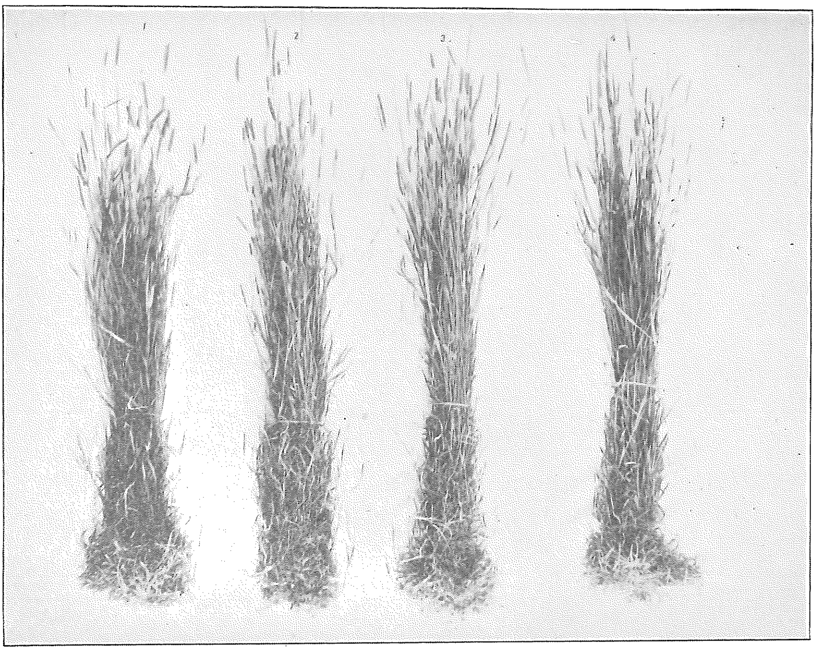
Box 1. Soluble phosphoric acid.

Box 2. Insoluble phosphoric acid—Florida rock.

Box 3. Insoluble phosphate of iron and alumina.

Box 4. No phosphate added.

TIMOTHY, IMMATURE.



TIMOTHY, MATURE.

Box 1. Soluble phosphoric acid.

Box 2. Insoluble phosphoric acid—Florida rock.

Box 3. Insoluble phosphate of iron and alumina.

Box 4. No phosphate added.

POTATOES.

TOMATOES.

KOHL-RABI.

Box 1. Soluble phosphoric acid.

Box 2. Insoluble phosphoric acid—Florida rock.

Box 3. Insoluble phosphate of iron and alumina.

Box 4. No phosphate added.

CARROTS.

PARSNIPS.

Box 1. Soluble phosphoric acid.

Box 2. Insoluble phosphoric acid—Florida rock.

Box 3. Insoluble phosphate of iron and alumina.

Box 4. No phosphate added.

ANALYSES OF FODDERS AND FEEDING STUFFS.

In connection with the work of the Station, analyses of the following miscellaneous feeding stuffs have been made by the Station chemists. For the most part the analyses were made in connection with the feeding experiments or experiments upon the growth of plants. In no case were they undertaken merely to increase the amount of this class of data. The methods of analyses recommended by the Association of Official Agricultural Chemists were employed.

The results of the analyses are given in the tables which follow:

COMPOSITION OF FODDERS AND FEEDING STUFFS ANALYZED AND NOT PREVIOUSLY PUBLISHED, CALCULATED TO WATER CONTENT AT TIME OF TAKING SAMPLE.

	Laboratory number.	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%	%
Bran	4015	9.83	5.47	16.31	8.93	53.96	5.50
Bran	4081	8.15	5.38	16.94	7.38	57.80	4.35
Bran	4107	9.65	6.71	16.56	8.56	53.36	5.16
Bran	4137	10.25	6.82	16.06	9.05	53.04	4.78
Corn Meal	4014	12.40	1.47	10.63	2.33	69.04	4.13
Corn Meal	4082	9.92	1.51	10.50	2.08	71.88	4.11
Corn Meal	4111	14.11	1.40	9.81	1.89	69.10	3.69
Corn Meal	4136	12.55	1.61	9.63	2.19	69.96	4.06
Cottonseed Meal	4083	5.27	5.49	52.25	3.81	21.08	12.10
Cottonseed Meal	4139	8.31	7.82	43.81	5.61	24.51	9.94
Cottonseed Meal	8044	6.57	5.97	51.06	5.44	20.87	10.09
Cottonseed Meal	8058	6.06	6.23	48.25	5.06	23.43	10.97
Chicago Gluten Meal	4016	10.11	1.38	36.00	3.86	40.49	8.16
Chicago Gluten Meal	4041	5.55	1.21	37.50	2.83	43.98	8.93
Chicago Gluten Meal	4106	10.40	1.15	36.75	1.59	47.24	2.87
Chicago Gluten Meal	4126	11.00	1.25	41.44	1.82	43.49	1.00
Chicago Gluten Meal	4141	12.94	1.42	40.31	2.00	40.96	2.37
King Gluten Meal	4018	9.53	1.94	26.31	2.45	44.59	15.18
King Gluten Meal	4140	6.72	1.81	35.94	2.36	35.45	17.72
King Gluten Meal	8011	3.48	.91	34.26	1.72	44.98	14.65
King Gluten Meal	8012	7.08	1.92	33.00	1.98	36.21	19.81
King Gluten Meal	8013	3.00	.53	35.37	2.01	41.62	17.47
Blatchford's Calf Meal	8273	7.70	5.46	25.63	5.28	50.37	5.56
Cleveland Flax Meal	4108	8.83	5.41	40.25	7.27	33.66	4.58
Linseed Meal	8057	9.10	5.39	35.19	9.05	34.84	6.43
Buffalo Gluten Feed	4095	9.32	3.53	27.25	6.69	50.10	3.11
Diamond Gluten Feed	8190	9.11	1.00	25.75	7.35	52.77	4.02
Gluten Feed	8047	9.15	3.38	28.19	6.89	49.42	2.97

COMPOSITION OF FODDERS AND FEEDING STUFFS—CONCLUDED.

	Laboratoay number.	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
	%	%	%	%	%	%	%
Gluten Feed	8188	8.98	2.83	27.50	6.82	50.90	2.97
Gluten Feed	8189	9.63	1.01	24.31	7.14	53.97	3.94
Mixed Feed	8276	11.16	4.42	14.94	5.30	60.38	3.80
Quaker Oat Feed	8046	8.33	5.10	11.38	18.18	53.41	3.60
The H-O Co.'s Poultry Feed	8038	8.46	2.71	18.00	4.65	60.71	5.47
The H-O Co.'s Poultry Feed	8271	10.39	2.87	16.75	5.02	59.21	5.76
The H-O Co.'s Poultry Feed	8362	10.36	3.09	16.94	4.61	59.45	5.55
The H-O Co.'s Scratching Feed for Poultry	8049	9.83	1.92	16.19	2.23	65.65	4.18
The H-O Co.'s Dairy Feed	8039	7.03	3.93	19.56	12.75	52.14	4.59
The H-O Co.'s Dairy Feed	8269	9.66	4.16	19.00	12.23	49.40	5.55
The H-O Co.'s Dairy Feed	8640	7.27	3.60	18.06	13.69	52.80	4.58
The H-O Co.'s Dairy Feed	8361	9.66	4.06	16.56	12.87	52.80	4.05
The H-O Co.'s Dairy Feed	8472	8.89	3.62	17.63	13.77	51.70	4.39
The H-O Co.'s Standard Horse Feed	8040	9.31	3.27	14.06	9.64	59.71	4.01
The H-O Co.'s Horse Feed	8270	12.07	3.35	10.38	10.61	59.62	3.97
The H-O Co.'s Horse Feed	8360	10.35	3.54	10.75	11.48	59.81	4.07
The H-O Co.'s Horse Feed	8473	9.38	2.87	11.81	10.03	61.64	4.27
The H-O Co.'s Horse Feed	8474	9.39	2.99	11.69	11.84	59.99	4.10
The H-O Co.'s Horse Feed	4080	11.06	3.24	13.44	9.80	58.56	3.90
The H-O Co.'s Scotch Oat Feed	8268	11.56	5.10	10.00	13.53	54.45	5.36
The H-O Co.'s "Victor" Corn, Oat and Barley Chop	8045	8.45	3.88	10.75	12.87	59.50	4.55
The H-O Co.'s De Fi Chop	8462	8.43	4.33	8.38	14.63	61.28	2.95
The H-O Co.'s Oat Bran	8471	7.54	6.03	10.88	19.14	51.03	5.38
Buckwheat Middlings	8363	13.81	4.57	25.56	12.86	36.66	6.54
Buckwheat Middlings	8379	11.29	4.69	25.56	10.68	40.35	6.43
Wheat Middlings	8056	9.93	3.45	17.38	5.53	58.82	4.89
Wheat Middlings	8060	10.05	2.84	17.44	3.72	61.66	4.29
Oat Middlings	8053	6.95	3.07	18.31	3.86	59.56	8.25
Oat Bran	8059	6.14	6.38	14.00	19.86	48.63	4.99
Oatena	8465	7.90	4.80	9.19	17.06	57.46	3.59
Ground Oat Hulls	8055	6.76	6.37	3.13	32.48	49.19	2.07
Grain Hulls	4109	11.01	11.22	11.75	16.15	47.57	2.30
Corn Germs	4110	4.76	1.96	15.31	6.65	24.91	46.41
Ground Corn	8054	11.88	1.07	10.19	1.80	71.67	3.39
Oat Hay—cut when in bloom	4097	26.46	5.55	7.25	26.99	31.90	1.85
Oat Hay—cut when grain was in milk	4096	26.59	4.57	7.77	23.14	35.54	2.39
Oat Hay—cut when grain was in dough	4089	16.30	5.21	6.47	26.58	42.60	2.84
Oat Hay—cut when part of heads were in bloom, part in milk	4127	13.76	6.33	8.80	28.87	39.38	2.86
Oat Hay—cut when part of the heads were in milk, part in dough	4130	13.28	6.25	6.59	29.45	41.13	3.30
Oat Hay—first 8 inch section of bottom of stalk	4134	9.80	6.17	2.50	39.23	40.58	1.72
Oat Hay—second 8 inch section of stalk	4135	10.00	7.35	4.31	37.43	38.91	2.00
Oat Hay—top of plant	4133	11.33	6.22	8.53	24.68	45.88	3.36
Silage—Sanford corn, very immature, no ears	4125	87.62	.98	1.50	3.56	5.90	.44
Corn Silage	4138	81.75	.91	1.92	4.70	9.89	.83
Corn Silage	8061	71.21	1.38	2.94	6.72	16.65	1.10
Hay	4117	18.19	5.01	6.88	24.52	43.44	1.96

COMPOSITION OF WATER FREE SUBSTANCE OF FODDERS AND FEEDING STUFFS ANALYZED AND NOT PREVIOUSLY PUBLISHED.

	Laboratory number.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%
Bran	4015	6.06	18.09	9.90	59.85	6.10
Bran	4081	5.86	18.45	8.04	62.92	4.73
Bran	4107	7.43	18.33	9.47	59.06	5.71
Bran	4137	7.60	17.89	10.09	59.10	5.32
Corn Meal	4014	1.67	12.13	2.68	78.81	4.71
Corn Meal	4082	1.67	11.66	2.31	79.80	4.56
Corn Meal	4111	1.63	11.42	2.20	80.45	4.30
Corn Meal	4136	1.84	11.00	2.50	80.02	4.64
Cottonseed Meal	4083	5.80	55.16	4.02	22.25	12.77
Cottonseed Meal	4139	8.53	47.79	6.12	26.73	10.83
Cottonseed Meal	8044	6.39	54.65	5.82	22.34	10.80
Cottonseed Meal	8058	6.63	51.36	5.39	24.94	11.68
Chicago Gluten Meal	4016	1.53	40.05	4.29	45.05	9.08
Chicago Gluten Meal	4041	1.28	39.70	3.00	46.56	9.46
Chicago Gluten Meal	4106	1.28	41.02	1.77	52.73	3.20
Chicago Gluten Meal	4126	1.40	46.56	2.05	48.87	1.12
Chicago Gluten Meal	4141	1.63	46.30	2.30	47.05	2.72
King Gluten Meal	4018	2.14	29.08	2.70	49.30	16.78
King Gluten Meal	4140	1.94	38.53	2.53	38.00	19.00
King Gluten Meal	8011	.94	35.50	1.78	46.60	15.18
King Gluten Meal	8012	2.06	35.52	2.13	38.97	21.32
King Gluten Meal	8013	.55	36.46	2.07	42.91	18.01
Blatchford's Calf Meal	8273	5.92	27.77	5.72	54.57	6.02
Cleveland Flax Meal	4108	5.93	44.15	7.97	36.92	5.03
Linseed Meal	8057	5.93	38.72	9.95	38.33	7.07
Buffalo Gluten Feed	4095	3.89	30.06	7.37	55.25	3.43
Diamond Gluten Feed	8190	1.10	28.33	8.09	58.06	4.42
Gluten Feed	8047	3.72	31.03	7.58	54.40	3.27
Gluten Feed	8188	3.11	30.23	7.48	55.92	3.26
Gluten Feed	8189	1.12	26.91	7.90	59.71	4.36
Mixed Feed	8276	4.98	16.82	5.97	67.96	4.27
Quaker Oat Feed	8046	5.56	12.41	19.83	58.27	3.93
The H-O Co.'s Poultry Feed	8038	2.96	19.66	5.08	66.32	5.98
The H-O Co.'s Poultry Feed	8271	3.20	18.69	5.60	66.08	6.43
The H-O Co.'s Poultry Feed	8362	3.45	18.90	5.14	66.33	6.18
The H-O Co.'s Scratching Feed for Poultry	8049	2.13	17.95	2.47	72.81	4.64
The H-O Co.'s Dairy Feed	8039	4.23	21.04	13.72	56.08	4.93
The H-O Co.'s Dairy Feed	8269	4.60	21.03	13.54	54.69	6.14
The H-O Co.'s Dairy Feed	8640	3.88	19.47	14.76	56.95	4.94
The H-O Co.'s Dairy Feed	8361	4.49	18.33	14.25	58.45	4.48
The H-O Co.'s Dairy Feed	8472	3.97	19.35	15.11	56.75	4.82
The H-O Co.'s Standard Horse Feed	8040	3.60	15.51	10.63	65.84	4.42
The H-O Co.'s Horse Feed	8270	3.81	11.80	12.07	67.80	4.52
The H-O Co.'s Horse Feed	8360	3.95	11.98	12.81	66.72	4.54
The H-O Co.'s Horse Feed	8473	3.17	13.03	11.07	68.02	4.71
The H-O Co.'s Horse Feed	8474	3.30	12.90	13.07	66.21	4.52
The H-O Co.'s Horse Feed	4080	3.64	15.11	11.02	65.84	4.39
The H-O Co.'s Scotch Oat Feed	8268	5.77	11.31	15.30	61.56	6.06
The H-O Co.'s "Victor" Corn, Oat and Barley Chop	8045	4.24	11.73	14.06	65.00	4.97
The H-O Co.'s De Fi Chop	8462	4.73	9.15	15.97	66.93	3.22
The H-O Co.'s Oat Bran	8471	6.52	11.77	20.70	55.19	5.82
Buckwheat Middlings	8363	5.30	29.66	14.92	42.53	7.89
Buckwheat Middlings	8379	5.29	29.94	12.04	45.48	7.25
Wheat Middlings	8056	3.83	19.29	6.14	65.31	5.43
Wheat Middlings	8060	3.16	19.39	4.14	68.54	4.77
Oat Middlings	8053	3.30	19.68	4.15	64.01	8.86
Oat Bran	8059	6.80	14.92	21.16	51.80	5.32
Oatena	8465	5.21	9.98	18.52	62.39	3.90
Ground Oat Hulls	8055	6.83	3.35	34.84	52.76	2.22
Grain Hulls	4109	12.61	13.21	18.15	53.45	2.58
Corn Germs	4110	2.05	16.08	6.98	26.16	48.73
Ground Corn	8054	1.21	11.56	2.04	81.34	3.85

COMPOSITION OF WATER FREE SUBSTANCE OF FODDERS AND FEEDING STUFFS—CONCLUDED.

	Laboratory number.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%
Oat Hay—cut when in bloom	4097	7.55	9.86	36.70	43.38	2.51
Oat Hay—cut when grain was in milk	4096	6.23	10.58	31.53	48.41	3.25
Oat Hay—cut when grain was in dough	4089	6.23	7.73	31.74	50.91	3.39
Oat Hay—cut when part of the heads were in bloom and part in milk	4127	7.34	10.20	33.48	45.66	3.32
Oat Hay—cut when part of the heads were in milk and part in dough	4130	7.21	7.60	33.96	47.42	3.81
Oat Hay—first 8 inch section of bottom of stalk	4134	6.84	2.77	43.49	45.00	1.90
Oat Hay—second 8 inch section of stalk	4135	8.16	4.79	41.60	43.23	2.22
Oat Hay—top of plant	4133	7.01	9.62	27.83	51.75	3.79
Silage—Sanford corn, very immature, no ears	4125	7.93	12.12	28.75	47.62	3.58
Corn Silage	4138	5.01	10.52	25.75	54.19	4.53
Corn Silage	8061	4.79	10.21	23.34	57.84	3.82
Hay.	4117	6.13	8.41	29.97	53.10	2.39

DIGESTION EXPERIMENTS WITH SHEEP.

J. M. BARTLETT.

The digestion experiments, the results of which are presented in the following pages, were not all made during 1898—three of them being made in 1897. The general plan was the same as heretofore followed. Sheep were the animals used and the feeding periods consisted of seven days preliminary feeding and five days for the experiment.*

The materials of which the digestibility was determined were:

1st. Oat Hay; cut in bloom.

2d. Oat Hay; cut when the grain was in milk.

3d. Oat Hay; cut when the grain was in dough.

4th. Oat Hay; cut when partly in bloom and partly in milk.

5th. Oat Hay; cut when the grain was partly in milk and partly in dough stage.

6th. H-O Horse-feed.

7th. Flax meal.

DIGESTION EXPERIMENT 63—(OAT HAY IN BLOOM.)

RATIONS.

Fed daily, Sheep No. I, 600 grams per day.

Fed daily, Sheep No. II, 600 grams per day.

Fed daily, Sheep No. III, 800 grams per day.

Fed daily, Sheep No. IV, 200 grams per day.

---

* Digestion experiments with sheep have been conducted at this station since 1885, and the results are given in the Reports for 1886, 1887, 1888, 1889, 1890, 1891, 1893, 1894, 1896 and 1897. The Report for 1891 contains a description of the digestion room, stalls, harness, etc., used in the experiments.

COMPOSITION OF FODDERS AND FECES.

	Laboratory number.	Dry matter.	Water-free. Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	%
Oat hay (cut when in bloom)	4097	73.53	92.45	7.55	9.86	36.70	43.38	2.51	4502
FECES.									
Sheep I	4102	....	91.65	8.35	9.65	33.39	46.06	2.55	4744
Sheep II.	4103	....	93.01	6.99	8.83	34.38	46.93	2.87	4891
Sheep III	4104	....	91.57	8.43	9.22	33.93	45.76	2.66	4723
Sheep IV	4105	....	89.43	10.57	12.87	26.44	46.80	3.32	4736

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.
SHEEP I.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Oat hay (cut when in bloom)	2205.9	2039.4	166.5	217.5	809.4	957.3	55.2
Feces	1051.7	963.9	87.8	101.5	351.1	484.6	26.7
Digested	1154.2	1075.5	78.7	116.0	458.3	472.7	28.5
Per cent digested	52.3	52.2	47.3	53.3	56.6	49.4	51.6
SHEEP II.							
Oat hay (cut when in bloom)	2205.9	2039.4	166.5	217.5	809.4	957.3	55.2
Feces	1084.6	1008.8	75.8	95.7	373.0	509.0	31.1
Digested	1121.3	1030.6	90.7	121.8	436.4	448.3	24.1
Per cent digested	50.8	50.5	54.5	56.0	53.9	46.8	43.7
SHEEP III.							
Oat hay (cut when in bloom)	2941.2	2719.2	222.0	290.0	1079.2	1276.4	73.6
Feces	1332.4	1220.0	112.4	122.8	452.0	609.7	35.5
Digested	1608.8	1499.2	109.6	167.2	627.2	666.7	38.1
Per cent digested	54.7	51.4	49.3	57.7	58.1	52.2	51.8
SHEEP IV.							
Oat hay (cut when in bloom)	735.3	679.8	55.5	72.5	269.8	319.1	18.4
Feces	298.3	266.8	31.5	38.4	78.9	139.6	9.9
Digested	437.0	413.0	24.0	34.1	190.9	179.5	8.5
Per cent digested	59.4	60.8	43.2	46.9	70.8	56.3	46.2
Average	54.3	53.7	48.6	53.5	59.9	51.2	48.3

FUEL VALUE OF FOOD FOR FIVE 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	9931	4990	4941	101	5042	50.77
Sheep II	9931	5306	4625	106	4731	47.64
Sheep III	13241	6294	6947	145	7092	53.56
Sheep IV	3310	1412	1898	30	1928	58.25

DIGESTION EXPERIMENT 64—(OAT HAY IN MILK.)

RATIONS.

Fed daily, Sheep I, 800 grams per day.
Fed daily, Sheep II, 400 grams per day.
Fed daily, Sheep III, 800 grams per day.
Fed daily, Sheep IV, 400 grams per day.

COMPOSITION OF FODDERS AND FECES.

	Laboratory number.	Dry matter.	Water Free.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
Fodder.		%	%	%	%	%	%	%	
Oat hay (cut when in milk)	4096	73.41	93.77	6.23	10.58	31.53	48.41	3.25	4561
Feces.									
Sheep I	4098	-	92.28	7.72	8.64	33.63	47.00	3.01	4763
Sheep II	4099	-	92.41	7.59	8.97	33.88	47.18	2.38	4839
Sheep III	4100	-	90.63	9.37	8.97	34.95	44.52	2.19	4628
Sheep IV	4101	-	90.22	9.78	12.10	28.97	46.16	2.99	4766

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.
SHEEP I.	Grams	Grams	Grams.	Grams.	Grams.	Grams.	Grams.
Oat hay (cut when in milk)	2805.2	2632.8	172.4	303.0	878.6	1359.0	92.2
Feces	1466.6	1353.3	113.3	126.7	493.2	689.2	44.2
Digested	1338.6	1279.5	59.1	176.3	385.4	669.8	48.0
Per cent digested	47.7	48.5	34.3	58.2	43.9	49.3	52.1
SHEEP II.							
Oat hay (cut when in milk)	1468.2	1376.7	91.5	155.4	463.0	710.6	47.7
Feces	694.5	641.8	52.7	62.3	235.3	327.7	16.5
Digested	773.7	734.9	38.8	93.1	227.7	382.9	31.2
Per cent digested	52.7	53.3	42.4	59.9	49.2	53.9	65.4
SHEEP III.							
Oat hay (cut when in milk)	2936.4	2753.4	183.0	310.7	926.0	1421.2	95.5
Feces	1431.4	1297.3	134.1	128.8	500.0	637.1	31.4
Digested	1505.0	1456.1	48.9	181.9	426.0	784.1	64.1
Per cent digested	51.2	52.8	26.7	58.5	46.0	55.1	67.1
SHEEP IV.							
Oat hay (cut when in milk)	1226.2	1154.3	71.9	141.2	375.6	595.9	41.6
Feces	493.8	445.5	48.3	59.8	143.0	228.0	14.7
Digested	732.4	708.8	23.6	81.4	232.6	367.9	26.9
Per cent digested	59.7	61.4	32.9	57.7	61.9	61.7	64.7
Average	52.8	54.0	34.1	58.6	50.3	55.0	62.3

FUEL VALUE OF FOOD FOR FIVE 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	12795	6937	5808	153.4	5961.4	46.6
Sheep II	6696	3360	3336	81.0	3417.0	51.0
Sheep III	13393	6625	6768	158.3	6926.3	51.7
Sheep IV	5593	2353	3240	70.8	3310.8	59.2

DIGESTION EXPERIMENT 65—(OAT HAY CUT IN DOUGH.)

RATIONS FED.

Fed daily, Sheep I, 600 grams per day.
Fed daily, Sheep II, 400 grams per day.
Fed daily, Sheep III, 600 grams per day.
Fed daily, Sheep IV, 400 grams per day.

COMPOSITION OF FODDERS AND FECES.

	Laboratory number.	Dry matter.	WATER-FREE.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Oat hay (cut when in dough)	4089	83.70	93.77	6.23	7.73	31.74	50.91	3.39	4541
FECES.									
Sheep I	4091	-	91.85	8.15	9.39	34.45	45.54	2.47	4643
Sheep II	4092	-	93.50	6.50	8.36	35.77	46.43	2.94	4850
Sheep III	4093	-	91.43	8.57	8.69	35.23	45.29	2.21	4654
Sheep IV	4094	-	91.84	8.16	12.05	31.01	45.40	3.38	4859

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.
SHEEP I.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Oat hay (cut when in dough)................	2304.7	2162.1	142.6	184.8	711.1	1184.1	82.1
Feces....................	1080.4	992.4	88.0	101.5	372.3	492.0	26.6
Digested................	1224.3	1169.7	54.6	83.3	338.8	692.1	55.5
Per cent digested.....	53.1	54.1	38.3	45.1	47.6	58.4	67.6
SHEEP II.							
Oat hay (cut when in dough)................	1559.5	1463.2	96.3	124.4	483.8	800.1	54.9
Feces....................	674.1	630.3	43.8	56.3	241.2	313.0	19.8
Digested................	885.4	832.9	52.5	68.1	242.6	487.1	35.1
Per cent digested......	56.1	56.9	54.5	54.7	50.2	60.9	63.9
SHEEP III.							
Oat hay (cut when in dough)................	2511.0	2354.5	156.5	194.0	797.0	1278.5	85.0
Feces....................	1225.4	1120.3	105.1	106.5	431.7	555.0	27.1
Digested................	1285.6	1234.2	51.4	87.5	365.3	723.5	57.9
Per cent digested......	51.1	52.4	32.8	45.1	45.8	56.6	68.1
SHEEP IV.							
Oat hay (cut when in dough)................	1457.1	1367.7	89.4	119.9	441.1	753.2	53.5
Feces....................	657.2	603.6	53.6	79.2	203.8	298.4	22.2
Digested................	799.9	764.1	35.8	40.7	237.3	454.8	31.3
Per cent digested......	54.8	55.8	40.0	33.9	53.8	60.4	58.5
Average............	53.8	54.8	41.4	44.7	49.4	59.1	64.5

FUEL VALUE OF FOOD FOR FIVE 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............	10466	5016	5450	72.5	5522.5	52.7
Sheep II............	7082	3269	3813	59.2	3872.2	54.7
Sheep III..........	11402	5703	5699	76.1	5775.1	50.6
Sheep IV..........	6617	3193	3424	35.4	3459.4	52.2

DIGESTION EXPERIMENT 66—(OAT HAY PARTLY IN BLOOM, PARTLY IN MILK.)

RATIONS.

Fed daily, Sheep I, 600 grams per day.
Fed daily, Sheep III, 600 grams per day.

COMPOSITION OF FODDERS AND FECES.

	Laboratory number.	Dry matter.	Water-free. Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Oat hay (just coming into milk)	4127	86.24	92.66	7.34	10.20	33.48	45.66	3.32	4535
FECES.									
Sheep I	4128	-	89.95	10.05	7.95	34.95	44.10	2.95	4611
Sheep III	4129	-	89.33	10.67	8.89	34.06	43.80	2.58	4655

TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PER CENT DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
SHEEP I.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Oat hay (just coming into milk)	2587.2	2397.3	189.9	263.9	866.2	1181.5	85.9
Feces	1132.3	1018.5	113.8	90.1	395.7	499.3	33.4
Amount digested......	1454.9	1378.8	76.1	173.8	470.5	682.0	52.5
Per cent digested	56.2	57.5	40.1	65.9	54.3	57.7	61.1
SHEEP III.							
Oat hay (just coming into milk)	2587.2	2397.3	189.9	263.9	866.2	1181.3	85.9
Feces.....................	1151.5	1028.7	122.9	102.4	392.2	504.3	29.7
Amount digested	1435.7	1368.6	67.0	161.5	474.0	677.0	56.2
Per cent digested......	55.5	57.1	35.3	61.2	54.7	57.3	65.4
Average	55.9	57.3	37.7	63.6	54.5	57.5	63.3

FUEL VALUE FOR FOUR DAYS AS DETERMINED BY THE BOMB CALORIMETER.

	Fuel value of food.	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	11733	5221	6512	151.2	6663.2	56.79
Sheep III.	11733	5360	6373	140.5	6513.5	55.51

DIGESTION EXPERIMENT 67—(OAT HAY, PARTLY IN MILK, AND PARTLY IN DOUGH.)

RATIONS.

Fed daily, Sheep I, 600 grams per day.
Fed daily, Sheep III, 600 grams per day.

COMPOSITION OF FODDERS AND FECES.

	Laboratory number.	Dry matter.	Water-free.						
			Organic matter.	Ash.	Protein.	Fiber.	Nitrogen—free extract.	Fat.	Calories per gram.
FODDER.		%	%	%	%	%	%	%	
Oat hay (just coming into dough stage)..	4130	86.72	92.79	7.21	7.60	33.96	47.42	3.81	4649
FECES.									
Sheep I.	4131	-	90.00	10.00	8.82	35.96	42.86	2.36	4587
Sheep II............	4132	-	90.09	9.91	8.97	36.17	42.48	2.47	4613

TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PER CENT DIGESTED.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
SHEEP I.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Oat hay (just coming into dough stage)....	2601.6	2414.0	187.6	197.7	883.5	1233.7	99.1
Feces	1197.2	1077.5	119.7	105.6	430.5	513.1	28.3
Digested	1404.4	1336.5	67.9	92.1	453.0	720.6	70.8
Per cent digested......	54.0	55.4	36.2	46.5	51.3	58.4	71.4
SHEEP III.							
Oat hay (just coming into dough stage)....	2601.6	2414.0	187.6	197.7	883.5	1233.7	99.1
Feces..................	1133.2	1020.9	112.3	101.6	409.9	481.4	28.0
Digested................	1468.4	1393.1	75.3	96.1	473.6	752.3	71.1
Per cent digested......	56.4	57.7	40.1	48.6	53.6	61.0	71.7
Average	55.2	56.6	38.2	47.6	52.5	59.7	71.6

FUEL VALUE FOR FIVE DAYS AS DETERMINED BY THE BOMB CALORIMETER.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea, etc.	Total fuel value.	Per cent available fuel value.
Sheep I	12095	5492	6603	80.1	6683.1	55.25
Sheep III	12095	5227	6868	83.6	6951.6	57.47

DIGESTION EXPERIMENT 68—(H-O HORSE FEED.)

This feed was fed without hay or other coarse fodder, which is a somewhat unusual thing to do with so concentrated a feed. It was not analyzed before the experiment was made as its composition was supposed to be about the same as that of a sample previously analyzed, but it proved to be considerably richer. The sheep were quite large and strong, however, and stood the ration very well, only one refusing to eat all that was given him.

RATIONS.

Fed daily, Sheep II, 800 grams per day.
Fed daily, Sheep III, 800 grams per day.

COMPOSITION OF FODDERS AND FECES.

	Laboratory number.	Dry matter.	Water-free. Organic matter.	Protein.	Nitrogen-free extract.	Fat.
FODDERS.		%	%	%	%	%
H-O Horse Feed	4080	88.94	96.36	15.11	65.84	4.39
FECES.						
Sheep II	4087	-	86.90	18.96	44.62	4.92
Sheep III	4088	-	90.67	11.62	48.01	2.33

TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED IN FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry substance.	Organic matter.	Protein.	Nitrogen-free extract.	Fat.
SHEEP II.	Grams.	Grams.	Grams.	Grams.	Grams.
H-O Horse Feed	3201.8	3085.3	483.8	2108.1	140.6
Feces	748.2	650.2	141.9	333.8	36.8
Digested	2453.6	2435.1	341.9	1774.3	103.8
Per cent digested	76.6	78.9	70.7	84.3	73.9
SHEEP III.					
H-O Horse Feed	3557.6	3428.2	537.6	2342.3	156.2
Feces	897.5	813.8	104.3	430.9	20.9
Digested	2660.1	2614.4	433.3	1911.4	135.3
Per cent digested	74.8	76.3	80.6	81.6	86.6
Average	75.7	77.6	75.7	83.0	80.3

DIGESTION EXPERIMENT 69—(FLAX MEAL FED WITH OAT HAY.)

RATIONS.

Fed daily, Sheep I, Oat hay, 400 grams; Flax meal 200 grams.
Fed daily, Sheep II, Oat hay, 400 grams; Flax meal 200 grams.
Fed daily, Sheep III, Oat hay, 400 grams; Flax meal 200 grams.
Fed daily, Sheep IV, Oat hay, 200 grams; Flax meal 200 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.		%	%	%	%	%	%	%	
Oat hay (cut when in milk)	4096	73.41	93.77	6.23	10.58	31.53	48.41	3.25	4561
Cleveland Flax Meal	4108	91.17	94.07	5.93	44.15	7.97	36.92	5.03	4791
FECES.									
Sheep I	4112	-	90.12	9.88	15.19	32.63	40.43	1.87	4589
Sheep II	4113	-	92.85	7.15	12.48	34.09	44.09	2.19	4780
Sheep III	4114	-	90.46	9.54	17.99	29.79	40.37	2.31	4661
Sheep IV	4115	-	85.44	14.56	19.62	22.73	39.98	3.11	4520

TOTAL NUTRIENTS IN FOOD EATEN AND FECES EXCRETED FOR FIVE DAYS AND PERCENTAGES DIGESTED.

	Dry substance.	Organic matter.	Protein.	Nitrogen-free extract.	Fat.
SHEEP I.	Grams.	Grams.	Grams.	Grams.	Grams.
Fed in hay	1468.2	1376.7	155.4	710.6	47.7
Fed in flax meal	911.7	857.6	402.5	336.6	45.8
Total fed	2379.9	2234.3	557.9	1047.2	93.5
Total feces	984.5	887.2	149.5	398.1	18.4
Total digested	1395.4	1347.1	408.4	649.1	75.1
Digested from hay	700.3	668.9	90.4	350.3	24.9
Digested from flax meal	695.1	678.2	318.0	298.8	50.2
Per cent digested from flax meal	76.2	79.1	79.0	88.8	109.6
SHEEP II.					
Fed in hay	1468.2	1376.7	155.4	710.6	47.7
Fed in flax meal	911.7	857.6	402.5	336.6	45.8
Total fed	2379.9	2234.3	557.9	1047.2	93.5
Total feces	802.0	744.6	100.1	353.5	17.6
Total digested	1577.9	1489.7	457.8	693.7	75.9
Digested from hay	773.7	734.9	93.1	382.9	31.2
Digested from flax meal	804.2	754.8	364.7	310.8	44.7
Per cent digested from flax meal	88.2	88.0	90.6	92.3	97.6
SHEEP III.					
Fed in hay	1468.2	1376.7	155.4	710.6	47.7
Fed in flax meal	911.7	857.6	402.5	336.6	45.8
Total fed	2379.9	2234.3	557.9	1047.2	93.5
Total feces	904.2	817.9	162.7	365.0	20.9
Total digested	1475.7	1416.4	395.2	682.2	72.6
Digested from hay	751.8	727.4	90.9	391.5	32.0
Digested from flax meal	723.9	689.0	304.3	290.7	40.6
Per cent digested from flax meal	79.3	80.3	75.6	86.4	88.6
SHEEP IV.					
Fed in hay	734.1	688.4	77.7	355.3	23.8
Fed in flax meal	911.7	857.6	402.5	336.6	45.8
Total fed	1645.8	1546.0	480.2	691.9	69.6
Total feces	490.1	418.7	96.2	195.9	15.2
Total digested	1155.7	1127.3	384.0	496.0	54.4
Digested from hay	438.3	423.2	44.9	219.4	15.4
Digested from flax meal	717.4	704.1	339.1	276.6	39.0
Per cent digested from flax meal	78.7	82.1	84.2	82.2	85.2
Average	80.6	82.4	82.4	87.4	95.3

FUEL VALUE FOR FIVE DAYS AS DETERMINED BY THE BOMB CALORIMETER.

	Fuel value of food.	Fuel value of feces.	Fuel value of food digested.	Fuel value of urea, etc.	Total fuel value.	Per cent available fuel value.
	Calories.	Calories.	Calories.	Calories.	Calories.	
Sheep I	11064	4518	6546	355.3	6901.3	62.37
Sheep II	11064	3833	7231	398.3	7629.3	68.95
Sheep III	11064	4215	6849	343.8	7192.8	65.01
Sheep IV	7716	2215	5501	334.0	5835.0	75.62

SUMMARY OF DIGESTION COEFFICIENTS OBTAINED IN THE EXPERIMENTS HERE REPORTED.*

	Number of experiment.	Dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%	%	%
Oat hay: cut in bloom	63	54.3	53.7	48.6	53.5	59.9	51.2	48.3
Oat hay: cut in milk	64	52.8	54.0	34.1	58.6	50.3	55.0	62.3
Oat hay: cut in dough	65	53.8	54.8	41.0	44.7	49.4	59.1	64.5
Oat hay: cut in bloom and milk	66	55.9	57.3	37.7	63.6	54.5	57.5	63.3
Oat hay: cut in milk and dough	67	55.2	56.6	38.2	47.6	52.5	59.7	71.6
H-O Co.'s Horse Feed	68	75.7	77.6	-	75.7	-	83.0	80.3
Flax meal	69	80.6	82.4	-	82.4	-	87.4	95.3

*On pages 156 to 158 of the Report of this Station for 1897 there are given the results of all digestion experiments with sheep made at the Station up to that time.

OAT HAY HARVESTED AT DIFFERENT STAGES OF MATURITY.

J. M. Bartlett.

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

The oat plant, however, is not an ideal one for making hay. The stalks are hollow, coarse and hard, and unless dried very quickly in a bright sun they become bleached, even when cut green, so that they look little better than straw. To cure the crop in its best condition and retain its bright green color and palatability, it should be dried in a bright sun for a few hours, with liberal use of the hay tedder when there is a heavy growth; then raked together and the curing completed in the windrow or cock, with as little exposure to moisture as possible. If the weather is unfavorable, as is frequently the case during the latter part of July or first of August when oats are mature enough to cut for hay, they are very liable to be seriously injured and rendered unpalatable. They have not proved a good crop for ensiling, not keeping nearly as well as corn or many other crops, therefore the silo cannot be offered as a means of curing in bad weather. Oats, however, when not sown too thickly, have an advantage over other plants, which make more desirable hay, of being a fairly good catch crop for seeding to grass, as they mature early enough to allow the young grass to get a good start in the fall, and for this reason are desirable on the farm.

It is quite well known, and there is considerable experimental data showing that most plants like the grasses, clovers, etc., usually grown for hay are at their best to harvest when in bloom, but as regards oats there is very little available information indicating at what stage of growth they should be cut for hay making.

Accordingly some experiments were undertaken to determine the comparative value of oat hay cut at different stages of maturity. In 1897 a section of a field of oats was set apart for these tests. The portion selected was covered with a fairly uniform growth and the oats in all parts of it appeared at about the same stage of maturity. The piece was then divided into three equal sections. One of these sections was cut on July 27th when the oats were in bloom. A second section was cut one week later, August 5th, when nearly all the kernels were in the milk stage, and the third August 12th when nearly all the grains had passed to the dough stage of maturity, the tops and upper portion of the stalks were green, but the lower portions showed signs of ripening. When cured this cutting made nearly as good looking hay as the other two sections, but evidently was not as palatable as it was not as readily eaten by the sheep. Care was taken in curing all the cuttings to avoid exposure to moisture, all were dried as quickly as possible and then stored in the barn until needed for further work.

To estimate the increased yield from the growth of the crop during the time that elapsed between the cuttings, three sections, each 10 x 15 feet, were taken in different parts of the large plats. One third, five feet of the length, was cut each time that cuttings were made from the larger sections, carefully dried and the dry matter determined in each, which is given in pounds per acre.

Dry matter of 1st cutting per acre,	4418.8 pounds.
Dry matter of 2d cutting per acre,	5218.3 pounds.
Dry matter of 3d cutting per acre,	4571.0 pounds.

The third cutting was worked on somewhat by birds, which probably accounts for the decrease in yield below the second.

The composition of the hays cut at different stages of maturity is shown in the table which follows. Another table also shows the composition of three different sections of the oat plant, the object being to determine at what distance from the ground the oats should be cut, or what loss occurred by leaving a long stubble. Some plants 3½ to 4 feet high were cut close to the ground; then divided into three sections, one of which was the first eight inches of the lower part of the stalk, another the second eight inches, and the third, the remainder of the plant or top. An inspection of the table shows a marked difference in composition of the different sections. The bottom section has very little food value, containing only 2.77% protein and 1.90% fat, both of which are probably not more than 40% digestible. The second section has only about half the protein of the top section and its digestibility is probably less. It would, therefore, be advisable to leave a high stubble, not less than eight to ten inches of plants 3 to 4 feet high in harvesting, and the loss incurred will be more than compensated by the improved quality and palatability of the hay by leaving the coarser part of the stalks on the ground.

COMPOSITION OF THE WATER-FREE OAT HAYS.

	Laboratory number.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
		%	%	%	%	%
Oat hay: cut when grain was in dough ...	4089	6.23	7.73	31.74	50.91	3.39
Oat hay: cut when grain was in milk	4096	6.23	10.58	31.53	48.41	3.25
Oat hay: cut when in bloom	4097	7.55	9.86	36.70	43.38	2.51
Oat hay: cut when just beginning to come into milk	4127	7.34	10.20	33.48	45.66	3.32
Oat hay: cut when part of the kernel had passed to dough stage	4130	7.21	7.60	33.96	47.42	3.81
Oat hay: first 8-inch section of bottom of stalk	4134	6.84	2.77	43.49	45.00	1.90
Oat hay: second 8-inch section of stalk...	4135	8.16	4.79	41.60	43.23	2.22
Oat hay: top of plant	4133	7.01	9.62	27.83	51.75	3.79

AMOUNT OF DIGESTIBLE NUTRIENTS IN 100 POUNDS OF WATER-FREE OAT HAY CUT AT DIFFERENT STAGES OF MATURITY.

	Dry substance.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
	%	%	%	%	%	%	%
Oat hay: in bloom	40.77	49.65	3.67	5.28	21.98	22.21	1.21
Oat hay: in milk	38.76	50.64	2.13	6.20	15.86	26.63	2.02
Oat hay: in dough	45.03	51.39	2.58	3.46	15.67	30.08	2.19
Oat hay: just coming into milk	48.21	53.10	2.77	6.49	18.24	26.26	2.10
Oat hay: just coming into dough stage	47.87	52.51	2.76	3.62	17.83	28.32	2.73

THE EFFECT OF FOOD ON THE HARDNESS OF BUTTER AND COMPOSITION OF BUTTER FAT.

J. M. Bartlett.

The primary object of the experiments presented in the following pages was to study the effect of gluten meals, varying greatly in fat content, on the texture of butter and composition of butter fat produced by cows receiving quite liberal quantities of these materials. Eight different meals which contained from 1% to 19% fat were used in as many different feeding trials, also Buffalo gluten feeds and flax meal were each fed during one experiment and cottonseed meal during three.

A total of eleven cows were used in the experiments, and in all, twelve tests were made. The work was begun in the winter of 1896-97 and again taken up during the winters of 1897-98 and 1898-99.

In the third or last experiment the effect of the fat of the food on the fat content of the milk was given some attention. A detailed account of the work is given in the pages which follow.

Considerable work has already been done by investigators both in this country and Europe, showing that the texture or hardness of butter and composition of the butter fat is influenced very markedly by the food of the animal.

Some years ago quite extensive experiments were made at the Texas Experiment Station in feeding cottonseed and its meals to learn their effect on the fat of the milk produced. The results showed that large rations of these materials produced very hard butters, the fats of some of them having a melting point above 40° C. with very low volatile acids and iodine numbers. At the New Hampshire Experiment Station* some work was done showing that the gluten meals produced softer butters

* Bulletin No. 13.

than corn or cottonseed meals, and the fats of these soft butters had higher iodine absorption power, indicating a change in their chemical composition. Also at the same Station† it was shown that when oils were fed the butter fat produced varied its composition in most cases in accordance with the composition of the fat fed.

The Vermont Experiment Station‡ found that a gluten meal having about 12% fat made a softer butter fat with lower melting point and a higher iodine number than other rations consisting of corn meal and bran, or of cottonseed meal, corn meal and bran.

Spier§ observed, in his extensive feeding experiments, that the different concentrated feeds affected the melting point of the butter very materially. He obtained the firmest butter with the highest melting point when decorticated cottonseed cake was fed, and attributes the cause to the highly nitrogenous ration used.

A. Mayer** states in his account of extensive investigations in feeding cows that the hardness of butter is considerably affected by the food.

Practical dairymen have long been aware of the fact that certain concentrated feeds when liberally used in rations for milch cows, have a very decided effect on the texture or grain of the butter. Cottonseed meal is very generally known to produce hard butter, while the gluten meals are equally well known to produce soft butter. Corn meal has always been used to some extent by farmers who have practiced feeding grain and is known to make excellent butter of about the desired degree of hardness, and the glutens which are a by-product from the manufacture of glucose or starch from corn, and therefore, a corn product, would be expected to make butter having like characteristics. In practice, however, they have been found to have a very different effect and the reputation of the gluten products for making soft butter has become so well established that in some sections of the State butter factories have refused to accept cream from parties who were feeding them. Among private dairymen the opinion very generally prevails that these feeds are not desirable for use, especially in warm weather. On

† Bulletin No. 16. ‡ Report of the Vermont Experiment Station 1897.

§ Transactions of the Highland Agricultural Society, Scotland, 1897.

** Landw. Vers. Stat. 41, pp. 14-35.

the other hand, cottonseed meal was known to make a hard butter, and when fed in moderate quantities with corn meal and bran, produced an article of the best quality. Consequently, cottonseed meal became a popular feed as a source of protein, almost to the exclusion of the gluten meals among farmers who were feeding for butter production. But in the fall and early winter of 1896 and 1897 the gluten meals were offered in our markets at very low prices furnishing, thereby, protein more cheaply than any other concentrated feed. For this reason it was desirable that farmers use these feeds to the largest possible extent. In view of this fact it was considered advisable to investigate the cause of the unfavorable action of these products and determine, if possible, a way to eliminate it either through the method of manufacturing or feeding them.

A comparison of the composition of the gluten meals with corn meal showed that the chief variations were in the protein and fat content. The percentages of these substances being much higher in the gluten than in the corn meal, this fact, together with the work done by Morse†† in feeding oil to cows, led us to believe that the oil of the gluten products was the disturbing element. Accordingly some feeding experiments were begun in the winter of 1896-7 to test the following points, viz.: If the high oil content of the glutens caused them to make soft butters, and if so, to what extent they should be freed from it to remedy the difficulty.

EXPERIMENT I.

In this experiment, the feeding trials were divided into periods of two weeks each, which is a shorter time for feeding tests than is generally desirable, but as the only object in this experiment was to test the effect of the feed on the composition of the butter fat, the length of time employed was considered sufficient.

At this time there was offered in the market two kinds of gluten meals, one being rich in fat, containing from 15% to 20% and another containing from 7% to 10% fat. These meals varied sufficiently in their fat content to be desirable for use in this experiment, especially as the one richer in fat was poorer in protein, making it necessary to greatly increase the fat in one

†† N. H. Station Bulletin 16.

ration over that in the other to get the required amount of protein.

Three good Jersey cows quite fresh in milk were used, and it will be seen that they were fed a cottonseed meal ration in the first and fourth periods; the object being to test their ability to make good butter in the first period and the effect of the advance in time of lactation in the fourth period.

DAILY RATION FOR EACH ANIMAL.

Basal ration of, hay, 10 pounds, silage, 25 pounds.

Period I. Eight pounds grain mixture: 3 parts cottonseed meal; 2 parts wheat bran; 3 parts corn meal.

Period II. Eight pounds grain mixture: 9 parts Chicago gluten meal; 4 parts wheat bran; 3 parts corn meal.

Period III. Eight pounds grain mixture: 3 parts King gluten meal; 1 part wheat bran.

Period IV. Eight pounds grain mixture. Same as period I.

DIGESTION COEFFICIENTS USED IN CALCULATING THE DIGESTIBLE NUTRIENTS IN THE EXPERIMENTS HERE REPORTED.

	Protein.	Fiber.	Nitrogen-free extract.	Fat.
	%	%	%	%
Hay	44	52.5	62	39
Silage	56	72	76	73
Cottonseed meal	88	-	64	97
Gluten meals	87	-	91	88
Gluten feed	85	43	81	81
Flax meal	82.4	-	87.4	95.3
Corn meal	77	-	92	92
Wheat bran	78	25	68	72

COMPOSITION FODDERS AND FEEDS USED.

	Station number.	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
Hay	4061	16.50	4.92	7.91	26.57	42.33	1.77
Silage	4048	81.43	1.28	1.85	4.92	9.97	0.55
Cottonseed meal	4013	7.46	5.63	50.31	4.40	21.24	10.96
Wheat bran	4015	9.83	5.47	16.31	8.93	53.96	5.50
Corn meal	4014	12.40	1.47	10.63	2.33	69.04	4.13
Chicago gluten meal	4016	10.11	1.38	36.00	3.86	40.49	8.16
King gluten meal	4018	9.53	1.94	26.31	2.45	44.59	15.18

DIGESTIBLE NUTRIENTS EATEN DAILY IN EACH RATION.

	Protein —pounds.	Carbohydrates —pounds.	Fat —pounds.	Nutritive ratio.
Period I.				
Grain mixture	1.88	2.85	.52	
Hay	.35	4.03	.07	
Silage	.26	2.77	.10	
Total	2.49	9.65	.69	1:4.50
Period II.				
Grain mixture	1.72	3.38	.46	
Hay	.35	4.03	.07	
Silage	.26	2.77	.10	
Total	2.33	10.18	.63	1:4.98
Period III.				
Grain mixture	1.61	3.30	.88	
Hay	.35	4.03	.07	
Silage	.26	2.77	.10	
Total	2.22	10.10	1.05	1:5.61
Period IV.				
Grain mixture	1.88	2.85	.52	
Hay	.35	4.03	.07	
Silage	.26	2.77	.10	
Total	2.49	9.65	.69	1:4.50

COMPOSITION OF THE BUTTERS AND BUTTER FATS.

	BUTTER.				BUTTER FAT.		
	Water.	Ash.	Casein.	Fat.	Melting point.	Iodine number.	Volatile acids.
Period I—Cottonseed meal ration.	12.65	1.51	1.10	84.75	35.1	27.65	30.39
Period II—Chicago gluten meal ration	13.00	3.81	1.33	81.85	33.3	29.88	30.72
Period III—King gluten meal ration	12.76	4.22	1.30	81.73	32.5	37.2	32.5
Period IV—Cottonseed meal ration	-	-	-	-	35.1	25.9	31.9

EXPERIMENT II.

To further test the effect of food on the hardness of butter and composition of the butter fat, with other cows than those used in Experiment I and for longer feeding periods, a second experiment was undertaken in the winter of 1897-1898. The time covered by this test was divided into five feeding periods of twenty-one days each, with one transition week between each period for changing the ration. In the first trial a cottonseed meal ration was used to test the capacity of the cows, as in the first experiment. In the second period the cottonseed meal was replaced by flax meal, one of the linseed products, which contains a small per cent of fat as compared with the old process linseed meal, that always bore the reputation of making soft butter. The object of this test was to learn if a more complete removal of the fat corrected that tendency. During the experiment a daily record of the milk yield was kept and the milk of the last five days of each period was analyzed. The results of the experiment are given in the following tables:

Cows used (registered Jerseys):

Addie, fresh in milk, October 8, 1897; Hope, fresh in milk, October 28, 1897; Loblitop, fresh in milk, October 14, 1897; Rose, fresh in milk, November 16, 1897.

DAILY RATIONS FOR EACH ANIMAL.

Basal ration: hay, 15 pounds; silage, 15 pounds; same for each period.

Period I. Grain, 8 pounds of mixture of: 2 parts cottonseed meal; 2 parts wheat bran; 3 parts corn meal.

Period II. Grain, 8 pounds of mixture of: 2 parts flax meal; 1 part wheat bran; 2 parts corn meal.

Period III. Grain, 8 pounds of mixture of: 3 parts Chicago gluten meal; 2 parts wheat bran; 2 parts corn meal.

Period IV. Grain, 8 pounds of mixture of: 5 parts gluten feed; 1 part wheat bran; 2 parts corn meal.

Period V. Grain, 8 pounds of mixture of: 5 parts King gluten meal; 4 parts wheat bran; 3 parts corn meal.

COMPOSITION OF FODDERS AND FEEDS USED.

	Station number.	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
Hay	4121	10.12	5.17	8.19	26.79	47.39	2.34
Silage	4125	87.62	.98	1.50	3.56	5.90	.44
Cottonseed meal	4083	5.27	5.49	52.25	3.81	21.08	12.10
Corn meal	4082	9.92	1.51	10.50	2.08	71.88	4.11
Wheat bran	4081	8.15	5.38	16.94	7.38	57.80	4.35
Flax meal	4108	8.83	5.41	40.25	7.27	33.66	4.58
Chicago gluten meal	4041	5.55	1.21	37.50	2.83	43.98	8.93
Gluten feed	4095	9 32	3.53	27.25	6.69	50.10	3.11
King gluten meal	4140	6.72	1.81	35.94	2.36	35.45	17.72

TOTAL DIGESTIBLE NUTRIENTS EATEN DAILY DURING EACH PERIOD.

	Protein —pounds.	Carbohydrates —pounds. Fiber and nitrogen-free extract.	Fat —pounds.	Nutritive ratio.
Period I.				
From grain ration	1.63	3.52	.47	
From hay	.55	6.54	.14	
From silage	.13	1.05	.05	
Total	2.31	11.11	.66	1:5.45
Period II.				
From grain ration	1.57	3.73	.31	
From hay	.55	6.54	.14	
From silage	.13	1.05	.05	
Total	2.25	11.32	.50	1:5.49
Period III.				
From grain ration	1.61	3.82	.43	
From hay	.55	6.54	.14	
From silage	.13	1.05	.05	
Total	2.29	11.41	.62	1:5.59
Period IV.				
From grain ration	1.45	3.76	.24	
From hay	.55	6.54	.14	
From silage	.13	1.05	.05	
Total	2.13	11.35	.43	1:5.78
Period V.				
From grain ration	1.55	3.49	.68	
From hay	.55	6.54	.14	
From silage	.13	1.05	.05	
Total	2.23	11.08	.87	1:5.85

COMPOSITION OF MILK, AND AVERAGE DAILY YIELD OF MILK, SOLIDS AND FATS FOR EACH PERIOD.

Period.	Cow.	Solids—per cent.	Fat—per cent.	Milk—pounds.	Solids—pounds.	Fat—pounds.
Period I	Addie	13.58	4.85	21.1	2.86	1.02
	Hope	13.92	5.25	19.9	2.77	1.05
	Loblitop	14.33	4.60	17.3	2.47	.80
	Rose	14.42	4.80	17.9	2.58	.86
Period II	Addie	13.65	4.25	19.9	2.72	.85
	Hope	14.61	4.95	17.8	2.60	.88
	Loblitop	13.91	3.90	17.5	2.43	.68
	Rose	14.17	4.15	16.5	2.34	.69
Period III	Addie	13.54	4.55	19.4	2.63	.88
	Hope	14.61	5.05	17.2	2.51	.87
	Loblitop	14.57	4.50	18.1	2.64	.81
	Rose	14.30	4.65	17.0	2.43	.79
Period IV	Addie	14.0	4.90	16.5	2.31	.81
	Hope	15.68	5.30	15.1	2.37	.80
	Loblitop	14.12	4.60	16.7	2.36	.77
	Rose	15.11	5.10	15.6	2.36	.80
Period V	Hope	15.57	5.5	14.6	2.27	.80
	Loblitop	13.59	4.4	19.1	2.60	.84
	Rose	13.76	4.6	16.5	2.27	.76

COMPOSITION OF BUTTERS AND BUTTER FATS.

	Butter.				Butter Fat.		
	Water.	Ash.	Casein.	Fat.	Melting point.	Iodine number.	Volatile fatty acids.
Period I—Cottonseed meal ration	14.47	1.74	.84	82.95	35.2	28.07	28.55
Period II—Flax meal ration	13.12	3.01	1.34	82.56	34.4	28.88	27.95
Period III—Chicago gluten meal ration	12.81	2.67	1.29	83.24	32.4	31.2	28.4
Period IV—Gluten feed	14.77	1.93	1.01	82.30	32.85	30.44	27.9
Period V—King gluten meal ration	11.18	3.28	1.30	81.22	32.9	38.4	31.9

EXPERIMENT III.

As the results of the two previous experiments indicated that glutens containing large amounts of fat or oil produced softer butters than those containing smaller amounts, it seemed necessary, in order to make the experiment of practical value, to determine the minimum amount of fat that a gluten could contain when fed in sufficient quantity to supply the necessary protein for butter production.

Arrangements were made with the Cleveland Linseed Oil Company to extract some gluten meal and reduce the fat content to one per cent or less. About this time the Glucose Sugar Refining Company changed the character of their output, making a gluten meal containing less than three per cent of fat. A stock of this meal was also secured for feeding the herd in 1898, and was liberally fed through the winter and summer vacations when butter was made from the product.

In this experiment Jersey cows which were known to be good butter makers were used. They were more advanced in the period of lactation than the animals previously employed, but as they were all still giving a fairly good flow of milk this did not seem objectionable. The feeding periods were twenty-eight days each and the cream for churning was collected during the third or fourth week.

In the second period, one-half pound of tallow was added to the ration which in other respects was the same as in period I. The object of this was to determine whether it was the quality or quantity of fat that affected the butter. The tallow fed was thoroughly emulsified before giving it to the animals. The emulsification was accomplished in the following manner. The grain ration and tallow for each cow was weighed out. The tallow was then put in a water pail with about three quarts hot water and about a pint of the grain, then a jet of steam under high pressure was introduced which emulsified the fat perfectly in about ten or fifteen minutes. The whole was then mixed with the remainder of the grain and fed when cold. Fed in this manner, with one exception, the cows ate the tallow readily.

In the third period the extracted gluten was replaced by the regular stock gluten and one pound King gluten meal was added to increase the amount of fat or oil from corn. The results of each period are given below.

Cows used (registered Jerseys.)

Adle, fresh in milk, April 26; Buttercup fresh in milk, May; Dudley, fresh in milk, August 7; Pansy, fresh in milk, March 28.

DAILY RATIONS FOR EACH ANIMAL.

Hay, 7 pounds; silage, 25 pounds; same for each period.

Period I. Grain, 7 pounds mixture of: 3 parts extracted gluten meal; 2 parts wheat bran; 2 parts corn meal.

Period II. Grain, same as in period 1 + ½ pound tallow.

Period III. Grain, 8 pounds: 3 parts Chicago gluten; 2 parts wheat bran; 2 parts corn meal; 1 part King gluten meal.

COMPOSITION OF FODDERS AND FEEDS.

	Station number.	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Fat.
Hay	-	14.3	4.74	9.06	28.19	42.21	1.50
Silage	4138	81.75	.91	1.92	4.70	9.89	.83
Extracted gluten	4126	11.00	1.25	41.44	1.82	43.49	1.00
Corn meal	4136	12.55	1.61	9.63	2.19	69.96	4.06
Wheat bran	4137	10.25	6.82	16.06	9.05	53.04	4.78
Chicago gluten meal	4141	12.94	1.42	40.31	2.00	40.96	2.37
King gluten meal	4140	6.72	1.81	35.94	2.36	35.45	17.72
Tallow	-	-	-	-	-	-	99.99

TOTAL DIGESTIBLE NUTRIENTS EATEN DAILY DURING EACH PERIOD

	Protein—pounds.	Carbohydrates—pounds. Fiber and nitrogen-free extract.	Fat—pounds.	Nutritive ratio.
Period I.				
From grain eaten	1.48	3.26	.17	
From hay	.28	2.87	.04	
From silage	.27	2.72	.15	
Total	2.03	8.85	.36	1:4.75
Period II.				
From grain eaten	1.48	3.26	.67	
From hay	.28	2.87	.04	
From silage	.27	2.72	.15	
Total	2.03	8.85	.86	1:5.31
Period III.				
From grain eaten	1.76	3.49	.36	
From hay	.28	2.87	.04	
From silage	.27	2.72	.15	
Total	2.31	9.08	.55	1:4.45

COMPOSITION OF BUTTER AND BUTTER FAT.

	Butter.				Butter Fat.		
	Water.	Ash and salt.	Casein.	Fat.	Melting point.	Iodine number.	Volatile acids.
Period I—Extracted gluten ration	9.31	1.71	.68	88.33	33.75	26.71	29.7
Period II—Extracted gluten and tallow	10.93	1.44	.70	86.93	34.2	29.31	33.0
Period III-Chicago gluten and King gluten	12.00	2.85	1.06	84.09	33.1	30.66	29.4

DIGESTIBLE FAT FED DAILY, AND THE EFFECT OF THE DIFFERENT RATIONS ON THE BUTTER AND BUTTER FAT.

The concentrated feeds used in the rations.	Digestible fat from grain fed daily—pounds.	Estimated hardness of butter.*	Melting point of fat.	Iodine number of fat.	Volatile acids 1-10 normal alkali.
Cottonseed meal ration of Period I, Exp't. I	0.52	10	35.1	27.65	30.39
Cottonseed meal ration of Period IV, Exp't I.	0.52	10	35.1	25.9	31.9
Cottonseed meal ration of Period I, Exp't II	0.47	10	35.2	28.07	28.55
Average	....	.....	32.1	27.2	30.28
Gluten meal, quite rich in fat, Period II, Exp't I	0.46	8	33.3	29.88	30.72
Gluten meal, quite rich in fat, Period III, Exp't II	.43	7½	32.4	31.2	28.4
Average	....	......	32.9	30.54	29.56
Gluten meal, very rich in fat, Period III, Exp't I	.88	6	32.5	37.2	32.5
Gluten meal, very rich in fat, Period V, Exp't II	.68	6	32.9	38.4	31.9
Average	....	......	32.7	37.8	32.2
Extracted gluten meal, Period I, Exp't III	0.17	9	33.8	26.7	29.7
Extracted gluten meal, with tallow, Period II, Exp't III	0.67	9½	34.2	29.3	33.0
Gluten meal, poor in fat, fed herd	-	9	34.1	-	30.3
Mixed gluten meals, Period III, Exp't III	.55	8	33.1	30.66	29.4
Flax meal, Period II, Exp't II	0.31	9	34.1	28.88	27.95
Gluten feed, Period IV, Exp't II	†0.24	8	32.9	30.44	27.9

*An arbitrary comparative scale, 10 representing the hardest butter and 6 the softest.

†Largely corn oil.

DISCUSSION OF RESULTS.

The results of the three experiments presented in the above table indicate, without question, that the food of a cow does, to some extent, vary the composition of the fat of her milk and thereby influences the texture of her butter.

The work of Morse and others led the writer to assume that the fat or oil of some of the so-called concentrated feeds was the disturbing element, consequently these experiments were planned and carried out particularly to test that phase of the subject, and the evidence here presented seems to support the assumption.

It will be noticed that in making up the daily rations an effort was made to make the digestible protein for each period as nearly the same as possible, the chief variations of the rations being in the fat content of the grain fed.

Before referring to the table, it is necessary to state that we did not find the melting point of the fat as determined by the official method, a true indication of the hardness of the butter. It is true that the fats of very hard butters have high melting points, but the fat of some of the medium hard butters gave melting points practically the same as the softest butters, consequently, for convenience in discussing the results, an arbitrary scale of hardness is used, 10 representing the hardest and 6 the softest butter.

Several attempts were made to find some reliable way of determining the hardness or stability of butter in the laboratory that could be compared with its hardness as determined commercially. Some mechanical means have been recommended such as dropping a weighted glass rod and measuring the degree of penetration in the different butters at the same temperature. This method appears to better show the density or compactness of butter than its ability to stand up at high temperatures. In our trials of it, different prints of the same lot showed as great variations as the different lots. It is impossible for a butter maker to handle butter so nicely as to give it the same degree of compactness each time.

Several methods of determining melting points of the fat were tried but none appeared to be more satisfactory than the official method which was used and no single laboratory test indicated very closely the true hardness of the fat after it was congealed. It was observed, however, that whenever the melting point of the fat was low and the iodine number high, the butter was soft, also that when the conditions were reversed, the melting point high and the iodine number low the butter was hard; and in all cases when the iodine number was low, 30 or less, the hardness of the butter corresponded very closely to the melting point of the fat.

A study of all available results of work by other chemists gives still further encouragement that possibly these two determinations together can be relied upon to indicate the texture.

The manner of determining hardness employed in these experiments cannot be called strictly scientific, but it is believed that the figures given show more nearly the comparative hardness, than any single chemical method employed.

The figures given were obtained by thoroughly testing the butter in a practical way. All the samples were carefully examined by means of pressure, cutting, etc., to determine their hardness at temperatures ranging from 15° C. up to 25° C.; also the butter fats were placed side by side and tested in the same manner, as they seemed to correspond very closely to the butter in hardness. The opinion of the butter maker, on each lot as it was manufactured, was also noted and taken into consideration in making up the scale of figures.

We find by inspection of the table that the average melting point of the fats of the butters marked 6 in hardness is very nearly the same as the fats of those marked 7 and 8 when, as a matter of fact, the butters were so soft that they could hardly be handled at ordinary temperature, and the fats were somewhat liquid at a room temperature of 23° C. while the fats of those marked 7 and 8 were quite hard at the same temperature.

In manufacturing the butters every precaution was taken to avoid variations in hardness, that could arise from physical and mechanical causes by faulty manipulation. The method of manufacture was as uniform as possible for all the periods, and it is difficult to see how the variations in hardness could arise from other than changes in the composition of the butter fat. In fact some of the softest butters contained less water than the hardest ones.

The cream was raised by the Cooley process, then evenly ripened and churned at a uniform temperature of 60° F. All of this part of the work was done under the supervision and skillful management of Prof. Gowell.

In studying the results given in the table, we find that the gluten meals containing the most fat produced the softest butters in every instance, and that the butter produced by these meals increased in hardness in proportion as the glutens decreased in fat content, or in other words, a ration containing six to eight-tenths of a pound of corn oil produced a very soft butter while one containing two to three-tenths made a medium butter, and one with less than one-tenth a fairly hard butter. A chemical examination of the butter fats shows quite a difference in their composition; the most marked difference being shown in the iodine number, which is 11 per cent higher when the glutens rich in fat were fed than when the extracted gluten was used. This indicates that when the ration contains large amounts of corn oil, the butter fats were composed more largely of the liquid fats, olein or linolein, which probably accounts for their softer condition. In these particular cases it appears reasonable to assume that the soft oils of the gluten meals caused the changes in the butter fat.

The basal ration of the different periods was practically the same. The amount of digestible protein fed in period III, experiment I, and period V, experiment II, when the softest butters were made, was greater than that of period I of experiment IV, when the extracted gluten was used and made butter of normal firmness. Consequently the soft butter cannot be attributed to the non-nitrogenous character of the ration, and neither could it to the excess of fat alone but to its character, for in period II of experiment III, when one-half pound of tallow was added to the ration, the butter became harder and the melting point of the butter fat increased, showing that in some way, either directly or indirectly, the properties of the fat of the food are transmitted to the fat of the milk.

Morse arrived at the same conclusions in his experiments in feeding oils. Baumert and Falkè† found that feeding certain

* New Hampshire Experiment Station Bul. 16.

† Zeit. für Untersuch. der Nahr. und Genussmittel, 1898, 665-678.

oils very decidedly affected the melting point of butter fat while others were without much effect. Sesame oil produced a butter fat with a high melting point and almond and cocoanut oils had very little effect on the product which had a normal melting point. Spier, in discussing his work of feeding milch cows, states that nitrogenous foods such as cottonseed cake produce firm butters with high melting points, while starchy or carbonaceous foods like sugar meal make soft butters. These statements are true as applied to those two materials, but if the hardness of the butter is influenced wholly by the nitrogenous and carbonaceous matter of the rations, then it is difficult to explain why corn meal, a carbonaceous food, will make a harder butter than some gluten and linseed meals that are highly nitrogenous but contain quite large percentages of fat.

Cottonseed meal which invariably produces hard butter is not very different in the food elements it contains from the old process linseed meals and some of the glutens from which the starch has been quite completely removed, and these latter products, when they contain as much fat as cottonseed meals usually do, make soft butters.

A chemical examination of the fats of these three foods may offer a possible explanation. Crude cottonseed oil is found to contain quite a quantity of vegetable stearin, so-called, which is separated from the cotton oil of commerce by cold and pressure and used largely for making lard and butter substitutes. Its fatty acids have a high melting point (38° C.) and its general character is not unlike sesame oil which has been found to produce hard butter when fed to cows. Corn oil on the other hand contains practically no stearin, and according to Hopkins* is about 45 per cent olein and 48 per cent linolein, while linseed oil is 80 per cent linolein. The fatty acids of these two oils are liquid below zero Centigrade; linolein being liquid at—18° C. There seems to be sufficient difference in the character of the fats to account for the changes in the butter if one wishes to attribute the variation to the fat of the food. It is possible, however, that the proteids of the food play an important part in the formation of milk fat and have an important bearing on the hardness of the butter, but it is also evident that the oils of the

*Illinois Station Bulletin 52.

gluten products are detrimental to making good butter, and its firmness is very much decreased by the presence of these oils and increased by their removal.

The new process linseed meal now on the market contains but a small amount of fat and consequently, according to previous reasoning, should make a fairly hard butter. To test the matter a linseed product sold under the name of flax meal was fed in period II, experiment I. The result is given in the table above. During 1898 the whole herd of cows were fed a grain ration consisting of wheat bran, corn meal, and Chicago gluten meal containing 2.87% fat. Enough of this gluten was used to furnish the required amount of protein, and no cottonseed meal was fed. During the winter and summer vacations the product was made into butter of which quite a large part was shipped to Boston and the remainder disposed of in the local markets. The butter was rated as first quality and in no instance was a complaint made of it being soft. The sample marked in the table Herd butter was taken during the early part of September.

CONCLUSIONS.

1st. The hardness of butter can be regulated to a large extent by the food of the cows.

2d. Gluten products such as gluten meal, feeds, etc., containing large percentages of oil produce soft butter and should not be fed to dairy cows used for butter production.

3d. Gluten meals containing small percentages of fats, 3% or less, and high percentages of protein, when fed in combination with corn meal and bran, will make butter sufficiently hard for this climate.

4th. The glutens, however, if freed from fat will not produce butter of more than normal hardness and do not have the hardening effect of cottonseed meals; when a very hard butter is desired some cottonseed meal should be fed.

THE EFFECT OF FEEDING FAT ON THE FAT CONTENT OF THE MILK.

J. M. Bartlett.

The preceding experiments were not undertaken to test the effect of the fat of the food on the yield of fat in the milk. In the first two experiments (see pages 99 to 105) the feeding periods were not long enough and the milk was not tested often enough to give reliable data on this point. In experiment III, (see pages 105 to 108) however, the feeding periods were longer, being for the most part 28 days. A composite sample of the milk of each cow taken during the last four days of each week was tested and had it not been for the misfortune of having part of the records of the milk yield destroyed, we would have had considerable reliable data bearing on the subject. A number of attempts have been made in this country, also in Europe, to feed fat into milk, but with a few exceptions the experimenters have arrived at the same conclusion, viz., that the per cent of fat in the milk depends on the individuality of the cow, and can only be slightly or temporarily varied by the food.

Prof. Soxhlet * in 1896 made some experiments in which he claims to have materially increased the fat in milk of cows by feeding them oil in the form of an emulsion. The oil was emulsified for the purpose of aiding the animals in digesting it. The author believes others have failed to get like results for the reason that the fats have not been fed in digestible forms. He gives very little data as to the details of his experiment and most of the paper is given up to theorizing and discussing the results. In the discussion mention is made of feeding periods of four and eight days, and no further mention of time is made. If such short feeding periods were employed, the results can easily be explained, as nearly every one who has experimented with cows has had like experiences.

* Experiment Station Record (Vol. 8, pp. 1016).

F. Albert * and M. Maercker found that feeding rations rich in fat caused a decided increase in the fat of the milk, but a study of their data shows that their feeding periods were very short, being from 7 to 14 days each. The greatest increase both in the per cent of fat in the milk and total yield obtained with a ration rich in fat over one poor in fat was in a feeding period of only seven days. In another trial when two rations rich in fat followed in succession, making a total of about twenty-four days for the two periods, the average yield of fat fell off in the latter period to about the same as was obtained from the previous ration poor in fat.

The author attributes this loss to an over feeding of fat and makes no account of the cow being allowed sufficient time to accommodate herself to the abnormal ration. He also states that there was a great accumulation of body fat and thinks that possibly the results suggest a means of rapidly fattening a dry cow.

S. Rhodin † reports some results of feeding emulsified oils to cows in feeding periods of three to four weeks duration. The author briefly states in his conclusion that the fat content of the milk was increased at first by feeding oil in the form of an emulsion, but later on no increase took place; the milk on the contrary, dropped to its previous normal fat content.

The results of the experiment, presented in the following tables, are rather meager from which to draw any definite conclusions. They would be more satisfactory if all the records could be given, and the ration rich in fat had been continued through the third period as was planned, but owing to an error on the part of a workman, the fat ration was reduced nearly one-half.

The results are of interest, however, in showing the very decided increase in fat content of the milk for the first two weeks of the period when a ration rich in fat was fed and also the decided drop in the third week. The percentages of fat are lower in the third period than in the second but not materially different from those of the last two weeks of the first period and it is the belief of the writer that they were not decreased by the less amount of fat fed, but by the cows' gradual return to their normal capacity.

* Landw. Jahrb. 27 (1898.). † K. Landt. Akad. Handl., 37 (1888) No. 1, pp. 25-33.

AVERAGE PER CENT OF SOLIDS AND FAT, AND AVERAGE DAILY YIELD OF MILK, SOLIDS AND FAT.

Period I.	Cows.	Solids.	Fat.	Daily yield of milk.	Daily yield of solids.	Daily yield of fat.
		%	%	lbs.	lbs.	lbs.
First week	Adle	-	5.3	16.86	-	.89
	Buttercup	-	6.05	17.06	-	1.03
	Dudley	-	4.4	19.55	-	.86
	Pansy	-	5.6	14.91	-	.84
Second week	Adle	14.46	5.2	16.03	2.32	.83
	Buttercup	14.19	5.75	16.71	2.37	.96
	Dudley	13.06	4.8	19.28	2.52	.93
	Pansy	14.17	5.1	14.60	2.07	.74
Third week	Adle	15.44	6.1	-	-	-
	Buttercup	15.53	6.2	-	-	-
	Dudley	14.31	5.4	-	-	-
	Pansy	15.20	5.0	-	-	-
Fourth week	Adle	15.96	6.35	14.65	2.34	.93
	Buttercup	16.31	6.25	15.47	2.52	.97
	Dudley	14.74	5.15	18.41	2.71	.95
	Pansy	16.10	6.0	13.38	2.14	.80

AVERAGE PER CENT OF SOLIDS AND FAT, AND AVERAGE DAILY YIELD OF MILK, SOLIDS AND FAT.

Period II.	Cows.	Solids.	Fats.	Daily yield of milk.	Daily yield of solids.	Daily yield of fats.
		%	%	lbs.	lbs.	lbs.
First week	Adle	16.33	6.7	-	-	-
	Buttercup	16.28	6.85	-	-	-
	Dudley	14.96	5.8	-	-	-
	Pansy	16.08	6.2	-	-	-
Second week	Adle	16.61	7.1	13.64	2.27	.97
	Buttercup	15.88	6.65	15.60	2.48	1.04
	Dudley	14.45	5.7	18.41	2.66	1.05
	Pansy	15.59	6.25	14.70	2.29	.92
Third week	Adle	16.40	6.7	14.61	2.30	.98
	Buttercup	15.66	6.5	15.87	2.49	1.03
	Dudley	14.51	5.2	19.18	2.78	1.00
	Pansy	15.10	5.8	14.75	2.23	.86
Fourth week	Adle	16.86	6.9	14.58	2.46	1.01
	Buttercup	16.18	6.2	15.80	2.56	.98
	Dudley	15.13	5.55	20.84	3.15	1.16
	Pansy	15.75	5.95	15.54	2.45	.92

AVERAGE PER CENT OF SOLIDS AND FAT, AND AVERAGE DAILY YIELD OF MILK, SOLIDS AND FAT.

Period III.	Cows.	Solids.	Fats.	Daily yield of milk.	Daily yield of solids.	Daily yield of fat.
		%	%	Lbs.	Lbs.	Lbs.
First week	Adle	15.99	6.27	–	–	–
	Buttercup	15.48	5.92	–	–	–
	Dudley	14.44	5.05	–	–	–
	Pansy	14.77	5.32	–	–	–
Second week	Adle	16.94	6.45	–	–	–
	Buttercup	16.13	5.85	–	–	–
	Dudley	14.90	4.95	–	–	–
	Pansy	16.71	5.85	–	–	–
Third week	Adle	16.86	6.15	–	–	–
	Buttercup	15.86	6.35	–	–	–
	Dudley	14.78	5.65	–	–	–
	Pansy	16.03	5.70	–	–	–
Fourth week	Adle	16.69	6.55	–	–	–
	Buttercup	15.36	5.80	–	–	–
	Dudley	15.54	5.40	–	–	–
	Pansy	15.30	5.20	–	–	–

AVERAGE DAILY YIELD OF FAT FOR EACH WEEK PER COW.

	Period I.		Period II.		Period III.	
	Digestible fat fed daily per cow 0.36 pounds.		Digestible fat fed daily per cow 0.86 pounds.		Digestible fat fed daily per cow 0.55 pounds.	
	Fat. Per cent.	Fat. Pounds.	Fat. Per cent.	Fat. Pounds.	Fat. Per cent.	Fat. Pounds.
First week	5.34	0.90	6.39	–	5.64	–
Second week	5.21	0.86	6.43	1.00	5.78	–
Third week	5.66	–	6.05	.97	5.96	–
Fourth week	5.94	0.91	6.15	1.02	5.74	–

INJURIOUS MILLIPEDES.

By F. L. Harvey.

For several seasons, radishes grown in the forcing houses of the Station have been more or less covered with excrescences, rendering them unsightly and unfit for market. From one to six excrescences are often found on a single radish, and five per cent of the crop is sometimes affected. After a careful examination of the beds, the injury has been traced to the biting of the radishes by two species of millipedes, viz.,—*Polydesmus monilaris,* C. L. Koch, and *Iulus hortensis,* Wood. *Both of these species have been caught many times with their mouths on the excrescences in the various stages of their development. Millipedes have been reported as doing injury to the roots of corn and strawberries and *Polydesmus complanatus,* according to Fitch, causes club foot of cabbage. We find no records of any species having been injurious to radishes. While hunting down the above culprits, other species of millipedes were found in the forcing houses and are included below. Though not detected biting the roots of plants, their presence is objectionable as they feed upon organic matter that might be appropriated by plants. So far as we know, no species of *Myriopoda* have been reported from Maine, and this article may be regarded as a small contribution to the subject.

We are under obligations to Prof. O. F. Cook of the Department of Agriculture, Washington, D. C., for the examination of specimens, and to Mr. L. H. Horner of the Junior Class of the University of Maine for Figs. 2 and 4. Figs 1 and 5 are after Wood and Fig. 3 a camera sketch by the writer.

* Millipedes are supposed to usually feed upon decaying organic matter. We doubted for a long time that their work upon radishes was primary but from a careful study of the problem are forced to believe it.

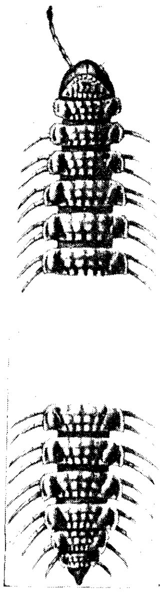


FIG. 5.

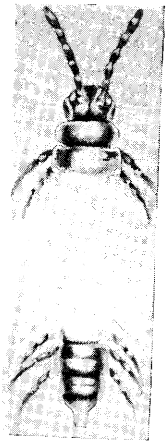


FIG. 4.

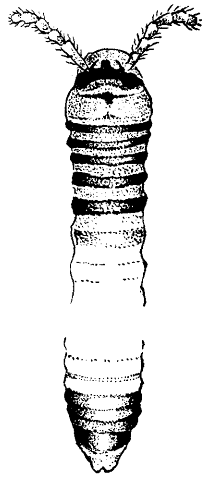


FIG. 2.

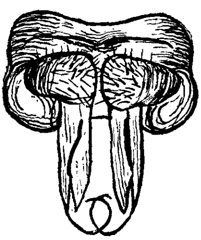


FIG. 1.

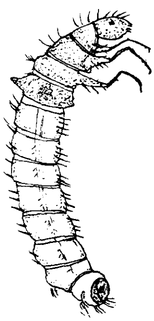


FIG. 6.

FIG. 3.

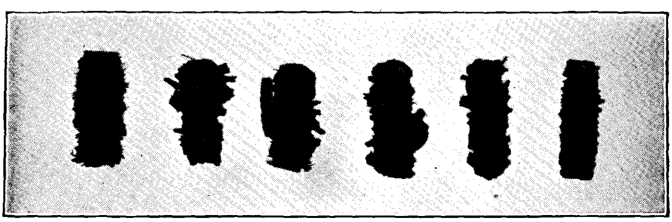


FIG. 7.

Polydesmus monilaris C. L. Koch—*P. serratus,* Wood.

Description: Deep brown. Antennæ pubescent, club-shaped; the dorsal plates of the segments armed with two rows of scales and a broad anterior obsolete series, their lateral margins toothed. Length one-third to one-half inch. The male genitalia hairy with a double terminal spine. See Fig. 1. Head and terminal segment, Fig. 5.

Remarks: This was originally described from Pennsylvania specimens and is a native species. In Maine it is the most common form found in cellars and under boards and rubbish everywhere out of doors. It is abundant in the greenhouses of Orono in the radish beds, and is one of the culprits, having been caught several times with its mouth in contact with the tubercles found on radishes.

Iulus hortensis, Wood.

Description: Brown, ornamented with a row of black spots on the side; antennæ rather short; hairy, slender, club-shaped; segments of the body 42; scuta closely channeled, both above and below; spine at the end of the body wanting; plate in front of the anus triangular, with its apex rounded. Length, 1 inch. The head and terminal segments are shown enlarged five times in Fig. 2.

Remarks: The young and the adults which have just molted are lighter colored and show the spots on the sides plainly. The spots do not show well on fully colored specimens.

This species is abundant throughout the greenhouses at Orono, and particularly so in the radish beds. It has also been caught biting the radishes, causing excrescences.

Iulus virgatus, Wood.

Description: Deep brown; back yellowish; median dorsal line black; antennæ moderately large, pilose, club-shaped; segments 30-35. Dorsal plates distinctly grooved. Spine at the end of the body wanting, anal scale sparsely hairy; preanal scale, broad, subtriangular with a rounded apex. Length from ½ to ¾ inch.

Remarks: The sides of the body of well colored specimens are deep brown or almost black. The dorsum approaches a fawn yellow and the median dark line is pronounced. Our specimens do not show the lateral bands mentioned by Wood and Bollman but are otherwise characteristic. We have found but very few specimens of this species about the greenhouse and no damage has been traced to it. It occurs in a cellar in Orono under boxes and barrels. It was probably brought into the cellar in dirt used for storing celery and roots, and into the greenhouses with plants brought in for the winter. It has been reported from Pennsylvania, District of Columbia and Indiana. It is without doubt indigenous to Maine.

Paraiulus immaculatus Wood.

Description: Deep reddish brown without spots; antennæ rather long, slender and hairy; anterior margin of the head notched; segments 48-51; dorsal plate channeled below; the spine at the end of the body, large, hooked, robust, acute. Length, 1 to 1½ inches.

Remarks: Was originally described from specimens collected in the Catskill Mountains, N. Y. It is found in the woods of Maine, and also is quite common in the greenhouses at Orono. As leaf mold and sphagnum from this locality are used in the beds, this species was introduced that way. So far as we know it has done no injury.

Orthomorpha gracilis C. L. Koch.

Description: Dark mahogany brown with the lateral laminæ prominent and yellow, giving the appearance of a yellow stripe along each side. Length, about an inch. The male genitalia are shown much enlarged in Fig. 3, and the head and terminal segments enlarged two and one-half times in Fig. 4.

Remarks: Widely introduced in greenhouses in Europe and America. Found throughout the tropics and according to Prof. O. F. Cook probably a native of the Malay region. At Orono it is found in abundance under pots in the sphagnum moss on the shelves, and also about the roots of plants, near and in the holes in the bottoms of the pots. Some times a half dozen specimens were taken from under a single pot. This species has never been found in the radish beds, but in a section of the house devoted to tropical and other plants in pots. It was probably introduced with some of the tropical plants. Whether it does injury to these plants we are not certain. We are of the opinion that it feeds on the decomposing sphagnum and other organic matter present.

REMEDIES.

No remedies other than hand picking have been tried in the houses at Orono. It has been found that the millipedes work at night mostly, and early in the morning are found near the surface of the ground. During the day, they burrow and are more difficult to find. The morning, therefore, is the best time to hunt for them. They do more injury in sub-watered than in surface watered beds. We would suggest putting slices of potatoes poisoned with strychnine in the beds. Of course, if this or any other poison is used, the radishes should be carefully washed before marketing. Chips of wood scattered in the beds afford hiding places and these could be examined in the morning for specimens. A more troublesome way is to heat the dirt used in the beds. This could be done by connecting a heating box containing a coil of perforated pipes with the engine, or by forcing steam into the dirt in the beds by means of a hose and nozzle.

AN INJURIOUS CADDICE FLY.

F. L. Harvey.

Family Limnephilidæ; Genus Limnephilus; Sp.

In the latter part of June, 1898, we received some caddice fly larvæ, their cases and their work from Mr. William Miller, manager of the Mt. Desert Nurseries, Bar Harbor, Maine. Mr. Miller stated regarding them: "That they have practically eaten up our hardy water lilies. I send you portions of the stem and leaf, illustrations of their work. As soon as we discovered what was destroying them, we took steps to eradicate them, and also removed all of the decayed and badly damaged foliage which remained. Our hardy aquatic pond will contain, perhaps, 300-350 square feet. The first three days one man gathered each day, about 3 gallons of the case worms. In another week or ten days, there would not have been a particle of leaf or stem in the pond. Some of the kinds are completely killed out and two-thirds of the pond is bare that was practically full last year. Since we have been keeping them down by hand picking, those that were strong enough and not destroyed before the trouble was discovered, have made a rapid and wonderful growth. Of course, in a large or deep pond, hand picking would be out of the question. Having control of the water level, we lowered it so as to reach them. The larvæ crawled up the stems of the lilies literally covering them. The stems were badly eaten, often nearly gone, also the under sides and margins of the leaves were attacked. I should like to know what they are? Is there anything that can be done to destroy them besides hand picking? Any information you can give in regard to destroying them would be gladly received, and I should like to know if they have been before reported as giving much trouble."

The injury being new to us, we wrote Dr. L. O. Howard of the Division of Entomology, United States Department of Agriculture, Washington, D. C., who informed us that the injury was also new to him. As caddice flies cannot be classified beyond the genus by the cases and larvæ, we wrote to Mr. Miller to catch some of the flies for us. Such thorough hand picking had been done that probably no larvæ were left to emerge, and though the pond was watched during the season, no flies were taken. The larvæ sent us by Mr. Miller were dead when received so we were not able to rear the flies.

During August we were in Bar Harbor and visited the Mt. Desert Nurseries and examined the pond. No caddice flies were then on the wing. We arranged with Mr. Miller to transfer some of the case-worms to a tub in the house and try to rear the flies. Later he informed us that no live case-worms could be found. Should they give trouble again, we will investigate farther.

We sent some of the cases to Mr. Nathan Banks who thinks they belong as placed below. To Mr. Miller, we made the following reply:

"The case-worms you sent belong to the Order *Trichoptera* (Caddice Flies), Family *Limnephilidæ,* Genus *Limnephilus.* It will be necessary to have the flies to decide the species. I send you a drawing of a species of caddice fly and wish you would send me any related insects you find about the pond.

"Caddice flies lay their eggs upon the surface of water plants. The young make cases in which they live, or some species appropriate the hollow stems of water plants. Some of them are carnivorous and feed upon other insects, but most of them are vegetable feeders. But little is known about their food habits excepting that many feed on water plants. The injury was entirely new to me. There is no record of caddice flies having been injurious to water lilies. They might commonly feed upon our wild species and the habit be overlooked as the plants are not of economic importance. They might have been in your artificial pond in some number and have been overlooked. It was the unusual number that attracted attention. As you have control of the water level in the pond, there is no better remedy than hand picking, or cleaning the pond in the winter. As you have done a thorough job of hand picking, probably you will never be troubled with them in such numbers again. We will be pleased to investigate farther should they continue to trouble you."

DESCRIPTION OF CASES AND LARVÆ.

Cases about three-fourths of an inch long and one-fourth wide. Of the log-house pattern. They seem to be built of fragments of water-lily stems. One of them ornamented with the case of a smaller species. Fig. 7 shows six of these cases, natural size.

Larvæ about three-fourths of an inch long. The portion within the case pale brown; the protruding thoracic segments and head much darker. The portion within the case provided with blunt hairs. The first abdominal segment enlarged and produced into tubercles above at the sides and below, to attach the larvæ to the case. Fig. 6 shows the larva enlarged two times.

INSECTS OF THE YEAR.

F. L. Harvey.

Short-nosed Ox-louse. (*Hæmatopinus eurysternus.*)

This species is found about Orono and is probably common in Maine, though it has never been sent to the Station before this season. The *Long-nosed Ox-louse* was reported in 1895. For description of these parasites see Experiment Station Report, 1895, page 99.

Walking Stick. (*Diapheromera femorata.*)

Specimens of this curious wingless insect were received from J. H. Hammond, Sanford. This species is certainly rare in Maine. These are the first we have seen from the State.

Apple-tree Aphis. (*Aphis mali* Fabr.)

Was reported as doing much damage to the foliage of apple trees and plum trees in several localities. Spraying with kerosene is probably the best remedy. The application should be made as soon as the insects appear. This insect is considered in Experiment Station Report 1888, p. 170.

Caddice Fly.

The larva of a caddice fly was reported as doing damage to water lilies in an artificial pond at Bar Harbor. Considered in detail elsewhere.

Bud Moths.

Several species of bud moths were reported the past season as doing much damage to the terminal buds and flower buds of apple trees. Spraying with Paris green as soon as the leaves begin to unfold, ought to destroy them.

THE RED HUMPED APPLE WORM. (*Œdemasia concinna.*)

Was reported from several new localities the past season. It seems to be on the increase in Maine. See Experiment Station Report, 1890, p. 135.

FALL CANKER WORM.

This insect continues to do some damage in Southern Maine. It will be remembered that it went across the State in a wave from the northeast to the southwest. It was also reported the past season from Aroostook county.

THE ZEBRA CATERPILLAR. (*Mamestra picta.*)

This is one of the most common caterpillars in gardens and cultivated fields. It is a general feeder found on a great variety of plants. See Experiment Station Report, 1897, pages 173 and 175.

APPLE-TREE TENT CATERPILLAR. (*Clisiocampa americana.*)

Was, as we predicted, very abundant particularly in southern and western Maine. The farmers who took care of their trees last year are now reaping the benefit, as the apple crop was short and apples are high.

THE BROWN TAILED MOTH.

Mr. Andrew Whitehouse, South Berwick, Me., upon whose premises the above pest was found in 1897, writes February 2d as follows: "I cannot find any specimens to send you. In the summer of 1897, my boy was badly poisoned by them. They were numerous on a woodbine on my premises and a few on my fruit trees. Last year I cut down the woodbine and burned it, and have not seen any since." Mr. Whitehouse thinks they came from Somerville, Mass., on roses.

The usual number of luna, cecropia and polyphemus moths were received. We received a polyphemus cocoon that was spun in a stocking. The caterpillar climbed up a post and out on the line to where the stocking hung, then down and into the stocking. When found the stocking had been on the line only a few hours.

Drone or Chrysanthemum Fly.

The larvæ of these flies have long breathing tubes at the end of the body which give them the name of rat-tail larvæ. Specimens reported were breeding in a tub containing a decoction of tobacco stems. We found the larvæ abundant at McLeod's lumber camp in a tub by the blacksmith's forge containing stagnant water.

Apple Maggot. (*Trypeta pomonella.*)

Was not as prevalent as usual, though doing considerable damage in some parts of the State.

Currant Fly. (*Epochra canadensis.*)

Was reported from Gardiner on currants. It was common also about Orono. We would like to hear from anybody whose currants are stung by a fly and turn red early, and drop.

Fickle Midge. (*Sciara inconstans.*)

This was reported last season as attacking gloxinia bulbs. The same complaints have been made the past season. Mrs. R. S. Warren, South Deer Isle, sent us specimens which she called springtails that were eating the leaves and blossoms. She writes, "I am positive now that the springtails destroy my gloxinias, for I have found them on the blossoms and stems where they had eaten the stem half through and the blossoms withered. Also they burrow into the leaves and sap them until they dry up and die." The specimens sent were Thysanurans and an unknown species of Thrips. The latter were no doubt the cause of the injuries. Mrs. Warren put slices of potato around the plants and the insects collected on them in great numbers. Probably the use of the potato as traps would be a good way to destroy them.

Buffalo Carpet Beetle. (*Anthrenus Scrophulariæ.*)

Reported from Winthrop and Orono. Beetles in the house. These beetles are attracted by flowers that are in bloom at the time when they are on the wing, and they can be used as traps. The following from the Thirteenth Report of the Entomologist of the State of New York, page 359.

"Mr. M. B. Coombs of Utica, N. Y., writes, 'My sister has for several years kept a bed of small tulips for drawing the beetles. They congregate almost entirely on the creamy or yellow shades. For about two weeks with a pair of tweezers she picked out from them from two to three dozen on unfavorable days, and hundreds on quiet sunny days.'"

MAY BEETLE. (*Lachnosterna fusca.*)

Mr. Kirk of Bar Harbor sent grubs of the above species and wrote as follows: "They have worked under the surface of the turf about two inches and eat everything before them. They have killed outright about 15,000 square feet of my tennis court. Most of the damage was done in July and August. I have had the infested ground dug up and the insects picked out. I have picked up more than a bushel." We wrote Mr. Kirk, calling his attention to the remedies usually applied for white grubs.

CUCUMBER BEETLE. (*Diabrotica vittata.*)

This beetle that usually confines itself to cucurbitaceous plants was reported the past season as feeding on the buds of cultivated asters.

POTATO STALK BORER. (*Gortynia nitela.*)

Continues to do some damage to potato plants.

BLACKBERRY CANE BORER. (*Oberea bimaculata.*)

Reported from western Maine. Also abundant at Orono on blackberries and raspberries.

STRAWBERRY WEEVIL. (*Anthronomus signatus.*)

Does some damage to strawberries. More common on wild than on cultivated plants.

PEAR TREE SLUG. (*Eriocampa cerasi.*)

Reported as injuring the foliage of cherry trees.

INSECTS EXAMINED IN 1898.

No.	Common Name.	Technical Name.	From Whom Received.	Remarks.
1	SHORT-NOSED OX LOUSE	*Hæmatopinus eurysternus*	Chas. N. Wells, Auburn	On cattle. See Ex. Sta. Rept. 1895, p. 99.
2	WALKING STICK	*Diapheromera femorata*	J. H. Hammond, Sanford.	
3	APPLE-TREE APHIS		T. D. Salley, Madison J. S. Blackwell, Madison O. B. Griffin, Reynolds F. E. Gilman, Foxcroft Austin Stover, Bluehill	On apple and plum trees.
4	OYSTER-SHELL BARK-LOUSE	*Mytilapsis pomorum*	Z. A. Gilbert, from Camden	On apple trees.
5	CADDICE FLY	*Species unknown*	Wm. Miller, Bar Harbor	Destroying water lilies in an artificial lily pond.
6	BUD MOTHS	*Several species*	L. L. Phillips, Hebron	On apple trees.
7	RED-HUMPED APPLE-WORM	*Œdemasia concinna*	Austin Stover, Bluehill O. B. Griffin, Reynolds Mrs. A. M. Hustin, Winn	On apple trees.
8	FALL CANKER-WORM	*Alsophila pometaria.*	V. T. Lundvall, New Sweden. Mowe F. Article, Camden	On apple trees.
9	ZEBRA CATERPILLAR	*Mamestra picta*	Austin Stover, Bluehill A. J. Abbott, North Paris O. F. Guptil, West Scarboro I. N. Lapham, Pittston	On strawberries, pea vines, carrots and raspberries.
10	WHITE-MARKED TUSSOCK-MOTH.	*Notolophus leucostigma*	C. Henry Page, Winthrop Chas. N. Wells, Auburn	On apple trees.
11	SALT-MARSH CATERPILLAR.	*Estigmene acræa*	B. Walker McKeen.	
12	FALL WEB-WORM	*Hyphantria cunea*	B. Walker McKeen, Hancock Co.	On apple trees.
13	GOOSEBERRY SPAN-WORM	*Diastictis ribearia*	F. L. Harvey, Orono.	On gooseberries.
4	LUNA MOTH	*Tropæa luna*	Samuel L. Boardman, Bangor	A night flying species.

INSECTS EXAMINED IN 1898—CONCLUDED.

No.	COMMON NAME.	TECHNICAL NAME.	FROM WHOM RECEIVED.	REMARKS.
15	CECROPIA EMPEROR MOTH	*Samia cecropia*	A. O. Butler, East Lebanon	Apple trees.
16	POLYPHEMUS MOTH	*Telea polyphemus*	V. T. Lundvall, New Sweden.	
17	APPLE-TREE TENT-CATERPILLAR	*Clisiocampa Americana*	Various parties southwestern Me.	On apple trees.
18	TIGER SWALLOW-TAIL BUTTERFLY	*Jasoniades glaucus turnus*	Chas. A. Moulton, Buxton.	
19	CLOUDED SULPHUR BUTTERFLY	*Eurymus philodice*	R. T. Young, North Hancock	Feeding on clover.
20	DRONE OR CHRYSANTHEMUM FLY	....	M. Henry McLaughlin, Bangor	Larvæ in decoction of tobacco stems.
21	CURRANT FLY	*Epochra canadensis*	H. K. Morrell, Gardiner	Infesting currants.
22	FICKLE MIDGE	*Sciara inconstans Fitch*	Mrs. R. S. Warren, So. Deer Isle	On gloxinia plants.
23	SHEEPTICK	*Melophagus ovinus*	Job Abbott, Dexter	Parasite on lambs.
24	CARPET BEETLE. BUFFALO BEETLE	*Anthrenus scrophulariæ*	C. Henry Page, Winthrop.	Attacking carpet. Beetles on window in house.
25	MAY-BEETLE. JUNE-BUG.	*Lachnosterna fusca*	E. Kirk, Bar Harbor.	Destroyed 1,500 square feet of tennis court in July and August.
26	CUCUMBER BEETLE	*Diabrotica vittata*	Mrs. Lucy Hutchins, Fryeburg Mrs. Alice Buzzell, Fryeburg	Attacking aster heads.
27	RIBBED PINE BORER	*Rhagium lineatum*	Chas. A. Moulton, Buxton.	
28	POTATO-STALK BORER	*Gortyna nitela*	A. O. Butler, East Lebanon O. B. Griffin, Reynolds	Boring in potato stalks.
29	BLACKBERRY CANE BORER	*Obesea bimaculata*	A. W. Grover, Bethel	Attacking blackberry and raspberry canes.
30	GOLDSMITH BEETLE	*Catalpa lanigera*	W. R. Atherton, Hallowell.	
31	STRAWBERRY WEEVIL	*Anthonomus signatus*	F. A. Fisher, Bluehill	On strawberries.
32	PEAR-TREE SLUG	*Eriocampa cerasi*	Austin Stover, Bluehill	Feeding on cherry.

NOTES ON THE PLANTS OF THE YEAR.

F. L. HARVEY.

Specimens of the plants mentioned below were examined during the year. The weeds received agree well with weed seeds found in seed offered for sale in Maine. Judging from increased correspondence, farmers are awakening to the importance of better seed and the necessity of carefully watching their fields to prevent the introduction and spread of new weeds. A large number of samples of seeds sold in Maine were examined the past season and over sixty kinds of foreign seeds detected.

But few fungi were reported as doing damage the past season.

HOLLYHOCK RUST. (*Puccinia malvacearum.*) This disease has established itself in Maine.

POTATO BLIGHT. (*Phytophthora infestans*). Was quite bad in some portions of Maine, but not so prevalent as in 1897.

WILD PEPPER GRASS. (*Lepidium virginicum and apetalum.*) In newly seeded land. The clover seed sold in Maine contains the seeds of these weeds.

WILD TURNIP. (*Brassica campestris.*) Appeared in fields sowed with western clover seed.

WILD MUSTARD. (*Sinapis alba.*) In land seeded with western clover seed. This is not as common in Maine as several other cruciferous weeds.

PURPLE MILKWORT. (*Polygala viridescens* L.) Growing along roadsides and in meadows. Not a bad weed.

ROUGH CINQUEFOIL. (*Potentilla monspeliensis.*) In newly seeded land. The seeds of this plant are abundant in Timothy seed sold in Maine.

BIENNIAL WORMWOOD. (*Artemesia biennis.*) Dooryards and waste places. Not a bad weed.

MAY WEED. (*Anthemis cotula.*) Waste places and fields. A bad weed. Found in Timothy seed.

ORANGE HAWKWEED. (*Hieracium aurantiacum.*) Reported from several new localities.

KING-DEVIL WEED. (*Hieracium prœaltum.*) Reported from Albion, Vassalboro, Exeter Mills, Carmel and Litchfield. Mr. H. K. Morrell writes as follows: "We found three patches of this pest in the bog woods of Litchfield and pulled it all up. The field formerly owned by Bartlett and Dennis in West Gardiner, where it is said to have first made its appearance, is as yellow as gold over the most of it. In a few days the seed will be ripe enough to fly by the wind. The State should take charge of such fields." In the vicinity of Riverside, on the east side of the Kennebec, this pest occurs on several farms. Exeter Mills where it has been found this season by Mr. Josiah Eastman is in Penobscot county, a long distance from other locations. Mr. Roy H. Harvey collected specimens in July on the farm of Mr. McLaughlin, two miles east of Carmel village. The locality is fifteen miles west of Bangor. Mr. Morrell's observations show the plant will grow in Maine outside of the fields.

YELLOW GOAT'S BEARD. (*Tragopogon pratensis.*) Not a common weed in Maine, but Mr. H. E. Cook of Vassalboro says: "There were thousands in an old field that I have recently come into possession of."

YELLOW DAISY. CONE FLOWER. (*Rudbeckia hirta.*) This weed is abundant in Maine and is increasing. We found the seed of it in Timothy seed samples examined this season.

CLOVER DODDER. (*Cuscuta epithymum.*) Seems to be on the increase. The bunches of the parasite should be cut, dried and burned. It seems to grow most in second crop clover.

GROUND CHERRY. (*Physalis Virginiana.*) Reported, but not a common weed in Maine. Apparently not found in the eastern part of the State.

WATER HOREHOUND. (*Lycopus Americanus.*) A common weed in low fields and grass lands.

HEMP NETTLE. (*Galeopsis Tetrahit.*) A bad weed in gardens, and rich soil in fields. Abundant in Maine.

ENGLISH PLANTAIN. (*Plantago lanceolata.*) The seeds of this, also dooryard plantain and aristate plantain were found abundantly in seed examined this season.

ROUGH PIGWEED. (*Amaranthus retroflexus.*) A bad weed in gardens and cultivated fields. Germinates late and will perfect its seeds after crops are laid by.

LAMB'S QUARTERS. PIGWEED. (*Chenopodium album.*) A common weed along road sides, waste places, gardens and cultivated fields. Seed abundant in western seed.

POKE-WEED, PIGEON BERRY. (*Phytolacca decandra.*) Not abundant. Reported for the first time, this season. Growing in a potato patch.

FRINGED BLACK BINDWEED. (*Polygonum clinode.*) This is a native bindweed that has been reported as a weed in newly cleared lands.

BLACK BINDWEED. (*Polygonun convolvulus.*) Common in fields and gardens. Western seed contains it in abundance.

VIRGINIA THREE-SEEDED MERCURY. (*Acalypha Virginica.*) Is becoming a common weed in low damp lands. It is an annual, and clean culture should eradicate it. It is native in low woods.

PLANTS EXAMINED IN 1898.

No.	Common Name.	Technical Name.	From Whom Received.	Remarks.
1	Wild Peppergrass	*Lepidium Virginicum*	E. S. Stuart, Garland	In newly seeded land.
2	Apetalous Peppergrass	*Lepidium apetalum*	L. E. Winslow, Mars Hill	Waste places and fields.
3	Shepherd's Purse	*Capsella bursa-pastoris*	H. B. Whipple, Bingham	In newly seeded land.
4	Wild Navew. Turnip	*Brassica campestris*	L. E. Winslow, Mars Hill H. B. Whipple, Bingham	In newly seeded land.
5	White Mustard	*Sinapis alba*	H. B. Whipple, Bingham	In newly seeded land.
6	Vetch	*Vicia cracca*	W. R. Atherton, Hallowell	Grass land.
7	Hop Clover	*Trifolium agrarium*	G. W. Chamberlain, W. Lebanon.	Roadsides and fields.
8	Purple Milkwort	*Polygala viridescens L.*	E. G. Lovejoy, Medford Center	Roadsides and grass lands.
9	Rough Cinquefoil	*Potentilla monspeliensis*	O. B. Griffin, Reynolds	Fields, waste places, roadsides.
10	Biennial Wormwood	*Artemesia biennis*	B. L. Fernald, Winn	Waste places.
11	Mayweed	*Anthemis cotula*	R. E. Winslow, Mars Hill	Yards, roadsides.
12	Orange Hawkweed	*Hieracium aurantiacum*	H. E. Cook, Vassalboro J. T. Brown, Webber	Fields, roadsides, pastures.
13	King-Devil Weed	*Hieracium prœaltum*	Josiah Eastman, Exeter Mills C. E. Crosby, Albion H. K. Morrill, Litchfield Sev'l parties Vass'b'o & Riv'sd R. H. Harvey, Carmel	Cultivated fields and swamp in woods.
14	Yellow Goat's Beard	*Tragopogon pratensis*	H. E. Cook, Vassalboro	Not a common weed in Maine.
15	Yellow Daisy. Coneflower	*Rudbeckia hirta*	Various parties Houlton, Riverside, etc	Common through Maine in grass lands.
16	Clover Dodder	*Cuscuta epithymum*	E. C. Putnam, Dixmont Center	Parasitic on clover.
17	Ground Cherry	*Physalis Virginicaa*	G. M. Twitchell from Thorndike.	Fields.

18	WATER HOREHOUND	*Lycopus Americanus*	H. B. Whipple, Bingham; B. L. Fernald, Winn	Low grass lands.
19	HEMP NETTLE	*Galeopsis Tetrahit*	H. B. Whipple, Bingham	Waste places and gardens.
20	ENGLISH PLANTAIN	*Plantago lanceolata*	H. M. Gage, Plymouth	Cultivated fields.
21	ROUGH PIGWEED	*Amaranthus retroflexus*	B. L. Fernald, Winn; H. B. Whipple, Bingham	Fields and gardens.
22	LAMB'S QUARTERS. PIGWEED	*Chenopodium album*	H. B. Whipple, Bingham	Fields, gardens, waste places.
23	POKE-WEED. PIGEON-BERRY	*Phytolacca decandra*	A. O. Butler, East Lebanon	Cultivated field.
24	MILD WATER-PEPPER	*Polygonum hydropiperoides*	H. B. Whipple, Bingham	Low grass lands.
25	FRINGED BLACK BINDWEED	*Polygonum cilinode*	H. B. Whipple, Bingham	Newly cleared lands.
26	BLACK BINDWEED	*Polygonum convolvulus*	H. B. Whipple, Bingham	Cultivated ground.
27	VIRGINIA THREE-SEEDED MERCURY	*Acalypha Virginica*	R. H. Libbey, Newport; Maine Farmer	Low grass land. Cultivated fields.
28	WOOD REED-GRASS	*Cinna arundinacea*	O. B. Griffin, Reynolds	Fields and woods.
29	RATTLE-SNAKE GRASS	*Glyceria Canadensis*	O. B. Griffin, Reynolds	Low grass land.
30	SQUIRREL-TAIL GRASS	*Hordeum jubatum*	Mrs. R. C. Leonard, Passadumk'g	Weed in fields.

TUBERCULOSIS AND THE STATION HERD.

F. L. RUSSELL.

Since some years before 1886 until within two years, some of the cattle kept on the College farm have been affected with tuberculosis, whenever the College has kept any cattle. Before 1886, cattle occasionally died from this disease or in absence of exact knowledge of their condition were sold for beef or otherwise disposed of on account of age or unthriftiness.

Well bred young animals were sold to improve other herds and sometimes carried tuberculosis with them. This is a very common way of spreading tuberculosis, but with our present knowledge, it ought to be very generally avoided.

In 1886, the College cattle were so badly diseased that it was considered best to kill the entire herd, as at that time there was no known means by which the diseased animals could be detected with any certainty. After the herd was destroyed the barns were disinfected with some care and no new stock was introduced for about a year.

In 1889, considerable new stock was purchased from different sources and in less than a year from the time they were purchased, two of them were found to be diseased and were killed. Again the barn was disinfected, but new cases of disease were frequently being discovered in the herd. In 1892, tuberculin became available for the detection of tuberculosis, and some time before it was used in other parts of the State, we were conducting experiments to test its value.

In 1893, we had become convinced of the value of tuberculin as a revealer of the presence of tuberculosis and took what was then rather radical ground, and after testing every bovine on the farm, down to the youngest calf, those that reacted to the test were killed. This made a large hole in the herd and required the sacrifice of some of the most valued animals, but we believe the results have fully justified the course taken.

In order to meet the demands for dairy products it was considered necessary to replace the cows killed, and ordinary grade and native cows that answered the requirements were purchased from nearby sources. Every precaution was taken to procure sound animals, and before they were introduced into the barns, they successfully passed the tuberculin test, *but as it was late in the fall and the barn was full of hay and grain, it was not considered practicable to disinfect the barn.* The lintel was disinfected but not the rest of the barn until the following summer.

During the winter of 1893 and 1894 and the following spring, several cases of tuberculosis developed, some of them being cows purchased the fall before, from healthy herds, and according to every known test, healthy animals themselves. They must have contracted the disease in the College barns. In the summer of 1894, the barn was disinfected and since that time comparatively few cases of tuberculosis have been found, the last case being discovered in the fall of 1897. In 1896, the barn was again disinfected in a very thorough manner. Since then we have found but two cases and each of them was discovered before it was possible that they should have infected their surroundings or other cattle. Since October 1897, no new case has been discovered, although the entire herd was tested in 1897 and again in 1898. We now feel justified in making the claim that since October 1897, the herd has been entirely free from tuberculosis for perhaps the first time in its history, although we are aware that it is possible that among the older animals there may be one or two that have been infected for years and may develop the disease at any time. The herd now numbers fifty-one head of all ages, most of these bred on the farm.

Some mistakes have been made without doubt, and it was unfortunate that means were not earlier discovered for accomplishing the end we have now reached, but if there has been anything exceptional in our experience with tuberculosis, it consists in the fact that in about three years' time we have exterminated the seeds of the disease from a badly infected herd and premises without sacrificing either to any great extent. Other colleges and experiment stations situated as we were in 1894 have felt it necessary to destroy buildings and cattle and in one instance, at least, import range cattle that it was assumed had never been exposed to tuberculosis. In getting rid of tuberculosis, we have used no means but what are at the command of any stock owner. In the first place, we have not harbored diseased cattle to serve as sources of contagion. As soon as their condition has been discovered, they have been destroyed. Since we have relied on the action of tuberculin, many animals that were doing good work and were apparently well have been sacrificed, but the autopsy has almost invariably justified the course taken, and in pursuing this course, we have doubtless saved more animals than we have destroyed. We have saved animals that would have become diseased if infected animals had been allowed to associate with them and infect their surroundings. The animals destroyed had been valuable, but the most skeptical in regard to the danger of bovine tuberculosis would hesitate before paying much for them with a full knowledge of their diseased condition. No animals have ever been sold from the College herd for any purpose that were even suspected of being diseased.

Tuberculin is not infallible by any means. Animals infected with tuberculosis in which the disease is dormant, making no progress for the time being, usually fail to react under the tuberculin test, and again, many animals that do react are so slightly diseased that it is possible or even probable that they might be safely kept for some time, but we know of no way by which these slightly diseased cattle can be distinguished from those in which the disease is more advanced, so that they would not be safe animals to keep. Again, the slightly diseased animal may, nobody can tell how soon, become a dangerous animal to have in a herd. Our observation has been that when cattle have tuberculosis in a sufficiently advanced stage so that it can be detected by any other than the tuberculin test, their days are usually numbered, they have already done their work of spreading contagion, and it matters little whether they are allowed to die from disease or are killed on the verge of the grave.

In addition to getting rid of diseased cattle to avoid infection, we have endeavored to get rid of the disease products that the cattle have left in the barns. The only active cause in the spread of tuberculosis is the tubercle bacillus. This germ is given off through various channels from tuberculous cattle and it is found in the barns the cattle have occupied, and it may lie there for months after the cattle have been removed. That this is no imaginary condition has been demonstrated many times by finding this germ in the dust of buildings where tuberculous animals have been kept and testing its life on small animals to which it has conveyed the disease.

We consider it quite as important to kill these disease germs as to kill the cattle that produce them. To kill the tubercle bacilli left in the barn by the diseased cattle has been our object in disinfecting the barns, and of course it has been necessary to disinfect as often as the barns have become infected by diseased cattle and no oftener. We shall not have occasion to disinfect them again unless we have another case of tuberculosis that makes sufficient progress before we discover it so that the germs of the disease are given off and reinfect the barns. The principle involved in the disinfection is to bring in contact with the disease germs some substance that will kill them. We have used for this purpose corrosive sublimate. In detail, the method employed is as follows:

All the hay, grain and farming tools have been removed from the barns, the only exception being the hoes, shovels and forks that have to be used there. Every movable thing that has been in the barn with the diseased cattle, or after the diseased cattle were removed, before the barn was disinfected, was taken out, or, if left in the barn, was disinfected the same as the barn itself. Then with brooms all dust and dirt that could be moved, was swept into the basement or out of doors into the sunlight. Then with a hand pump mounted on a barrel, such a pump as is commonly used for spraying orchards or potato fields, the disinfecting solution was thrown with considerable force against *every inch* of the wood work of the barn, into every *crack* and *crevice* where dust, laden with disease germs, might lodge. We commenced in the roof and worked downward, making thorough work of it as we went along. By using the pump we did not find this a very expensive operation. Including the cost of the material and the labor, the expense of cleaning and disinfecting a barn 100x50 feet with 18 feet posts and basement, was about $25.00. This did not include the cost of the pump which was but little injured, and has before and since that time been used for other purposes. The disinfecting solution was made by dissolving one part, by weight, of corrosive sublimate in about a thousand parts of water. The pump was mounted on a fifty gallon barrel and we used a little more than a half pound of the sublimate for a barrel of water. We bought the pulverized corrosive sublimate and dissolved it in hot water. It dissolves very slowly in cold water. The sublimate and its solution should be kept in glass or wooden vessels; it corrodes metal. The solution is poisonous if taken in sufficient quantities, so it should never be left uncovered where animals can get at it.

Another means that we have used in keeping our herd free from tuberculosis has been the testing with tuberculin of all animals purchased. By this means we have avoided purchasing diseased animals that were satisfactory in other respects, and if we were to neglect this precaution, we might easily undo all that we have accomplished. When we could do so conveniently, the animals purchased have been tested before they were brought to the farm. In other cases they have been tested here before they were admitted to the barns with the other cattle. In two cases, we have avoided introducing tuberculous cattle into the herd by this very simple precaution.

SUMMARY.

The College herd of cattle has never, prior to 1897, for long at a time, been entirely free from tuberculosis for nearly twenty years.

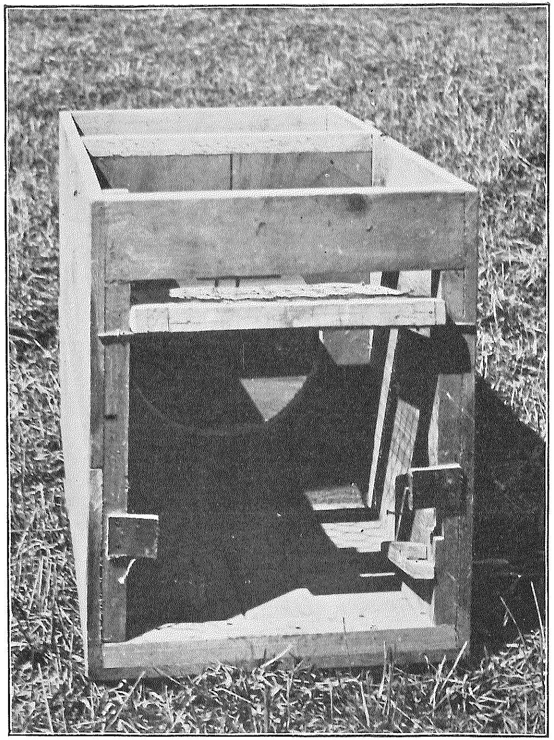
The entire herd was killed once to get rid of the disease.

It was again introduced with cattle purchased; since 1894 we have been making rapid progress in getting rid of the disease.

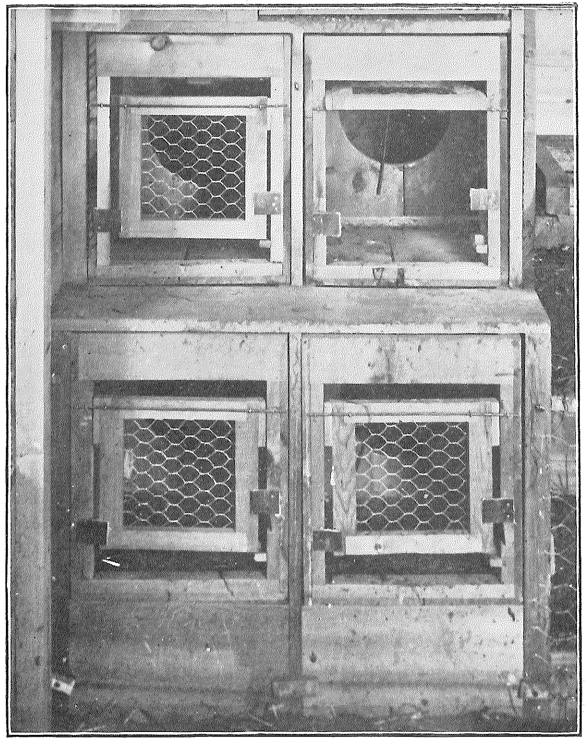
We have not been able to discover any cases for more than a year and a half and believe the herd, numbering fifty-one head, most of them bred on the farm, is now free from tuberculosis.

The herd has been freed from tuberculosis by first, killing all the animals that reacted to tuberculin; second, thoroughly disinfecting the barns where tuberculous cattle had been kept; third, carefully inspecting all cattle purchased into the herd.

The methods used for getting rid of tuberculosis are easily available and not expensive.



Single nest removed.



Nests in position.

INDIVIDUAL RECORD NESTS.

A NEST BOX FOR KEEPING INDIVIDUAL EGG RECORDS.

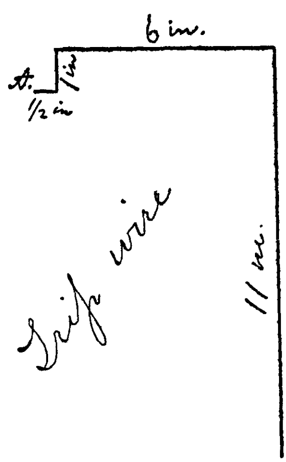
G. M. GOWELL.

Desiring to conduct experiments in breeding hens, we found it necessary, first, to be able to determine the eggs produced by each individual. Several appliances and patented devices were examined, but all seemed open to the objection, that while they might indicate to an extent the producer of the egg, the lack of certainty would be so great as to render them of little value for our purpose. We constructed a nest that proved so satisfactory, that we placed fifty-two of them in the breedinghouse, where they have been in use several months. They enable us to know the eggs produced by each bird with certainty. The boxes are placed four in a bank, and slide in and out like drawers and can be carried away for cleaning if necessary. If desired, they could be put on the floor or shelf by simply having a cover to each box.

Our breeding pens are ten by sixteen feet in size, and there are twenty hens and a cockerel in each one. Four nests in each pen have accommodated the birds by the attendant going through the pens once an hour during that part of the day when the birds were busiest. Earlier and later in the day, his visits have not been so frequent. More nests in the pen would reduce the frequency of his visits. To remove a hen, the nest is pulled part way out and as it has no cover, she is readily lifted up and the number on her leg band noted on the record sheet that hangs at hand. After having been taken off a few times, they do not object to being handled, the most of them remaining quiet, apparently expecting to be picked up.

The nest box is very simple, inexpensive, easy to attend and certain in its action. It is a box-like structure, without front end or cover. It is 28 inches long, 13 inches wide and 13 inches deep—inside measurements. A division board with a circular opening $7\frac{1}{2}$ inches in diameter is placed across the box 12 inches from the back end and 15 inches from the front end. The back section is the nest proper. Instead of a close door at the entrance, a light frame of inch by inch and a half stuff is covered with wire netting of one inch mesh. The door is ten and one-half inches wide and ten inches high and does not fill the entire entrance, a space of two and a half inches being left at the bottom and one and a half inches at the top, with a good margin at each side to avoid friction. If it filled the entire space it would be clumsy in its action. It is hinged at the top and opens up into the box. The hinges are placed on the front of the door rather than at the center or back, the better to secure complete closing action.

The trip consists of one piece of stiff wire about three-sixteenths of an inch in diameter and eighteen and one-half inches long, bent as shown in the drawing. A piece of board six inches wide and just long enough to reach across the box inside is nailed flatwise in front of the partition and one inch below the top of the box, a space of one-fourth of an inch being left between the edge of the board and the partition. The purpose of this board is only to support the trip wire in place. The six-inch section of the trip wire is placed across the board and the long part of the wire slipped through the quarter inch slot, and passed down close to and in front of the center of the seven and a half inch circular opening. Small wire staples are driven nearly down over the six-inch section of the trip wire into the board so as to hold it in place and yet let it roll sidewise easily.



When the door is set, the half inch section of the wire marked A comes under a hard wood peg or a tack with a large round head, which is driven into the lower edge of the door frame. The hen passes in through the circular opening and in doing so presses the wire to one side, and the trip slips from its connection with the door. The door promptly swings down and fastens itself in place by its lower edge striking the light end of a wooden latch or lever pressing it down and slipping over it, the lever immediately coming back into place and locking the door. The latch is five inches long, one inch wide and a half inch thick, and is fastened loosely one inch from its center to the side of the box, so that the outer end is just inside of the door when it is closed. The latch acts quickly enough to catch the door before it rebounds. It was feared that the noise arising from the closing of the door might startle the hens, so instead of wooden stops, pieces of old rubber belting were nailed at the outside entrances for the door to strike against.

The double box with nest in the rear end is necessary, as when a bird has laid and desires to leave the nest, she steps to the front and remains there until released. With one section only, she would be very likely to crush her egg by standing upon it.

One experiment which has been undertaken and which requires a long period of time in preparation is the attempt to establish families of hens that shall excel as egg producers. To do this, reliance upon the laws of inheritance and transmission must be coupled with selection. Selection will depend upon the actual production of the birds taken for foundation stock. From offspring of the foundation stock will be selected—by use of the nest boxes—the greatest yielders of desirable eggs.

The male birds will be bred from dams of known capacity and quality. Only by use of nest boxes and leg bands can we expect to control the work. Two hundred and sixty females, from three distinct breeds, are undergoing test for the foundation stock. One year's time will be required in the selection. From among them it is hoped may be found a few birds that are suited for the founding of the families. The breeds employed are Barred Plymouth Rock, White Wyandotte and Light Weight Light Brahma.

THE NUMBER OF LAYING HENS THAT CAN BE PROFITABLY KEPT IN ONE PEN.

G. M. Gowell.

To obtain data relative to the number of hens that can be kept in a room of a given size, and the receipts from the same, a test was made with fifteen pens of birds, of two breeds.

In the Station poultry building were fifteen pens, alike in size and arrangement. Each pen was ten by sixteen feet on the floor. It was five feet high at the back and eleven high at the front. Each pen had the same amount of window surface in the south side. The roosts, gravel, bone and water dishes and nests were arranged the same in all of the pens. The entire floor space of one hundred and sixty feet was available to the birds, as the walk was elevated above the floor so as not to interfere with its use. Equal yard space was attached to each room.

The birds employed were all of the same age—hatched May 2d—except those in pen No. 1 which were hatched April 16th. Care was exercised in selecting, to have all of the birds in the pens of a group as nearly alike in size, form and vigor as possible.

GROUP 1.

Pen No. 1 had fifteen Brahma pullets.
Pen No. 2 had twenty Brahma pullets.
Pen No. 3 had twenty-five Brahma pullets.
Pen No. 4 had thirty Brahma pullets.

GROUP 2.

Pens Nos. 5, 6, 7, 8, were duplicates of Nos. 1, 2, 3, and 4.

GROUP 3.

Pen No. 9 had fifteen Barred Plymouth Rock pullets.
Pen No. 10 had twenty Barred Plymouth pullets.
Pen No. 11 had twenty-five Barred Plymouth pullets.
Pen No. 12 had thirty Barred Plymouth Rock pullets.

GROUP 4.

Pens Nos. 13, 14 and 15 were duplicates of Pens Nos. 9, 10, 11.

The birds in all the pens received the same quality of food. All food was distributed among the pens of a single group in proportion to the number of birds each one contained. The birds in group No. 2 were not so well developed as those in other groups and were fed according to their needs. All birds in a single group were fed the same quantity. Uniform care and treatment prevailed. Two birds were lost by accident during the winter. A good supply of dry straw was kept on the floors at all times, and the birds were induced to exercise freely. The only lack of uniformity in conducting the test was in group 1, pen 1, where older birds were used than in other pens, which results in a more favorable showing than can be ascribed to numbers alone.

It was intended to carry the test through the year, but the building was destroyed by fire early in May, thus terminating the test at six months. For the purpose of this test only, it may be that the period from November first to May first represents better the influence of the floor space than would be the case when summer runs were added.

In examining the data, it should be remembered that each group forms a test independent of other groups. This is important as the birds in different groups are not alike, but all the birds in pens comprising a single group are uniform.

The uniformity of the results in every group are such as lead to the conclusion that as we increase the numbers of birds above fifteen on a floor space of one hundred and sixty feet, the egg yield diminishes as the number of birds increase. This testimony is emphatic, as among the four groups there was not a single exception to this conclusion.

The three tables which follow give the egg records for six winter months.

YIELD OF EGGS DURING SIX WINTER MONTHS OF HENS KEPT IN FLOCKS OF 15, 20, 25, AND 30 COMPARED.

Number of group.	Number of pen.	Number of birds.	Eggs Yielded.							
			November.	December.	January.	February.	March.	April.	Total.	Per bird.
1	1	15	186	261	237	122	194	260	1,260	84
	2	20	148	245	269	124	220	268	1,274	63.7
	3	25	104	277	232	125	251	381	1,370	54.8
	4	30	81	171	235	147	255	345	1,234	41.1
2	5	15	24	151	213	102	180	236	906	60.4
	6	20	66	207	224	127	204	326	1,154	57.7
	7	25	55	148	233	114	204	298	1,052	42.1
	8	30	34	138	212	111	266	390	1,151	38.4
3	9	15	27	85	212	144	240	299	1,007	67.1
	10	20	95	160	206	174	264	351	1,251	62.6
	11	25	92	176	226	185	326	390	1,395	55.8
	12	30	6	116	250	162	344	349	1,227	40.9
4	13	15	47	109	189	163	212	296	1,016	67.8
	14	20	60	158	188	177	277	295	1,155	57.8
	15	25	72	153	190	76	395	433	1,319	52.8

The following table gives the total number of eggs produced in all of the pens containing the same number of hens, and the average yield of eggs per bird.

EGG YIELDS WHEN ALL PENS CONTAINING THE SAME NUMBER OF BIRDS ARE COMBINED.

45 *birds, 15 in each pen gave 2,929 eggs. Per bird, 65.1.
80 birds, 20 in each pen gave 4,830 eggs. Per bird, 60.4.
100 birds, 25 in each pen gave 5,136 eggs. Per bird, 51.4.
90 birds, 30 in each pen gave 3,612 eggs. Per bird, 40.1.

The table which follows shows the most profitable number of hens in a flock in these experiments.

*The April hatched birds in Pen 1 not included in this table.

AVERAGE NUMBER AND ESTIMATED NET PROFIT FROM HENS IN FLOCKS OF 15, 20, 25, 30 BIRDS COMPARED.

Number of hens in each pen.	Number of eggs produced by each hen.	Number of eggs produced in each pen.	Value of eggs produced in each pen at 2 cents each.	Value of food used in each pen at average of 50 cents per bird.	Income from each pen less cost of food.
*15	65.1	976	$19.52	$7.50	$12.02
20	60.4	1,208	24.16	10.00	14.16
25	51.4	1,284	25.64	12.50	13.14
30	40.1	1,203	24.06	15.00	9.06

* The April hatched hens in Pen 1 are not included in this table.

From the above table it will be observed that pens containing twenty birds did not give as much profit per bird as did pens of fifteen birds, but the pens containing twenty birds gave a greater total net profit per pen than did those containing any greater or less number of birds. Pens with twenty-five birds gave slightly greater net returns than did the fifteen bird pens. The pens that had thirty birds each gave very much less net returns than did any of the others.

These tests show that when twenty birds were confined on one hundred and sixty feet floor space, they yielded more profit than did fifteen birds when kept in a similar room. This is a matter of considerable consequence, for the cost of buildings, for the proper housing of birds during the cold winters of our climate is the greatest item of expense to which the poultryman is subjected.

HERD RECORDS.

G. M. GOWELL.

In the Station report for 1897, statements were given of the yields of milk, fat and butter from each cow in the herd for the year. As stated there, the purpose was to add to the limited data so far accumulated bearing upon: the ratio of the decrease of the 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.

During 1898 there were twenty-four cows and heifers in the herd. As the animals are valuable for breeding purposes, they were fed such quantities and qualities of foods as seemed best for their welfare. The feeding has been with reference to individual needs for the production of moderate quantities of milk rather than forcing for large quantities.

From January first until June the animals of large capacities received each day about fourteen pounds of hay, composed of timothy, red top and alsike clover, and twenty-five pounds of corn silage, turnips or mangolds, in connection with eight pounds of concentrated food, consisting of equal weights of wheat bran, corn meal, and gluten or cottonseed meal, mixed together.

They were at pasture during June, July, August and part of September. During the remainder of the year they were kept in the barn and yards and fed as during the winter. Every night throughout the summer they were put in the barn and fed green oats, peas, corn or dry hay and silage when the grass in the pastures was not sufficient for their needs. About the same grain ration was given in the summer as in winter. Cows of smaller capacities received less feed, and heifers, even if well developed, were given diminished quantities of grain.

Animals when dry, or nearly so, received bran only as concentrated feed. By comparison with the records of last year it will be noticed tht certain cows yielded less this year than then. This is mostly accounted for by the difficulty in getting them to breed regularly which made them strippers a greater proportion of the year than in 1897. Discussion of these data will not be undertaken until more results are secured and tabulated.

MADALENE.—Holstein and Jersey. Nine years old. Calved April 4, 1898—due to calve March 14, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	....	....	....	....
February	....	....	....	....
March	....	....	....	....
April	870.0	4.0	34.80	40.60
May	936.0	4.2	39.31	45.86
June	852.0	4.3	36.63	42.73
July	792.0	4.8	38.01	44.34
August	666.0	4.2	27.97	32.63
September	578.0	3.8	21.96	25.62
October	382.0	4.0	15.28	17.82
November	310.0	4.0	12.40	14.46
December	....	....	....	....
	5,386.0		226.36	264.06

HUNTOON.—Holstein—full blood—not registered. Ten years old. Calved February 1, 1897, and October 16, 1898.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	616.5	4.4	27.12	31.64
February	642.0	4.0	25.68	29.96
March	586.0	4.5	26.37	30.76
April	528.0	5.3	27.98	32.64
May	527.0	4.8	25.29	29.50
June	510.0	4.4	22.44	26.18
July	486.0	4.7	22.84	26.64
August	266.0	5.2	13.86	16.13
September	....	....	....	....
October	601.0	4.0	24.04	28.04
November	1,050.0	3.7	38.85	44.32
December	897.0	3.6	32.29	37.67
	6,709.5		286.73	333.48

KATRINA.—Holstein Registry. Two years old. Calved February 20, 1899. Out of herd December 1, 1898.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	....	....	....	....
February	108.0	3.4	3.67	4.28
March	751.0	3.5	26.28	30.66
April	689.0	3.3	22.73	26.51
May	646.0	3.4	21.96	25.62
June	630.0	3.7	23.31	27.19
July	642.0	3.5	22.47	26.21
August	517.0	3.3	17.06	19.90
September	506.0	3.4	17.20	20.06
October	481.0	4.6	22.12	25.80
November	420.0	3.8	15.96	18.62
December	....	....	....	....
	6,390.0		192.76	224.85

CHESTER.—Grade Holstein. Six years old. Calved May 6, 1898—due to calve April 21, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	477.6	5.1	24.35	28.40
February	418.0	4.5	18.81	21.94
March	328.0	4.7	15.41	17.97
April	149.0	4.6	6.85	7.99
May	475.0	4.8	22.80	26.60
June	690.0	4.5	21.05	24.55
July	661.0	3.5	23.13	26.98
August	504.0	4.9	24.69	28.80
September	484.0	4.4	21.29	24.83
October	420.0	5.7	23.94	27.93
November	430.0	4.3	18.49	21.57
December	420.0	5.8	24.36	28.37
	5,456.6		245.17	285.93

FATAMIE.—Holstein—not registered. Eight years old. Calved May 27, 1898—due to calve April 19, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	400.6	3.6	14.42	16.82
February	335.0	3.8	12.53	14.61
March	154.0	3.8	5.85	6.82
April	....	....	....	....
May	151.0	3.6	5.43	6.33
June	1,058.0	3.8	40.20	46.90
July	1,130.0	3.0	33.90	39.55
August	837.0	3.2	26.78	31.24
September	992.0	3.0	29.76	34.72
October	752.0	4.0	30.08	35.09
November	730.0	3.3	24.09	28.10
December	651.0	4.5	29.29	34.17
	7,190.6		252.33	294.35

MARIE.—No. 3434 M. S. J. H. Book. Two years old April 4, 1898. Calved March 17, 1898—due to calve March 12, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	....	....	....	....
February	....	....	....	....
March	151.0	4.0	6.04	7.04
April	530.0	4.6	24.38	28.44
May	558.0	4.4	24.53	28.61
June	550.0	4.1	22.55	26.30
July	472.0	4.4	20.76	24.22
August	189.0	4.4	8.31	9.69
September	274.0	4.3	11.78	13.74
October	234.0	5.2	12.16	14.18
November	210.0	4.3	9.03	10.53
December	201.0	5.0	10.05	11.72
	3,369.0		149.59	174.47

PANSY.—Jersey—not registered. Eight years old. Calved April 9, 1898 and due to calve April 1, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	99.0	4.2	4.15	4.86
February	....	....	....	....
March	....	....	....	....
April	503.0	4.2	21.12	24.64
May	754.0	4.4	33.17	38.70
June	720.0	5.0	36.00	42.00
July	732.0	4.6	33.67	39.28
August	571.0	4.5	25.69	29.97
September	576.0	4.5	25.92	30.24
October	482.0	5.8	27.95	32.61
November	435.0	5.8	25.23	29.43
December	356.0	5.7	20.29	23.67
	6,119.0		253.19	295.38

ORLETTA.—No. 1734, M. S. J. H. Book. Eleven years old. Calved November 6, 1897—due to calve April 30, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	626.8	4.6	28.83	33.63
February	590.0	4.4	25.96	29.28
March	531.0	4.7	24.95	29.11
April	488.0	5.3	25.86	30.17
May	514.0	5.3	27.24	31.78
June	495.0	5.3	26.23	30.60
July	544.0	5.4	29.37	34.27
August	644.0	4.3	27.69	32.30
September	468.0	4.8	22.46	26.20
October	423.0	5.3	22.41	26.15
November	390.0	6.3	24.57	28.56
December	390.0	5.5	21.45	25.02
	6,043.8		306.99	357.07

TULIP.—No. 2501 M. S. J. H. Book. Six years old. Calved Jan. 31, 1898 and due to calve April 1, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	....	....	....	....
February	826.0	4.9	40.47	47.21
March	957.0	5.0	47.85	55.82
April	793.0	5.2	41.23	48.10
May	790.0	5.1	40.29	47.00
June	660.0	5.0	33.00	38.50
July	612.0	4.4	26.92	31.40
August	490.0	5.1	24.99	29.15
September	499.0	4.8	23.95	27.94
October	442.0	6.0	26.52	30.94
November	401.0	6.0	24.06	28.07
December	400.0	5.6	22.40	26.13
	6,870.0		351.72	410.34

RUTH.—No. 2369 M. S. J. H. Book. Six years old. Calved December 4, 1897 and October 28, 1898.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter. lbs.
January	840.2	4.2	35.62	41.56
February	811.0	4.1	33.25	38.79
March	722.0	4.3	31.04	36.21
April	675.0	4.2	28.35	33.07
May	620.0	4.4	27.28	31.82
June	585.0	4.9	28.66	33.44
July	504.0	4.8	24.19	28.22
August	352.0	5.2	18.30	21.35
September				
October				
November	930.0	4.4	40.92	47.74
December	938.0	4.3	40.33	47.05
	6,885.2		307.94	359.25

CHERRY 2d.—No. 3030 M. S. J. H. B. Six years old. Calved February 9, 1898, due to calve April 15, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	271.1	6.2	16.80	19.60
February	283.0	5.6	15.84	18.48
March	528.0	5.3	27.98	32.64
April	458.0	5.5	25.19	29.38
May	430.0	5.3	22.79	26.58
June	460.0	5.2	23.92	27.90
July	459.0	4.6	22.11	25.79
August	409.0	5.0	20.45	23.85
September	436.0	4.2	18.31	21.36
October	360.0	6.0	21.60	25.20
November	320.0	5.2	16.64	19.41
December	341.0	5.2	17.73	20.68
	4,755.1		249.36	290.87

LOBLITOP.—No. 1874 M. S. J. H. Book. Eleven years old. Calved October 14, 1897 and December 30, 1899.

1899.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	518.8	4.6	23.86	27.83
February	545.0	4.4	23.98	27.97
March	447.0	4.4	19.66	22.93
April	584.0	4.3	25.11	29.29
May	580.0	4.4	25.52	29.77
June	585.0	5.2	30.42	35.49
July	616.0	4.0	24.64	28.74
August	481.0	4.3	20.68	24.12
September	513.0	4.0	20.52	23.94
October	440.0	5.8	25.52	29.77
November	480.0	5.6	32.48	37.89
December	465.0	5.2	24.18	28.21
	6,254.8		296.57	345.95

BUTTERCUP.—Jersey—full blood—not registered. Six years old. Calved May 26, 1898—due to calve April 15, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	500.2	6.2	31.01	36.17
February	458.0	6.0	27.48	32.06
March	400.0	6.2	24.80	28.93
April	328.0	6.2	20.33	23.71
May	68.0	5.8	3.94	4.59
June	568.0	5.1	29.98	34.97
July	833.0	4.4	36.65	42.75
August	630.0	4.9	30.87	35.99
September	567.0	4.8	27.01	31.51
October	486.0	6.6	32.07	37.41
November	511.0	5.6	28.61	33.37
December	490.0	6.4	31.36	36.58
	5,862.0		324.11	378.04

CHERRY.—No. 3029 M. S. J. H. Book. Nine years old. Calved August 20, 1897—due to calve November 12, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	347.5	5.2	18.07	21.08
February	345.0	5.1	17.59	20.52
March	349.0	5.0	17.45	20.35
April	280.0	5.8	16.24	18.94
May	311.0	5.7	17.62	20.55
June	377.0	5.6	21.11	24.96
July	338.0	5.4	18.25	21.29
August	328.0	5.0	16.40	19.13
September	346.0	4.4	15.22	17.75
October	297.0	6.3	18.71	21.82
November	320.0	5.2	16.64	19.41
December	310.0	5.9	18.29	21.33
	3,948.5		211.59	247.13

ROSE—No. 1802 M. S. J. H. Book. Eleven years old. Calved November 16, 1897 and due to calve March 20, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	505.6	4.6	23.25	27.12
February	495.0	4.6	22.77	26.56
March	476.0	5.0	23.80	27.76
April	591.0	4.9	28.95	33.77
May	486.0	5.1	24.78	28.91
June	505.0	5.0	25.25	29.45
July	567.0	4.4	24.94	29.09
August	486.0	4.9	23.81	27.77
September	441.0	4.2	18.52	21.60
October	370.0	5.7	21.09	24.93
November	380.0	4.9	18.62	21.72
December	387.0	5.5	21.28	25.16
	5,740.6		277.06	323.84

HOPE—No. 2368 M. S. J. H. Book. Seven years old. Calved October 28, 1897, and due to calve March 16, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	568.1	5.0	28.45	33.13
February	503.0	4.6	23.13	26.98
March	466.0	5.4	25.16	29.35
April	425.0	5.7	24.12	28.14
May	291.0	5.6	16.29	18.99
June	475.0	5.3	25.17	29.36
July	472.0	6.7	31.62	36.89
August	360.0	5.1	18.36	21.42
September	396.0	4.4	17.42	20.32
October	283.0	5.5	15.56	18.15
November	242.0	5.2	12.58	14.67
December	170.0	6.2	10.54	12.29
	4,651.1		248.40	289.69

ADLE—Jersey—High grade. Five years old. Calved May 12, 1898, due to calve May 10, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	245.5	6.0	14.79	17.25
February	137.0	5.6	7.67	8.94
March	....	....	....	....
April	....	....	....	....
May	453.0	5.0	22.65	26.42
June	810.0	5.1	41.31	48.19
July	769.0	5.2	40.68	47.46
August	661.0	4.3	28.42	33.15
September	569.0	5.0	28.45	33.19
October	530.0	6.8	36.04	42.04
November	480.0	5.2	24.96	29.12
December	456.0	6.1	27.81	32.44
	5,111.5		272.78	318.20

LOTTIE.—No. 1751, M. S. J. H. Book. Eleven years old. Calved October 31, 1896, and October 14, 1898.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	322.9	6.4	20.66	24.10
February	297.0	6.0	17.82	20.79
March	312.0	6.2	19.34	22.56
April	307.0	6.5	19.95	23.27
May	219.0	6.0	13.14	15.33
June	180.0	6.2	11.16	13.02
July	171.0	5.0	8.55	9.97
August	....	....	....	....
September	....	....	....	....
October	448.0	5.0	22.40	26.32
November	740.0	4.0	29.60	34.53
December	660.0	5.0	33.00	38.50
	3,656.9		195.62	229.39

DUDLEY.—Jersey—High grade. Eight years old. Calved September 8, 1898.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	489.8	4.9	24.00	28.00
February	489.0	5.0	24.45	28.52
March	466.0	5.8	27.12	31.64
April	404.0	4.2	16.96	19.79
May	388.0	4.6	17.84	20.82
June	370.0	4.9	18.13	21.15
July	364.0	5.0	18.20	21.23
August	....	....	....	....
September	440.0	3.2	14.08	16.42
October	601.0	5.5	33.05	38.55
November	570.0	5.4	30.78	35.91
December	615.0	5.2	31.98	37.31
	5,196.8		256.59	299.34

TURNER.—Jersey—High grade. Eight years old. Calved October 21, 1897, due to calve April 9, 1899.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	606.9	4.4	26.70	31.15
February	533.0	3.4	18.12	21.14
March	511.0	4.6	23.50	27.41
April	405.0	3.4	13.77	16.06
May	435.0	4.0	17.40	20.30
June	450.0	4.4	19.80	23.10
July	441.0	3.6	15.87	18.51
August	256.0	4.7	12.03	14.03
September	270.0	3.6	9.72	11.34
October	210.0	3.3	6.93	8.08
November	80.0	3.0	2.40	2.80
December	....	....	....	....
	4,197.9		166.24	193.92

LOWELL.—Native. Ten years old. Calved September 10, 1898.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	545.7	4.6	25.10	29.28
February	533.0	3.1	16.52	19.27
March	510.0	5.0	25 50	29.75
April	476.0	4.8	22.84	26.64
May	423.0	5.0	21.15	24.47
June	390.0	5.2	20.28	22.66
July	365.0	3.5	12.77	14.89
August	....	....	....	....
September	600.0	3.5	21.00	24.05
October	820.0	4.4	36 08	42.09
November	720.0	4.0	28.80	33.60
December	700.0	4.8	33.60	39.20
	6,082.7		263.84	306.90

FERRY.—Native. Eight years old. Calved September 20, 1897.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	477.2	4.4	20.99	24.48
February	486.0	4.2	20.41	23.81
March	498.0	4.0	19.92	23.24
April	456.0	4.6	20.97	24.46
May	404.0	4.5	18.18	21.21
June	385.0	4.7	18.09	21.10
July	427.0	4.3	18.36	21.42
August	387.0	4.4	17.02	19.85
September. (Sold Sept. 1st)	....	....	....	....
October	....	....	....	....
November	....	....	....	....
December	....	....	....	....
	3,520.2		153.94	179.57

LINCOLN.—Native. Seven years old. Calved October, 1898.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	613.3	4.5	27.59	32.18
February	676.0	4.4	30.42	35.49
March	657.0	4.8	31.53	36.78
April	623.0	4.9	30.52	35.60
May	594.0	5.0	29.70	34.65
June	577.0	5.2	29.90	34.88
July	420.0	4.9	20.58	24.01
August	248.0	4.9	12.15	14.17
September	....	....	....	....
October	501.0	4.9	24.54	28.63
November	725.0	4.0	29.00	33.83
December	808.0	4.6	37.16	43.35
	6,441.3		303.09	353.57

TOPSEY.—Native. Two years old in February, 1898. Calved December 1, 1897.

1898.	Milk—lbs.	Per cent fat.	Fat—lbs.	Butter—lbs.
January	607.0	4.6	27.92	32.57
February	603.0	3.8	22.91	26.72
March	654.0	4.4	28.77	33.56
April	523.0	4.0	20.92	24.40
May	476.0	4.3	20.46	23.87
June	530.0	4.5	23.85	27.82
July	478.0	4.2	20.07	23.41
August	382.0	4.3	16.42	19.15
September	239.0	4.5	10.75	12.54
October	....	....	....	....
November	....	....	....	....
December	....	....	....	....
	4,492.0		192.07	228.04

A COMPARISON OF LARGE AND SMALL RADISH SEED.

W. M. MUNSON and L. J. SHEPARD.

In the spring of 1898 one of the students in horticulture, Mr. E. R. Mansfield, in studying the influence of the size of seed upon germination, obtained some very striking results. These results confirm the work of previous years and are in line with those published by Galloway and others,* but the details may be of interest at this time.

First Trial: From a packet of Scarlet Globe Radish seed were chosen one hundred of the smallest seeds, as nearly uniform in size as possible; likewise one hundred uniformly large seed. These were planted side by side in a seed-flat. When the resulting plants were about two to three inches high, forty-four average plants from each lot were transplanted to a bench where they grew, under like conditions, till maturity.

The following table shows concisely the results obtained:

YIELD OF RADISHES FROM LARGE AND SMALL SEEDS COMPARED.

Size of seed.	Number of plants.	Total weight, grams.	Number of first-class roots.	Number of second-class roots.	Per cent first-class roots.	Per cent second-class roots.	Per cent unmarketable.
Large	44	1,300	**35**	7	**79.6**	15.9	4.5
Small..................	44	931	**22**	17	**50.0**	38.6	11.4

The number of first-class roots from the large seed was about thirty per cent greater than from the small, while the weight of the crop exceeded the other by about one-third.

* Year Book, U. S. Dept. of Ag. 1896, pp. 92, and 305.

Second Trial: The difference in favor of the selected large seeds in the first trial was so striking that the work was repeated upon a larger scale the present year. The variety chosen for this purpose was "Non Plus Ultra," an early turnip-shaped sort which we have found specially good for forcing. The seeds were sown in six rows and at the end of two weeks the plants were thinned to eighteen in each row. Owing to the dark weather, many of these plants "damped off" after the thinning, hence a difference in the numbers, considered in the table. The following results were obtained:

Number of seeds planted, 300 each, large and small. Weight of large seed, 4.19 grams. Weight of small seed, 1.78 grams. Time from planting to harvesting, seven weeks. Temperature of house, 45°-60°.

YIELD OF RADISHES FROM LARGE AND SMALL SEEDS COMPARED.

Size.	Total germination.	Number of plants considered.	Number of first-class roots.	Number of second-class roots.	Number of culls.	Per cent of first-class by number.	Per cent of first-class by weight.
Large	196	87	55	22	10	**63.2**	**71.4**
Small	197	98	13	75	10	***13.2**	**15 9**

*The very low percentage of first-class roots is due to immaturity, rather than to other inferiority.

There was practically no difference in the total germination of the two lots, though in both cases the per cent of germination was low. At the time of harvesting there were sixty-three per cent of the roots, from large seed which were strictly first-class, as opposed to thirteen per cent from the small seed.

Third Trial: At the same time that the preceding work was being carried on, another lot of seed, of both sizes, was planted upon a bench which was used for testing the value of sub-watering. As before there was some trouble with damping off after the plants were thinned. The results are detailed below:

Number of seeds of each kind 200. Weight of large seed 2.8 grams. Weight of small seed 1.2 grams. Time from planting to harvesting, seven weeks. Temperature of house, 45°-60°.

YIELD OF RADISHES FROM LARGE AND SMALL SEEDS COMPARED.

Size.	Total germination.	Total number of plants used.	Number of first-class roots.	Number of second-class roots.	Weight of first-class roots —Grams.	Weight of second-class roots —Grams.	Per cent of first-class roots by number.	Per cent of first-class roots (by weight.)
Large	127	62	49	13	714	112	**79.0**	**86.5**
Small	132	65	33	32	336	238	**50.8**	**58.5**

As in the previous instance, the percentage of germination was low (sixty-three per cent), but was about uniform in the two lots. The number of first-class roots from the large seed exceeded that from the small seed by about twenty-eight per cent. In weight about the same difference was obtained.

Conclusions: From the above, it is evident that plants from large seed grow larger and mature earlier, than those from small seed. Inasmuch as the cost of seed is slight as compared with the cost of labor and fuel, and in view of the importance of having the crop ready for market in the shortest possible time, the gardener can well afford to sift the seed before planting and discard all which is small and inferior. For the purpose of sifting, common wire cloth which is used for window screens (1-12 inch mesh) will answer; though a screen with 1-10 inch mesh is better, as many of the small seeds will not readily pass through the window screen.

THE EFFECT OF SUB-WATERING RADISHES.

W. M. Munson and L. J. Shepard.

Much has been said and written upon the subject of "sub-watering" or "sub-irrigation" in greenhouses. The present paper simply details the experience of the writers in growing radishes by the new method and by the ordinary method of surface watering.

The method usually employed, in sub-watering greenhouse benches, is to provide a water-tight bottom and run one or more lines of tile or perforated iron pipe underneath the soil. The method employed in the first trial noted below was suggested by Professor Woods, and consists of a line of 2-inch drain pipe, cemented at the joints and closed at the ends, as seen in the cut. The water for the soil must pass through the porous sides of the tile.

First Trial: A quantity of seeds carefully selected as to size and quality, were planted on the lower bench in the house devoted to lettuce and radishes. When the plants were two weeks old they were thinned to about 1½ inches. After thinning, some of the plants damped off, so that the total number in the two lots is not the same. The percentages, however, are not affected.

The following table shows concisely the results obtained:

YIELD OF RADISHES FROM SUB-WATERED AND SURFACE-WATERED BENCHES COMPARED.

Treatment.	Per cent of germination.	Number of plants used.	Number of first-class roots.	Number of second-class roots.	Number of culls.	Per cent first-class by number.	Per cent first-class by weight.
Sub-watered	63.5	62	49	13	....	**79**	**86.4**
Surface-watered ..	65.3	87	55	22	10	**63**	**71.9**

There was little difference in the per cent of germination in the two lots; but the plants which were sub-watered were superior to the others from the beginning. At the time of harvesting, the number of first-class roots on the sub-watered section exceeded that on the surface watered section by 15%; while the average weight was 14.5% greater. This difference is plainly shown in the accompanying figure.

Second Trial: A second bench in the radish house was divided into two sections, and the advantage of sub-watering was demonstrated on a commercial scale. In this instance, the arrangement for sub-watering was somewhat different than in the previous one. The bottom and sides of the bed were coated with Portland cement. On this was placed about two inches of potsherds and broken brick, and then, after covering the brick with some pieces of burlaps, the soil was put in place. As the soil became dry, water was admitted through a pipe to the stratum of potsherds. A glass indicator served to show the height of the water. Each section of the bench was fourteen feet eight inches long and twenty-eight inches wide. The seed was planted in rows, eight inches apart, between rows of lettuce,—twenty-two rows in each lot.

There was little difference in germination of the two lots, but very many more plants were lost by damping off on the surface-watered section,—a fact that partly accounts for the difference in yield at harvest time.

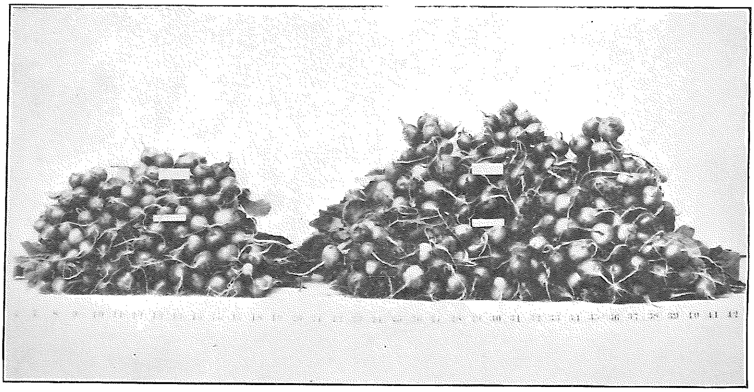
The results at harvest were as follows:

YIELD OF RADISHES FROM SUB-WATERED AND SURFACE-WATERED BENCHES COMPARED.

Treatment.	Number of bunches marketable.	Number of roots marketable.	Number of roots, second class and culls.*	Weight of marketable roots.	Weight of second class and culls.	Per cent marketable.
				Grams.	Grams.	
Sub-watered	28	212	242	3,752	2,590	**46.7**
Surface-watered	13	118	228	1,498	1,750	**34.1**

*The reason for the very high percentage of "second class and culls" is explained in the next table.

GREENHOUSE BENCH ARRANGED FOR SUB-WATERING.



A COMPARISCN OF RADISHES FRCM SURFACE-WATERED AND SUB-WATERED BENCHES.

The sub-watered section yielded twice as many bunches of marketable roots as did the other. The per cent of marketable roots was much higher and the average size greater from the sub-watered section. The difference in the yield of the two sections was more than enough to make the difference between profit and loss in growing the crop.

As will be observed from the above table, more than half of the roots are classified as "2d-class and culls." It should be said in explanation, that about half of the number so classed were simply of small size; many of them were inferior or diseased; others were of good size and quality, but badly disfigured by attacks of millipedes. The following table shows the relative difference in this respect:

QUALITY OF RADISHES FROM SUB-WATERED AND SURFACE-WATERED BENCHES COMPARED.

Treatment.	Marketable.	Second size.	Injured by millipedes.	Diseased.	Inferior.
Sub-watered:					
Number	212	119	77	6	63
Weight (in grams)	3,752	1,232	1,043	70	245
Surface-watered:					
Number	118	117	12	22	83
Weight (in grams)	1,498	1,008	112	224	406

The number of roots attacked by millipedes was much greater on the sub-watered section—a significant fact in connection with the control of this pest. It is also seen that the number of diseased and inferior roots was much larger on the surface-watered section. This, together with the fact previously noted, that there was much more trouble from "damping off" on this section is also significant. The injured roots were mostly of marketable size but deformed, as shown in fig. 8, following p. 229.

THE BLUEBERRY IN MAINE.

W. M. MUNSON.

Authors have not made a very clear discrimination in the vernacular names of the plants variously known as huckleberries and blueberries. In New England, however, the term blueberry is generally applied to various species of Vaccinium,—particularly *Vaccinium Pennsylvanicum,* Lam., *V. vacillans,* Solander, and *V. Canadense,* Kalm, which are not separated when harvested for market. *V. corymbosum,* L., is known as high bush blueberry. Huckleberry, on the other hand, usually refers to species of Gaylussacia in which the seeds are large and prominent—particularly *G. dumosa* T. & G. and *G. resinosa,* T. & G. The terms whortleberry and bilberry, which are given prominence in American references to plants of this class, are never heard among the "common people." The word huckleberry does not occur in English works except those of recent date, and there is no satisfactory explanation of the origin of the word.*

SPECIES FOUND ON THE BARRENS.

In the summer of 1898, in company with Professor Harvey, the writer made an extended visit to the blueberry fields in the vicinity of Cherryfield for the purpose of studying the different types found there. The following brief account of the species found may be of interest in this connection:

---

*The term huckleberry is, according to W. R. Gerard (*Trans. Mass. Hort. Society*, 1890, p. 17), merely a corruption by the American colonists of hurtleberry, which is simply a changed pronunciation of whortleberry, which again is a corruption of myrtleberry (from *Vaccinium myrtillus*). The corruption from hurtleberry is very easy by dropping the first *r*, *i. e.* hutleberry. Others derive the name whortleberry from the Anglo Saxon *heort-berg*, hart-berry, or as we would say deer-berry. The question is discussed by Dr. E. Lewis Sturtevant, in the Transactions of the Massachusetts Horticultural Society, 1890, p. 18.

DWARF OR LOW-BUSH BLUEBERRY.

1. *Vaccinium Pennsylvanicum,* Lam.

(*Vaccinium Pennsylvanicum,* Lam. Dict., 1, 72; Michx, Fl., 1, 223; Hook, Bot. Mag., t. 3434; Gray, Man. 6 ed., 312; Syn. Fl., 2., 1, 22. *Synonym, Vaccinium myrtilloides,* Michx, l. c.; *V. tenellum,* Pursch, Fl. 1, 288, not Ait.; Bigel., Fl. Bost., 150.)

A low branching shrub, 6 inches to 2 feet high, with green, warty but glabrous branches. Leaves oblong, or oblong-lanceolate, green and glabrous on both sides or slightly pubescent on the veins beneath, sharply serrulate, acute at both ends, ¾ to 1½ inches long, ¼ to ½ inch wide; flowers few in the clusters, longer than the very short pedicels; corolla oblong-campanulate, slightly restricted at the throat, white or pinkish; berry blue with more or less bloom, very sweet, ripening in July. Found mostly on dry, rocky or sandy soil.

This species, commonly known as "Early Sweet" or "Low Sweet," furnishes the greater part of the blueberries of our market. The fruit is usually large, sweet, bluish-black and covered with bloom. It varies greatly, however, in size, form and color. The plant is of low habit and, on newly burned areas, is very prolific. (Fig. 1 shows a blueberry carpet of this species.) Old plants bear but few flowers or fruits in a cluster, as already intimated, but plants one or two years from the "burn," usually send up a prominent spike, as shown in fig. 3. The berries can thus be stripped off by the handful and gathered very rapidly.

2. *Vaccinium vacillans,* Solander.

A low, stiff, branching shrub with glabrous, warty, yellowish-green branches; leaves obovate or oval, entire or minutely serrulate, pale, glabrous on both sides or often glaucus beneath; flowers bell-shaped or cylindrical, somewhat constricted at the throat, pink. Dry places, especially in sandy soil. May-June. Fruit ripe, July, August.

This species, often associated with *V. Pennsylvanicum,* is of excellent quality and ripens somewhat later than the other. As with *V. Pennsylvanicum,* the flowers are often racemose on long naked branches. The species was seldom met in the vicinity of Cherryfield, but is abundant in some parts of the State. It is deserving of attempts at cultivation.

LOW BLACK BLUEBERRY.

3. *Vaccinium nigrum*, Britton, (Mem. Torr. Club, 5; 252, 1894). (*Vaccinium Pennsylvanicum* var. *nigrum*, Wood.).

"Similar to *Vaccinium Pennsylvanicum* and often growing with it; 6 to 12 inches high, the twigs glabrous. Leaves oblong, oblanceolate or obovate, acute at apex, narrowed or rounded at the base, finely serrulate, very nearly sessile, ½ to 1 inch long, ¼ to ½ inch wide, glabrous on both sides, green above, pale and glaucus beneath; flowers few in the clusters, longer than their pedicels; corolla globose-ovoid, very little constricted at the throat, white or cream color; berry black, without bloom, about ¼ inch in diameter.—Blooms earlier than *V. Pennsylvanicum* May. Fruit ripens in July." Britton & Brown, Flora of North U. S. II, 579.

This type (fig. 5) is not infrequent in the vicinity of Cherryfield and is classed with the ordinary "Early Sweet." It is usually found in areas varying in extent from a few square feet to several rods. Scattering bushes are also found mingled with *V. Pennsylvanicum.*

VELVET LEAF OR "SOUR TOP."

4. *Vaccinium Canadense,* Richards. (Richards in Frank. Jour. 2, 12 (1893); Hook Fl., 2, 32; and Bot. Mag., t. 3446; Gray, Syn. Fl., 2, 1, 22). A low pubescent, branching shrub, 6 inches to 2 feet high. Leaves oblong, oblong-lanceolate or narrowly elliptic, pubescent, at least beneath, entire, 1 to 1½ inches long, ⅓ to ½ inch wide; flowers few, in clusters which are sometimes numerous on naked branches, appearing with the leaves; pedicels usually shorter than the flowers; corolla oblong-campanulate, greenish white; berry blue, with bloom (rarely white), moist places, May and June. Fruit ripe July and August.

This species, usually more vigorous in habit than the preceding, grows more commonly in rather moist, rocky, not swampy, localities. The firuit (fig. 4) is larger and more acid than the other low forms (hence the popular name "Sour Top"), and matures from one to three weeks later. It is not so popular in the general market as is the first mentioned species, but it is very prolific and its lateness in ripening is a point in its favor.

HIGH-BUSH BLUEBERRY.

5. *Vaccinium corymbosum,* L.

(*Vaccinium corymbosum* L. Sp. Pl. 350, 1753. *V. amœnum,* Ait., Hort., Kew. 2: 12. 1789).

Tall (5-10 feet), with minutely warty, greenish-brown branches; leaves ovate, oval or oblong, short petioled; flowers, appearing with the leaves, equal to or longer than the pedicels; corolla cylindrical or slightly constricted at the throat, white or pinkish; berry blue with a bloom. Exceedingly variable. Swamps and moist woods, often extending to dry hillsides.

This species is very variable, not only in the habit of growth, but in its blooming characters and fruit. Not infrequently individual plants bear large quantities of fruit measuring 3/8 to 5/8 inch in diameter, while a black fruited variety, (*var. atrococcum,* Gray), has small, polished, black fruits, equally as good as the other in flavor. The fact of variability renders this species one of the most promising for cultivation. It flourishes alike in the sunlight and in partial shade; on the dry upland and in the swamp. It is also worthy of note that plants of similar quality, both as to habit and size of fruit, are usually found associated in groups—a fact which indicates that these characteristics are probably transmitted by seed.

THE BLUEBERRY INDUSTRY.

The blueberry has been highly prized as an article of food from the earliest colonial period. Up to the present time, however, practically no attention has been given to the cultivation and systematic improvement of the fruit.

In many of the northern and eastern states there are thousands of acres of land, utterly worthless for agricultural purposes, which after the pine is removed, send up an abundant growth of blueberry bushes, alders, poplars, grey birches, etc., and which, by proper management may, it is believed, be made to yield a handsome profit to their owners.

In the southeastern part of Maine, principally in Washington county, there are about 150,000 acres known as the "blueberry barrens." This land lies chiefly in the townships of Cherryfield, Columbia, Deblois, Beddington, and Numbers 18 and 19. Much of this land was burned over by the Indians before the colonial period and since the timber was removed from the remainder, it too, has been repeatedly burned to keep down the growth of birches, alders, etc. and to facilitate the harvesting of the fruit.

About 40,000 acres of the blueberry barrens belong to Mr. William Freeman of Cherryfield, to whom, and to his son, Mr. George G. Freeman, the writer is under obligation for many courtesies during his visits to the plains. Mr. Freeman's method of handling his blueberry lands may be taken as an example of what may be done in developing the industry in other sections. The plan is somewhat as follows:

The land is divided into several parts, each of which is leased to some responsible party who assumes the whole care of burning over the land, keeping off trespassers, harvesting and marketing the fruit. Mr. Freeman receives, as rental, one-half cent per quart for all the fruit gathered.

The pickers receive one and a half to three cents per quart; those who lease the land and haul the fruit to the canning factory, or to the station for shipment, one-half to one cent per quart. The fruit is all canned or shipped by J. & E. A. Wyman, who keep a record of the amount as it is brought in and pay the royalty to Mr. Freeman, retaining for themselves whatever profit there may be on the canned fruit.

Every year a certain section of each "lease" is burned over. This burning must be done very early in the spring, before the ground becomes dry; otherwise the fire goes too deep, the humus is burned from the ground and most of the bushes are killed. Many hundred acres on what should be the best part of the "barrens" have thus been ruined. The method most commonly used in burning a given area, is for the operator to pass around the section to be burned, dragging after him an ordinary torch or a mill-lamp. He then retraces his steps and follows over the burned area setting new fires in the portions which have escaped, and back-firing if there is danger of spreading unduly over areas which it is desired to leave unburned. A device which was found in use by one party consists of a piece of ½-inch gas-pipe bent at the end at an angle of about 60 degrees. The end opposite the bent portion is closed with a cap or a plug, and in the other end, after filling the pipe with kerosene, is placed a plug of cotton waste or tow. This device is regarded as superior to the lamp or torch as it is more easily handled.

As already indicated, most of the fruit from the barrens is taken to the factories for canning. Early in the season, however, before the factories are opened, a considerable amount is shipped to Portland, Boston and other points for use while fresh. This fruit is usually shipped in quart boxes—shown in fig. 2.

All of this early fruit is picked by hand, and only the ripe fruit is gathered. Later in the season, particularly on "old burns," *i. e.,* on areas which will have to be burned over the next year, the fruit is gathered with a "blueberry rake." This is an implement somewhat similar to the cranberry rake in use on Cape Cod, and may be likened to a dust pan, the bottom of which is composed of stiff parallel wire rods. The fruit may be gathered much more quickly and more cheaply by means of the rake. The bushes are, however, seriously injured by the treatment. In no case should the rake be used in gathering the high bush blueberries.

The canning of blueberries is mainly in the hands of the following companies: J. & E. A. Wyman, Cherryfield; A. L. Stewart, Cherryfield; the Columbia Falls Packing Company, Columbia Falls; J. A. Coffin, Columbia Falls, and Burnham and Morrill, Harrington. At the Wyman cannery, which has a daily capacity of 600 bushels, the average annual output is about 8,300 cases of two dozen cans each; representing 6,250 bushels of fresh fruit. The average price per case for the canned fruit is $1.90. In other words, the value of the annual product of this one factory is more than $10,000. The total canned product of the blueberry barrens in 1898 was about 15,000 cases valued at about $28,500. This was but little more than one-half of the average season's production, which is said to be not far from 30,000 cases of twenty-four cans each.

POSSIBILITIES OF CULTURE.

The distribution of the blueberry is not confined to a few thousand acres in Washington county, but all over the southern and western parts of the State are vast areas which, while bearing a considerable number of bushes and yielding a profitable return to the few people who make a practice of gathering the wild fruit, are not utilized as they might be. The systematic treatment already described, might, with profit, be extended to many parts of Franklin and Oxford counties as well.

There are also large areas, otherwise worthless, in the more hilly sections, even in close proximity to natural growth of blueberry bushes, which might, apparently, be made to yield good returns if in some way a growth of blueberries could be started—either by setting bushes or by scattering seed. With this end in view, arrangements were made in the spring of 1898, with F. J. D. Barnjam of Carrabassett, to procure 1,000 bushes from the neighboring hillsides and plant them in an old pasture where their development may be observed.

In August, 1897, while studying the types found upon the plains near Cherryfield, the writer selected numerous specially promising clumps of bushes of the several species, and later transferred them to the Station garden. These were given thorough culture during the past season, and have made a good growth. In August, 1898, more plants were selected, and in October they were removed to the Station and planted with the others. The two lots cover about one-eighth acre of land.

At the same time the bushes above mentioned were selected, a quantity of the largest and best fruit from the best bushes was gathered. This fruit was macerated and the seed sown with the hope of raising some superior seedlings. These will be grown in nursery rows and later transferred to the field.

In garden culture, but little has ever been done with the blueberry. That very satisfactory results might, however, be obtained, there is little doubt. The fruit in its wild state is far superior to that of many other cultivated plants.

As already noted, the work is still in its infancy at the Station. A few statements from others who have made the attempt in previous years, may, however, be of interest in this connection.

Edmund Hersey, Hingham, Mass.: "I have for many years been trying in a small way to find out what can be accomplished in growing the high bush blueberry. My conclusions are briefly: (1) It does not take kindly to garden cultivation; (2) it is very difficult to propagate from the seed; (3) it is somewhat difficult to graft; but patience and a little of the "know

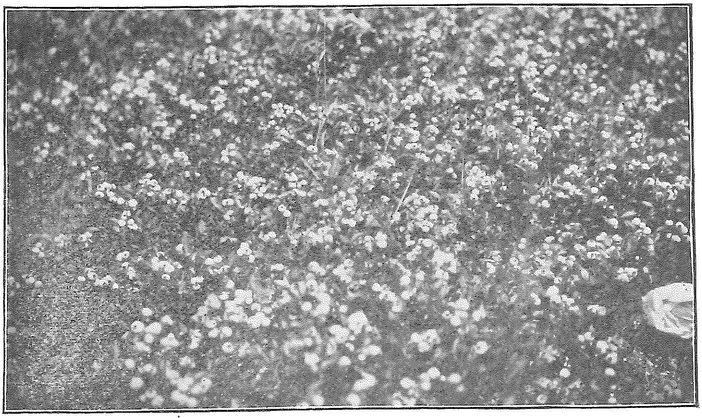


FIG. 1. A BLUEBERRY CARPET.

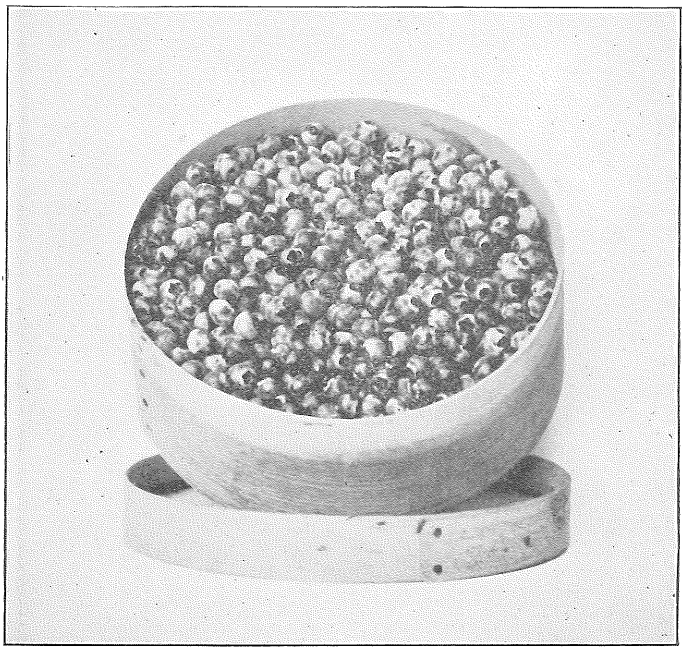


FIG. 2. READY FOR SHIPMENT.

FIG. 3. *Vaccinium Pennsylvanicum*, L.

FIG. 4. *Vaccinium Canadense*, Richards.

FIG. 5. *Vaccinium nigrum*, Britton.

THREE LEADING TYPES OF BLUEBERRIES.

how" will overcome all of these. If grown in the garden (1) they must be on the north side of a board fence, or in the shade of trees, and the ground must be mulched with leaves, or evergreen boughs; (2) let the seed get fully ripe and drop, then sow in a moist shady place; (3) graft small bushes at the surface of the ground and cover most of the cion with moist earth. I have succeeded in all of the above."

W. D. Huntington, Lynn, Mass.: "I have been cultivating blueberries in a small way for home use, and as an interesting experiment, for ten or twelve years, and am fully convinced of the possibilities of the venture commercially. The variety I have succeeded best with is *V. Corymbosum,* carefully selected. My ground is a rocky, poor, upland soil, but the berries take on an improved look and size, and the bushes are loaded down with three or four times as much fruit as in the pastures or swamps, and are 25 or 30 per cent larger. I should set them six feet apart each way and give them clean culture. The plants are greatly benefited by a mulch of strawy manure placed around them in autumn and will not be injured by a large quantity.

"I have some seedlings in bearing, but they are not as good as the parent plant and I have not sufficient room to grow large quantities of them to get one rare plant. Have had many berries ½ to 9-16 inches in diameter and a few ⅝. I would not think a plant that did not have a few berries ½ inch in diameter, worth cultivating. Some of my plants have borne 12 quart boxes of berries in a season. These sold to our near neighbors at 20 cents per box and they always ask for more."

Benj. G. Smith, Cambridge, Mass.: "In an amateur way I have experimented with highbush blueberries for about twenty years. I secured some of the largest and finest high-bush blueberries I have ever seen and planted the seeds, a few of which vegetated the first year and more the second. I gave them personal attention and in three or four years they fruited and in a year or two more abundantly."

Mr. Smith found, as might be expected, that the seedlings were quite variable, and few of them were equal in size to the fruits from which the seed was taken. This variable character is, however, one of the hopeful indications for the future of this fruit.

SUMMARY.

1. In New England the term "Blueberry" is applied indiscriminately to various species of Vaccinium, particularly to *V. Pennsylvanicum,* Lam., *V. vacillans,* Solander, and *V. Canadense,* Kalm. *V. Corymbosum* L., is known as the high bush blueberry.

2. The species most commonly found are, in the order of their commercial importance, *Vaccinium Pennsylvanicum,* Lam., *V. Canadense,* Kalm., *V. corymbosum,* L., *V. nigrum,* Britton, and *V. vacillans,* Solander.

3. The "Blueberry Barrens" of Maine are mainly in Washington county and are about 150,000 acres in extent. There are, however, many thousand acres in other parts of the State that are, or might be made, profitable blueberry lands.

4. Blueberry lands that are treated systematically are usually burned over every third year for the purpose of renewing the bushes and of checking the growth of the alders, birches, etc. Lands bearing the high bush blueberry are seldom burned over.

5. The Station is now making an effort to introduce several species into cultivation. This is done by transferring some of the most productive and largest fruited plants to the garden, and by growing seedlings from selected fruit.

6. The few attempts that have been made at garden culture of the blueberry, indicate that, with care, satisfactory results may be obtained.

EXPERIMENTS UPON THE DIGESTIBILITY OF BREAD WITH MEN.

Chas. D. Woods and L. H. Merrill.

In coöperation with the Nutrition Division of the United States Department of Agriculture, this Station is making investigations upon the nutritive value of wheat. While much study has been given to this interesting field, very few results have been obtained which are applicable to the conditions common in this country. The European investigations have been made with flours different from those in common use in America and the breads have been made by methods unknown to bakers in this land. The studies here reported are only a part of an investigation undertaken with the hope of accumulating data which shall serve to answer the numerous questions arising as to the effect of milling upon the nutritive value of the resulting flours. The full account of these investigations will be given at a later time in publications of the U. S. Department of Agriculture. In the following pages there are given the results of the experiments on the digestibility of different kinds of wheat flours.

Analyses of Foods and Feces.

The bread reserved for analysis was sliced and dried at a temperature of about 60° C. The feces were dried on the tins upon which they were deposited at 60° C. After removal from the drying closets, the samples were allowed to stand for two days exposed to the air of the sampling room. They were then broken up in a mortar, ground in a mill so as to pass through a sieve with round holes one-half millimeter in diameter, and bottled for analysis.

Methods of Analyses.—These were the official methods of the Association of Official Agricultural Chemists. In the ash determinations of the flour and bread, it was found necessary to exhaust the charred mass with hot water before the incineration could be completed. The ether extraction of the feces was accomplished with considerable difficulty, the results not being regarded as wholly satisfactory.

Heats of Combustion.—The heats of combustion of the food, feces and urine were determined by burning in the bomb calorimeter. The milk and urine were prepared for burning in the following manner: A weighed filter block, previously dried for two days over sulphuric acid, was placed in a platinum capsule and saturated with the milk or urine. A second weighing gave the amount of the fluid added. The block was then placed in a drying oven and dried at a temperature not exceeding 70° C. It was again saturated and dried. The burning was accomplished in the usual manner, the fuel value of the filter block itself, previously determined by burning similar blocks, being deducted from the result.

Description of Breads.—Nos. 6,001-6,006. White bread made from Pillsbury's Best Flour and raised with yeast from the following recipe: Flour 900 grams, salt 12 grams, sugar 18 grams, lard 23 grams.

No. 6,007. Bread from bakery, made from Washburn's best flour, with yeast.

Nos. 6,034-6,037. Graham bread made from ground No. 1 winter wheat and raised with baking powder, as follows: Flour 1,462 grams, sugar 90 grams, salt 50 grams, baking powder 32 grams.

Nos. 6,047-6,049. Entire wheat bread made from Franklin Mills entire wheat flour, and raised with baking powder, the same as Nos. 6,034-6,037.

Nos. 6,064, 6,065, 6,077, 6,078, 6,120. White bread made from Pillsbury's Best Flour. It was raised with yeast and was of excellent quality.

Nos. 6,086 and 6,087. Entire wheat bread made from Franklin Mills entire wheat flour, with yeast. No white flour was used.

Nos. 6,097 and 6,098. Graham bread made with yeast, without addition of white flour, from a locally ground white winter wheat graham flour.

The results of the analysis follow:

PERCENTAGE COMPOSITION AND HEATS OF COMBUSTION PER GRAM OF FOOD MATERIALS, CALCULATED TO WATER CONTENT AT TIMES THEY WERE USED IN THE DIGESTION EXPERIMENTS HERE REPORTED.

Laboratory Number.	Number Experiment.	Material.	Water.	Nitrogen.	Protein.	Fat.	Carbo-hydrates.	Ash.	Heats of combustion. Determined.
			%	%	%	%	%	%	Cal.
6001..	1	White bread	36.06	1.40	8.78	1.73	52.73	.70	2,841
6002..	2	White bread	34.48	1.39	8.68	1.68	54.42	.74	2,938
6003..	3	White bread	34.68	1.39	8.68	1.91	53.42	1.30	2,926
6004..	4	White bread	34.10	1.40	8.73	1.74	54.04	1.39	2,938
6005..	5	White bread	34.07	1.36	8.51	2.98	52.46	1.98	2,943
6006..	6	White bread	33.35	1.37	8.59	2.23	53.90	1.93	2,960
6007..	7-8	White bread	38.51	1.52	9.50	.81	50.42	.76	2,698
6034..	9	Graham bread	28.17	1.62	10.11	1.28	57.42	3.02	3,032
6035..	10	Graham bread	41.92	1.32	8.24	1.05	46.85	1.94	2,476
6036..	11	Graham bread	51.81	1.08	6.76	.90	38.61	1.92	2,049
6037..	12	Graham bread	42.39	1.26	7.86	1.16	46.55	2.04	2,456
6047..	13	Entire wheat bread	42.22	1.35	8.45	.42	47.07	1.84	2,467
6048..	14	Entire wheat bread	40.11	1.40	8.77	.42	48.79	1.91	2,560
6049..	15	Entire wheat bread	40.39	1.39	8.67	.43	48.62	1.89	2,558
6064..	16	White bread	38.04	1.45	9.07	1.95	49.65	1.29	2,818
6065..	17	White bread	37.43	1.47	9.19	1.87	50.22	1.29	2,840
6077..	18	White bread	37.35	1.44	8.97	2.39	49.93	1.35	2,845
6078..	19	White bread	37.61	1.43	8.96	2.29	49.65	1.49	2,829
6086..	20	Entire wheat bread	38.34	1.51	9.43	2.62	48.21	1.40	2,859
6087..	21	Entire wheat bread	38.83	1.49	9.29	2.68	47.83	1.37	2,829
6097..	22	Graham bread	42.09	1.14	7.15	2.97	46.21	1.58	2,639
6098..	23	Graham bread	41.90	1.19	7.42	2.75	46.46	1.47	2,648
6120..	24	White bread	38.14	1.45	9.04	1.34	50.33	1.15	2,809
6008..	5	Milk	86.87	.49	3.06	3.70	5.60	.77	792
6009..	6	Milk	86.87	.55	3.44	4.00	4.93	.76	799
6010..	7	Milk	86.87	.53	3.31	4.00	5.02	.80	780
6011..	8	Milk	86.52	.53	3.31	4.25	5.16	.76	807
6032..	9-12	Milk	86.45	.55	3.44	4.00	5.38	.73	823
6033..	9-12	Milk	86.07	.53	3.31	3.95	5.93	.74	819
6046..	13-15	Milk	86.39	.55	3.44	4.15	5.30	.72	820

PERCENTAGE COMPOSITION AND HEATS OF COMBUSTION—CONCLUDED.

Laboratory Number.	Number Experiment.	Material.	Water.	Nitrogen.	Protein.	Fat.	Carbohydrates.	Ash.	Heats of combustion. Determined.
			%	%	%	%	%	%	Cal.
6057..	13-15	Milk	86.43	.55	3.44	4.00	5.34	.79	812
6066..	16-17	Milk	87.20	.56	3.50	4.20	4.41	.69	728
6068..	16-17	Milk	86.81	.59	3.69	4.20	4.60	.70	799
6071..	16-17	Milk	86.72	.56	3.50	4.20	4.88	.70	752
6079..	18-19	Milk	86.38	.53	3.31	4.25	5.56	.50	797
6080..	18-19	Milk	86.84	.57	3.56	3.98	5.08	.54	774
6088..	20-21	Milk	85.51	.59	3.69	5.00	5.15	.65	902
6089..	20-21	Milk	86.02	.57	3.56	5.00	4.84	.58	857
6099..	22-23	Milk	86.07	.58	3.63	4.60	4.95	.75	888
6100..	22-23	Milk	86.88	.54	3.38	4.60	4.52	.62	814
6121..	24	Milk	85.55	.58	3.63	5.40	4.67	.75	898
6067..	16-17	Butter	9.93	.21	1.31	85.00	......	3.76	......
6081..	18-19	Butter	11.44	.22	1.38	82.45	......	4.73	.....
6090..	20-21	Butter	13.04	.13	.81	80.19	......	5.96	......
6107..	22-23	Butter	13.26	.18	1.13	79.13	......	6.48	.....
6122..	24	Butter	13.20	.20	1.25	81.48	......	4.07	......

PERCENTAGE COMPOSITION AND HEATS OF COMBUSTION PER GRAM OF DRY MATTER OF FOOD MATERIALS AND FECES IN THE DIGESTION EXPERIMENTS HERE REPORTED.

Laboratory number.	Number experiment.	Material.	Nitrogen.	Protein.	Fat.	Carbohydrates.	Ash.	Heats of combustion. Determined.
			%	%	%	%	%	Cal.
6001..	1	White bread	2.20	13.73	2.70	82.48	1 09	4,444
6002..	2	White bread	2.12	13.25	2.57	83.05	1.13	4,484
6003 .	3	White bread	2.13	13.29	2.92	81.80	1.99	4,480
6004..	4	White bread	2.12	13.24	2.64	82.01	2.11	4,457
6005..	5	White bread	2.07	12.91	4.51	79.57	3.01	4,463
6006..	6	White bread	2.06	12.89	3.34	80.88	2.89	4,441
6007..	7–8	White bread	2.47	15.46	1.31	82.00	1.23	4,389
6034..	9	Graham bread	2.25	14.07	1.79	79.94	4.20	4,221
6035..	10	Graham bread	2.27	14.20	1.81	80.66	3.33	4,263
6036..	11	Graham bread	2.24	14.03	1.85	80.14	3.98	4,253
6037..	12	Graham bread	2.18	13.64	2.01	80.80	3.55	4,264
6047..	13	Entire wheat bread	2.34	14.61	.73	81.47	3.19	4,281
6048..	14	Entire wheat bread	2.34	14.61	.73	81.47	3.19	4,275
6049..	15	Entire wheat bread	2.34	14.61	.73	81.47	3.19	4,266
6064..	16	White bread	2.34	14.64	3.15	80.13	2.08	4,548
6065..	17	White bread	2.35	14.68	2.99	80.26	2.07	4,538
6077..	18	White bread	2.29	14.32	3.82	79.70	2.16	4,541
6078..	19	White bread	2.30	14.36	3.67	79.58	2.39	4,533
6086..	20	Entire wheat bread	2.45	15.30	4.24	78.17	2.28	4,636
6087..	21	Entire wheat bread	2.43	15.19	4.38	78.20	2.24	4,625
6097..	22	Graham bread	1.98	12.35	5.14	79.77	2.74	4,662
6098..	23	Graham bread	2.04	12.77	4.73	79.96	2.54	4,557
6120..	24	White bread	2.34	14.61	2.17	81.36	1.86	4,816
6020..	1	Feces	5.35	33.47	12.86	37.26	16.41	6,074
6021..	2	Feces	8.57	53.67	17.70	18.29	10.34	5,950
6022..	3	Feces	5.96	37.22	14.25	28.32	20.21	5,361
6023..	4	Feces	8.83	55.16	14.69	18 37	11.78	5,900
6024..	5	Feces	6.35	39.69	20.04	25.89	14.38	5,800
6025..	6	Feces	4.82	30.14	17.38	29.97	22.51	5,611
6026..	7	Feces	5.27	32.91	12.51	32.86	21.72	5,563

PERCENTAGE COMPOSITION AND HEATS OF COMBUSTION—CONCLUDED.

Laboratory number.	Number experiment.	Material.	Nitrogen.	Protein.	Fat.	Carbohydrates.	Ash.	Heats of combustion. Determined.
			%	%	%	%	%	Cal.
6027..	8	Feces	5.27	32.93	23.62	22.46	20.99	5,424
6042..	9	Feces	4.11	25.69	7.74	49.15	17.42	5,220
6043..	10	Feces	4.24	26.52	9.95	44.53	19.00	4,613
6044..	11	Feces	3.74	23.40	7.95	48.19	20.46	4,890
6045..	12	Feces	4.07	25.44	8.54	44.56	21.46	4,654
6051..	13	Feces	5.10	31.88	12.86	35.35	19.91	5,400
6052..	14	Feces	4.10	25.64	8.52	39.42	26.42	4,340
6053..	15	Feces	4.47	27.91	10.25	38.18	23.66	4,736
6069..	16	Feces	4.40	27.52	16.87	31.70	23.91	5,753
6070..	17	Feces	4.87	30.45	27.42	25.40	16.73	6,019
6082..	18	Feces	3.94	24.65	12.95	36.17	26.23	5,604
6083..	19	Feces	4.11	25.70	11.91	39.55	22.84	6,082
6091..	20	Feces	4.43	27.68	15.52	38.43	18.37	5,667
6092..	21	Feces	4.71	29.46	14.81	40.71	15.02	5,866
6103..	22	Feces	3.40	21.23	9.14	52.29	17.34	5,035
6104..	23	Feces	3.78	23.63	8.41	52.62	15.34	5,065
6124..	24	Feces	3.01	18.81	12.47	43.71	25.01	5,844

DIGESTION EXPERIMENTS WITH BREAD.

The experiments here reported were made in 1896 and 1897. The subjects were young men with vigorous appetites and apparently normal digestion.

The food eaten.—The experiments began in each case with a supper of milk, with which each subject took six gelatine capsules filled with lamp-black. For the two days following the food consisted chiefly of the bread under investigation. Butter was eaten with the bread, and the men were allowed milk and coffee with sugar. On the morning following the second day of the bread diet, the men again took lamp-black in capsules and a breakfast of milk, no solid food being taken until noon.

No attempt was made to limit the amount of food taken. The food of the men was kept separate. Whenever a new loaf was needed, it was weighed and quartered, one quarter serving for analysis. At the close of the experiment the food remaining was weighed and the amount subtracted from that furnished.

Feces.—The feces were deposited in a line in large tins provided for the purpose. That coming from the milk taken at the beginning and end of the experiment, being deeply colored by the lamp-black, was for the most part readily separated from the feces coming from the bread diet.

Urine.—As no marker can be used for urine, it was collected for the two days of the bread diet, it being understood, of course, that this does not correspond to the food taken during that period.

The tables which follow give the details of the digestion experiments, the table on page 193 containing a summary of the results.

There is nothing in the table which requires explanation unless it is the method of calculating the "per cent of energy utilized." This is the same as used at the Storrs (Conn.) Experiment Station and is described in the report of that Station for 1894,* from which the following is quoted.

"When protein is burned in the calorimeter it is completely oxidized, the carbon being burned to carbon dioxide and the

* Fuel values of digested nutrients in experiments with sheep, W. O. Atwatar and Chas. D. Woods.

hydrogen to water. The nitrogen is left uncombined. When protein is consumed in the body the oxidation is not complete. The nitrogen is left in urea, uric acid and other allied compounds, all of which contain carbon and hydrogen, together with some oxygen. In estimating the actual fuel value of the digested ingredients which an animal can utilize, allowance must be made for these unconsumed residual products, which are excreted by the kidneys. Urea is usually the most abundant of these excretory products, and it is here assumed that all of the nitrogen of the digested protein is excreted as urea. The fuel value of urea as determined by Stohmann and Berthelot is 2.53 Calories per gram.

"The method used in the calculations here has been as follows: Urea (CON_2H_4) contains 46.67 per cent of nitrogen. Hence nitrogen multiplied by the factor 2.143 equals urea. The protein as here estimated is the nitrogen multiplied by 6.25. Hence dividing the protein by 6.25 and multiplying the quotient by 2.143 gives the equivalent urea. Assuming that all of the digested protein is excreted as urea, the number of grams of urea multiplied by 2.53 the fuel value of one gram of urea, gives the total fuel value of the urea equivalent to the digested protein. But (protein divided by 6.25) $\times$2.143$\times$2.53=protein$\times$.87 This last expression, protein $\times$.87, therefore, represents the fuel value of the urea equivalent to the digestible protein."

Combustions of urine have shown that the fuel value of the organic matter of urine is higher than that of urea. When sufficient data have accumulated to warrant its adoption, another factor will need to be employed; until then it is probably better to use that for urea. As the total fuel value of the urea and other organic materials found in urine is small in comparison with the fuel value of the food ingested, the error in the assumption here involved is not a large one.

DIGESTION EXPERIMENT No. 1.

Kind of food, white bread.
Subject; H. B. S.
Weight (without clothes); at beginning 145 lbs., at end 147 lbs.
Beef tea, coffee, tea and water were drunk with the bread ad libitum.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6001	White bread	1,633	1,032.7	143.4	28.3	861.0	11.4	4,639
	Total	1,633	1,032.7	143.4	28.3	861.0	11.4	4,639
6020	Feces..................	....	32.6	13.1	5.0	14.5	6.4	178
	Amount digested	....	1,000.1	130.3	23.3	846.5	5.0	4,461
	Per cent digested	....	96.84	90.87	82.33	98.31	43.86	
	Estimated heat of combustion of urine	....	....	....	....	....	....	113
	Energy of food oxidized in the body ..	....	....	....	....	....	....	4,348
	Per cent energy utilized........	....	....	....	....	....	....	93.7

DIGESTION EXPERIMENT No. 2.

Kind of food; white bread.
Subject; H. B. S. (same as No. 1).
Beef tea, coffee, tea, and water were drunk ad libitum.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6002	White bread..........	956	619.3	83.0	16.0	520.3	7.0	2,809
	Total	956	619.3	83.0	16.0	520.3	7.0	2,809
6021	Feces..................	....	27.8	16.6	5.5	5.7	3.2	165
	Amount digested	... .	591.5	66.4	10.5	514.6	3.8	2,644
	Per cent digested	....	95.51	80.00	65.62	98.90	54.29	
	Estimated heat of combustion of urine	....	....	....	....	....	....	58
	Energy of food oxidized in the body ..	....	....	....	....	... ..	....	2,586
	Per cent energy utilized	....	....	....	....	....	....	92.4

DIGESTION EXPERIMENT No. 3.

Kind of food; white bread.
Subject; L. H. H.
Beef tea, coffee, tea and water were drunk ad libitum.

Laboratory number of sample.		Weight food material—Grams.	Total organic material—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6003	White bread	1,080.0	691.3	93.8	20.6	576.9	14.1	3,160
	Total	1,080.0	691.3	93.8	20.6	576.9	14.1	3,160
6022	Feces	....	37.5	17.5	6.7	13.3	9.5	213
	Amount digested	....	653.8	76.3	13.9	563.6	4.6	2,947
	Per cent digested	....	94.58	81.68	67.47	97.69	32.62	....
	Estimated heat of combustion of urine	....	....	....	....	....	....	66
	Energy of food oxidized in the body ..	....	....	....	....	....	....	2,881
	Per cent energy utilized	....	....	....	....	....	....	91.2

DIGESTION EXPERIMENT No. 4.

Kind of food; white bread.
Subject; I. W. F.
Beef tea, coffee, tea and water were drunk ad libitum.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6004	White bread..........	1,069	689.5	93.3	18.6	577.6	14.9	3,141
	Total	1,069	689.5	93.3	18.6	577.6	14.9	3,141
6023	Feces	......	36.8	23.0	6.1	7.7	4.9	205
	Amount digested.....	....	652.7	70.3	12.5	569.9	10.0	2,936
	Per cent digested	....	94.66	75.35	67.20	98.67	67.11	
	Estimated heat of combustion of urine	....	....	....	....	....	....	61
	Energy of food oxidized in the body...	....	....	....	....	....	....	2,875
	Per cent energy utilized.............	....	....	....	....	....	......	91.5

DIGESTION EXPERIMENT No. 5.

Kind of food; white bread and milk.
Subject; L. H. H.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6005	White bread	1,116.0	713.8	95.0	33.3	585.4	22.1	3,284
6008	Milk	803.3	99.3	24.6	29.7	45.0	6.2	636
6009	Milk	927.0	114.7	31.9	37.1	45.7	7.0	741
	Total	....	927.8	151.5	100.1	676.1	35.3	4,661
6024	Feces	....	44.2	20.5	10.4	13.4	7.5	113
	Amount digested......	....	883.6	131.0	89.7	662.7	27.8	4,548
	Per cent digested ...	....	95.24	86.47	89.61	98.02	78.75	
	Estimated heat of combustion of urine	....	....	....	....	....	....	114
	Energy of food oxidized in the body ..	....	....	....	....	....	....	4,434
	Per cent energy utilized	....	....	....	....	....	....	95.1

DIGESTION EXPERIMENT No. 6.

Kind of food; white bread and milk.
Subject; H. B. S.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6006	White bread	977.0	632.3	83.9	21.8	526.6	18.9	2,892
6008	Milk	1,390.5	171.8	42.5	51.4	77.9	10.7	1,101
6009	Milk	1,339.0	165.7	46.1	53.6	66.0	10.2	1,070
	Total	.. ....	969.8	172.5	126.8	670.5	39.8	5,063
6025	Feces	....	40.7	15.9	9.1	15.7	11.9	236
	Amount digested	..... .	929.1	156.6	117.7	654.8	27.9	4827
	Per cent digested	... .	95.80	90.78	92.82	97.66	70.10	
	Estimated heat of combustion of urine	....	....	....	....	.. ....	....	136
	Energy of food oxidized in the body ..	... .	....	....	....	....	... .	4,691
	Per cent energy utilized	....	....	....	....	....	....	92.6

DIGESTION EXPERIMENT No. 7.

Kind of food; white bread and milk.
Subject; C. W. S.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6007	White bread	2,042	1,240.4	193.9	16.5	1,030.0	15.5	5,509
6010	Milk	1,548	190.8	51.2	61.9	77.7	12.4	1,197
6011	Milk	2,064	262.5	68.3	87.7	106.5	15.7	1,666
	Total	....	1,693.7	313.4	166.1	1,214.2	43.6	8,372
6026	Feces	....	60.2	25.3	9.6	25.3	16.7	342
	Amount digested	....	1,633.5	288.1	156.5	1,188.9	26.9	8,030
	Per cent digested	....	96.45	91.93	94.22	97.91	61.69	....
	Estimated heat of combustion of urine	....	....	....	....	....	....	251
	Energy of food oxidized in the body ..	....	....	....	....	....	....	7,779
	Per cent energy utilized	....	....	....	....	....	....	92.9

DIGESTION EXPERIMENT No. 8.

Kind of food; white bread and milk.
Subject; P. F. F.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6007	White bread	1,197.0	726.9	113.7	9.7	603.5	9.1	3,230
6010	Milk	1,826.6	225.3	60.5	73.1	91.7	14.6	1,428
6011	Milk	1,702.8	216.6	56.4	72.4	87.8	12.9	1,374
	Total	....	1,168.8	230.6	155.2	783.0	36.6	6,032
6027	Feces	....	60.1	25.0	18.0	17.1	16.0	375
	Amount digested	.... ..	1,108.7	205.6	137.2	756.9	20.6	5,657
	Per cent digested	....	94.86	89.16	88.40	97.82	56.12	
	Estimated heat of combustion of urine	....	....	... ..	....	....	....	179
	Energy of food oxidized in the body ..	....	....	....	....	....	....	5,478
	Per cent energy utilized	....	....	....	....	.. ..	....	90.8

DIGESTION EXPERIMENT No. 9.

Kind of food; graham bread and milk.
Subject; C. W. S.

Laboratory Number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6034	Graham bread	1,593.0	1,096.3	161.0	20.5	914.8	48.0	4,830
6032	Milk	2,218.8	284.5	76.3	88.8	119.4	16.2	1,826
6033	Milk	2,579.0	340.1	85.4	101.8	152.9	19.1	2,112
	Total..............	....	1,720.9	322.7	211.1	1,187.1	83.3	8,768
6042	Feces	....	126.6	39.4	11.9	75.3	26.7	637
	Amount digested.....	......	1,594.3	283.3	199.2	1,111.8	56.6	8,131
	Per cent digested	....	92.64	87.79	94.36	93.66	67.95	
	Estimated heat of combustion of urine	....	....	....	....	....	....	247
	Energy of food oxidized in the body...	....	....	....	....	....	....	7,884
	Per cent energy utilized	....	....	....	....	....	....	89.9

DIGESTION EXPERIMENT No. 10.

Kind of food; graham bread and milk.
Subject; F. H. M.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6035	Graham bread........	1,317.0	739.3	108.5	13.8	617.0	25.6	3,262
6032	Milk...................	1,341.6	172.0	46.1	53.7	72.2	9.8	1,104
6033	Milk...................	2,717.0	358.3	89.9	107.3	161.1	20.1	2,225
	Total	....	1,269.6	244.5	174.8	850.3	55.5	6,591
6043	Feces	....	84.7	27.7	10.4	46.6	19.9	440
	Amount digested.....	....	1,184.9	216.8	164.4	803.7	35.6	6,151
	Per cent digested	....	93.33	88.67	94.05	94.52	64.13	
	Estimated heat of combustion of urine	....	....	....	....	....	....	189
	Energy of food oxidized in the body...	....	....	....	....	....	....	5,962
	Per cent energy utilized..........	....	....	....	....	....	....	90.6

DIGESTION EXPERIMENT No. 11.

Kind of food; graham bread and milk.
Subject; C. D. H.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6036	Graham bread........	1,361.0	629.7	92.0	12.3	525.4	26.2	2,788
6032	Milk..................	2,734.0	350.5	94.0	109.4	147.1	20.0	2,250
6033	Milk..................	2,889.6	381.1	95.6	114.1	171.4	21.4	2,367
	Total	....	1,361.3	281.6	235.8	843.9	67.6	7,405
6044	Feces	....	77.6	22.8	7.8	47.0	19.9	391
	Amount digested	....	1,283.7	258.8	228.0	796.9	47.7	7,014
	Per cent digested.....	....	94.29	91.90	96.69	94.43	70.56	
	Estimated heat of combustion of urine	....	....	....	....	....	......	225
	Energy of food oxidized in the body...	....	....	....	....	....	....	6,789
	Per cent energy utilized.............	....	....	....	....	....	....	91.7

DIGESTION EXPERIMENT No. 12.

Kind of food; graham bread and milk.
Subject; P. F. F.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6037	Graham bread........	1,326.0	736.9	104.2	15.4	617.3	27.1	3,257
6032	Milk..................	2,165.2	277.6	74.5	86.6	116.5	15.8	1,782
6033	Milk..................	2,683.0	353.8	88.8	105.9	159.1	19.9	2,199
	Total	....	1,368.3	267.5	207.9	892.9	62.8	7,238
6045	Feces	....	105.6	34.2	11.5	59.9	28.9	541
	Amount digested	....	1,262.7	233.3	196.4	833.0	33.9	6,697
	Per cent digested	....	92.28	87.22	94.47	93.29	53.98	
	Estimated heat of combustion of urine	......	....	....	....	....	....	203
	Energy of food oxidized in the body ..	....	....	....	....	....	....	6,494
	Per cent energy utilized.	....	....	....	....	....	....	89.9

DIGESTION EXPERIMENT No. 13.

Kind of food; entire wheat bread.
Subject; C. W. S.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6047	Entire wheat bread..	1,579	883.3	133.4	6.7	743.2	29.1	3,895
6046	Milk	2,064	266.0	71.0	85.6	109.4	14.9	1,692
6057	Milk	2,274	290.6	78.2	91.0	121.4	18.0	1,847
	Total	....	1,439.9	282.6	183.3	974.0	62.0	7,434
6051	Feces	......	77.4	30.8	12.4	34.2	19.2	424
	Amount digested	....	1,362.5	251.8	170.9	939.8	42.8	7,010
	Per cent digested....	....	94.62	89.10	93.23	96.49	69.03	
	Estimated heat of combustion of urine	....	....	....	....	....	....	219
	Energy of food oxidized in the body ..	....	....	....	....	....	....	6,791
	Per cent energy utilized................	....	....	....	....	....	....	91.4

DIGESTION EXPERIMENT No. 14.

Kind of food; entire wheat bread.
Subject; P. F. F.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6048	Entire wheat bread..	1,949.0	1,130.0	171.0	8.2	950.8	37.3	4,989
6046	Milk	2,992.8	385.8	103.0	124.2	158.6	21.6	2,454
6057	Milk	2,585.0	330.3	88.9	103.4	138.0	20.4	2,100
	Total	....	1,846.1	362.9	235.8	1247.4	79.3	9,543
6052	Feces	....	55.8	23.3	6.5	26.0	20.0	295
	Amount digested	....	1,790.3	339.6	229.3	1221.4	59.3	9,248
	Per cent digested	....	96.98	93.58	97.24	97.91	74.78	
	Estimated heat of combustion of urine	......	....	....	....	....	....	296
	Energy of food oxidized in the body ..	....	....	....	....	....	....	8,952
	Per cent energy utilized................	....	....	....	....	....	....	93.8

DIGESTION EXPERIMENT No. 15.

Kind of food; entire wheat bread.
Subject; A. B. O.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6049	Entire wheat bread..	1,600.0	923.8	139.0	6.9	777.9	30.2	4,093
6046	Milk	2,373.6	305.9	81.6	98.5	125.8	17.1	1,946
6057	Milk	2,585.0	330.3	88.9	103.4	138.0	20.4	2,100
	Total	....	1,560.0	309.5	208.8	1,041.7	67.7	8,139
6053	Feces..................	....	60.0	22.5	8.1	29.4	18.6	320
	Amount digested ...	....	1,500.0	287.0	200.7	1,012.3	49.1	7,819
	Per cent digested	....	96.15	92.73	96.12	97.18	72.53	
	Estimated heat of combustion of urine	....	....	....	....	....	....	250
	Energy of food oxidized in the body ..	....	....	....	....	....	....	7,569
	Per cent energy utilized................	....	....	....	....	....	....	93..0

DIGESTION EXPERIMENT No. 16.

Kind of food; white bread with milk, butter and sugar.
Subject; A. J. P.
Weight (without clothes); at beginning 136.9 lbs., at end 136.3 lbs.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6064	White bread	1,328.6	806.1	120.5	25.9	659.7	17.1	4,744
6066	Milk	800.0	96.9	28.0	33.6	35.3	5.5	582
6068	Milk	1,800.0	224.8	66.4	75.6	82.8	12.6	1,438
6071	Milk	1,200.0	151.0	42.0	50.4	58.6	8.4	902
6067	Butter	185.0	159.7	2.4	157.3	....	7.0	1,476
	Sugar	53.0	53.0	....	....	53.0	....	211
	Total	....	1,491.5	259.3	342.8	889.4	50.6	9,353
6069	Feces..................	....	26.0	9.4	5.8	10.8	8.1	196
	Amount digested	....	1,465.5	249.9	337.0	878.6	42.5	9,157
	Per cent digested	....	98.26	96.31	98.31	98.79	83.99	
	Estimated heat of combustion of urine	....	....	....	....	....	....	217
	Energy of food oxidized in the body ..	....	....	....	....	....	....	8,940
	Per cent energy utilized	....	....	....	....	....	....	95.6

DIGESTION EXPERIMENT No. 17.

Kind of food; white bread with milk, butter and sugar.
Subject; B. R. M.
Weight (without clothes); at beginning 165.4 lbs., at end 164.2 lbs.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6065	White bread	1,642.2	1,006.4	150.9	30.7	824.8	21.2	4,664
6066	Milk	800.0	96.9	28.0	33.6	35.3	5.5	582
6068	Milk	1,455.0	181.7	53.7	61.1	66.9	10.2	1,163
6071	Milk	800.0	100.6	28.0	33.6	39.0	5.6	602
6067	Butter	259.6	224.0	3.4	220.6	......	9.8	2,070
	Sugar	148.6	148.6	......	......	148.6	......	592
	Total	......	2,758.2	264.0	379.6	1,114.6	52.3	9,673
6070	Feces	......	61.9	22.6	20.4	18.9	12.4	447
	Amount digested	......	2,696.3	241.4	359.2	1,095.7	39.9	9,226
	Per cent digested	......	97.75	91.44	94.62	98.34	76.29	
	Estimated heat of combustion of urine	......	......	......	......	......	......	210
	Energy of food oxidized in the body	......	......	......	......	......	......	9,016
	Per cent energy utilized	......	......	......	......	......	......	93.2

DIGESTION EXPERIMENT No. 18.

Kind of food; white bread with milk, butter and sugar.
Subject; A. J. P.
Weight (without clothes); at beginning 134.5 lbs., at end 134.5 lbs.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6077	White bread	1,168.6	716.3	104.9	27.9	583.5	15.8	3,325
6079	Milk	2,200.0	288.7	72.8	93.5	122.4	11.0	1,753
6080	Milk	1,600.0	202.0	57.0	63.7	81.3	8.6	1,238
6081	Butter	146.4	122.7	2.0	120.7	......	6.9	1,133
	Sugar	59.6	59.6	......	......	59.6	......	238
	Total	......	1,389.3	236.7	305.8	846.8	42.3	7,687
6082	Feces	......	32.5	10.9	5.7	15.9	11.5	247
	Amount digested	......	1,356.8	225.8	300.1	830.9	30.8	7,440
	Per cent digested	......	97.66	95.40	98.12	98.13	72.83	
	Estimated heat of combustion of urine	......	......	......	......	......	......	196
	Energy of food oxidized in the body	......	......	......	......	......	......	7,244
	Per cent energy utilized	......	......	......	......	......	......	94.2

DIGESTION EXPERIMENT No. 19.

Kind of food; white bread with milk, butter and sugar.
Subject; O. W. K.
Weight (without clothes); at beginning 135.1 lbs., at end 134 lbs.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6078	White bread	1,137.6	692.7	102.0	26.0	564.7	17.0	3,218
6079	Milk	2,200.0	288.7	72.8	93.5	122.4	11.0	1,753
6080	Milk	1,600.0	202.0	57.0	63.7	81.3	8.6	1,238
6081	Butter	135.6	113.7	1.9	111.8	....	6.4	1,040
	Sugar	80.4	80.4	....	....	80.4	......	321
	Total	....	1,377.5	233.7	295.0	848.8	43.0	7,570
6083	Feces	....	32.4	10.8	5.0	16.6	9.6	242
	Amount digested	....	1,345.1	222.9	290.0	832.2	34.4	7,328
	Per cent digested	....	97.65	95.36	98.05	98.30	80.00	
	Estimated heat of combustion of urine	....	....	....	....	....	....	194
	Energy of food oxidized in the body	....	....	....	....	....	....	7,134
	Per cent energy utilized	....	....	....	....	....	....	94.2

DIGESTION EXPERIMENT No. 20.

Kind of food; entire wheat bread with milk, butter and sugar.
Subject; A. J. P.
Weight (without clothes); at beginning 133.5 lbs., at end 134.7 lbs.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6086	Entire wheat bread	1,247.6	751.7	117.6	32.7	601.4	17.5	3,567
6088	Milk	1,500.0	207.6	55.4	75.0	77.2	9.8	1,353
6089	Milk	545.0	73.0	19.4	27.2	26.4	3.1	467
6090	Butter	248.8	201.5	2.0	199.5	....	14.8	1,866
	Sugar	109.6	109.6	....	....	109.6	....	437
	Total	....	1,343.4	194.4	334.4	814.6	45.2	7,690
6091	Feces	....	43.3	14.7	8.2	20.4	9.8	301
	Amount digested	....	1,300.1	179.7	326.2	794.2	35.4	7,389
	Per cent digested	....	96.77	90.38	97.54	97.49	78.32	
	Estimated heat of combustion of urine	....	....	....	....	....	....	156
	Energy of food oxidized in the body	....	....	....	....	....	....	7,233
	Per cent energy utilized	....	....	....	....	....	....	95.3

DIGESTION EXPERIMENT No. 21.

Kind of food; entire wheat bread, with milk, butter and sugar.
Subject; O. W. K.
Weight (without clothes); at beginning 135.5 lbs; at end 135.1 lbs.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6087	Entire wheat bread..	1,210 4	723.9	112.5	32.5	578.9	16.6	3,424
6088	Milk	1,500.0	207.6	55.4	75.0	77.2	9.8	1,353
6089	Milk	545.0	73.0	19.4	27.2	26.4	3.1	467
6090	Butter	267.6	216.8	2.2	214.6	....	15.9	2,008
	Sugar	184.8	184.8	....	....	184.8	....	737
	Total	....	1,406.1	189.5	349.3	867.3	45.4	7,989
6092	Feces	....	36.6	12.4	7.0	17.2	8.2	275
	Amount digested	....	1,369.5	177.1	342.3	850.1	37.2	7,714
	Per cent digested	....	97.39	93.46	98.00	98.02	81.91	
	Estimated heat of combustion of urine	....	....	....	....	....	....	154
	Energy of food oxidized in the body ..	....	....	....	....	....	....	7,560
	Per cent energy utilized	....	....	....	....	....	....	94.7

DIGESTION EXPERIMENT No. 22.

Kind of food; graham bread, with milk, butter and sugar.
Subject; A. J. P.
Weight (without clothes), at beginning 136.1 lbs., at end 135.7 lbs.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6097	Graham bread	1,584.1	892.4	113.3	47.1	732.0	25.0	4,180
6099	Milk	1,200.0	158.2	43.6	55.2	59.4	9.0	1,065
6100	Milk	1,000.0	125.0	33.8	46.0	45.2	6.2	814
6107	Butter	189.8	152.4	2.1	150.3	....	12.3	1,410
	Sugar	102.0	102.0	....	....	102.0	....	407
	Total	....	1,430.0	192.8	298.6	938.6	52.5	7,876
6103	Feces	....	91.5	23.5	10.1	57.9	19.3	558
	Amount digested	....	1,338.5	169.3	288.5	880.7	33.2	7,318
	Per cent digested	....	93.60	87.81	96.62	93.83	63.24	
	Estimated heat of combustion of urine	....	....	....	....	....	....	147
	Energy of food oxidized in the body ..	....	....	....	....	....	....	7,171
	Per cent energy utilized	....	....	....	....	....	....	91.0

DIGESTION EXPERIMENT No. 23.

Kind of food; graham bread, with milk, butter and sugar.
Subject; O. W. K.
Weight (without clothes); at beginning, 136.2 lbs., at end, 136 lbs.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6098	Graham bread..	1,200.0	679.8	89.1	33 0	557.7	17.6	3,178
6099	Milk	1,400.0	184.5	50.8	64.4	69.3	10.5	1,243
6100	Milk	1,076.0	134.5	36.4	49.5	48.6	6.7	876
6107	Butter	201.4	161.7	2.3	159.4	....	13.0	1,495
	Sugar.......	185.0	185.0	....	....	185.0	......	738
	Total	....	1,345.5	178.6	306.3	860.6	47.8	7,530
6104	Feces......	....	78.8	22.0	7.8	49.0	14.3	472
	Amount digested.....	....	1,266.7	156.6	298.5	811.6	33.5	7,058
	Per cent digested	....	94.14	87.68	97.45	94.31	70.08	
	Estimated heat of combustion of urine	....	....	....	....	....	....	155
	Energy of food oxidized in the body ..	....	....	....	....	....	....	6,903
	Per cent energy utilized..............	....	....	....	....	....	....	91.7

DIGESTION EXPERIMENT No. 24.

Kind of food; white bread, with milk, butter and sugar.
Subject; O. W. K.
Weight (without clothes); at beginning 147.6 lbs., at end, 144 7 lbs.

Laboratory number of sample.		Weight food material—Grams.	Total organic matter—Grams.	Protein—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heats of combustion, determined—Calories.
6120	White bread	568.0	344.8	51.3	7 6	285.9	6.5	1,595
6121	Milk..................	1,629.6	223.3	59.2	88.0	76.1	12.2	1,463
6122	Butter................	67.8	56.0	.8	55.2	......	2.8	516
	Sugar................	40.2	40.2	....	....	40.2	....	125
	Total	....	664.3	111.3	150.8	402.2	21.5	3,699
6124	Feces	....	9.3	2.4	1.5	5.4	3.1	50
	Amount digested.....	....	655.0	108.9	149.3	396.8	18.4	3,649
	Per cent digested	....	98.60	97.84	99.00	98.66	85.58	
	Estimated heat of combustion of urine	....	....	....	....	....	....	95
	Energy of food oxidized in the body ..	....	....	....	....	....	....	3,554
	Per cent energy utilized................	....	....	....	....	....	....	96.1

SUMMARY OF DIGESTION EXPERIMENTS.

AVAILABILITY OF NUTRIENTS AND HEATS OF COMBUSTION.

Number of experiment.	Kinds of Food.	Subject.	Total organic matter.	Protein.	Fat.	Carbohydrates.	Ash.	Heats of combustion, determined.
			%	%	%	%	%	%
1	White bread	H. B. S.	96.8	90.9	82.3	98.3	43.9	93.7
2	White bread	H. B. S.	95.5	80.0	65.6	98.9	54.3	92.4
3	White bread	L. H. H.	94.6	81.7	67.5	97.7	32.6	91.2
4	White bread	I. W. F.	94.7	75.4	67.2	98.7	67.1	91.5
	White bread, average	4	95.4	82.0	70.7	98.4	49.5	92.2
5	White bread and milk	L. H. H.	95.2	86.5	89.6	98.0	78.8	95.1
6	White bread and milk	H. B. S.	95.8	90.8	92.8	97.7	70.1	92.6
7	White bread and milk	C. W. S.	96.5	91.9	94.2	97.9	61.7	92.9
8	White bread and milk	P. F. F.	94.9	89.2	88.4	97.8	56.1	90.8
16	White bread and milk	A. J. P.	98.3	96.3	98.3	98.8	84.0	95.6
17	White bread and milk	B. R. M.	97.8	91.4	94.6	98.3	76.3	93.2
18	White bread and milk	A. J. P.	97.7	95.4	98.1	98.1	72.8	94.2
19	White bread and milk	O. W. K.	97.7	95.4	98.3	98.1	80.0	94.2
24	White bread and milk	O. W. K.	98.6	97.8	99.0	98.7	85.6	96.1
	White bread and milk, average.	9	96.9	92.8	94.8	98.2	73.9	93.9
9	Graham bread and milk.	C. W. S.	92.6	87.8	94.4	93.7	68.0	89.9
10	Graham bread and milk.	F. H. M.	93.3	88.7	94.1	94.5	64.1	90.6
11	Graham bread and milk.	C. D. H.	94.3	91.9	96.7	94.4	70.6	91.7
12	Graham bread and milk	P. F. F.	92.3	87.2	94.5	93.3	54.0	89.9
22	Graham bread and milk.	A. J. P.	93.6	87.8	96.6	93.8	63.2	91.0
23	Graham bread and milk	O. W. K.	94.1	87.7	97.5	94.3	70.1	91.7
	Graham bread and milk, average	6	93.4	88.5	95.6	94.0	65.0	90.8
13	Entire wheat bread and milk	C. W. S.	94.6	89.1	93.2	96.5	69.0	91.4
14	Entire wheat bread and milk	P. F. F.	97.0	93.6	97.2	97.9	74.8	93.8
15	Entire wheat bread and milk	A. B. O.	96.2	92.7	96.1	97.2	72.5	93.0
20	Entire wheat bread and milk	A. J. P.	96.8	90.4	97.5	97.5	78.3	95.3
21	Entire wheat bread and milk	O. W. K.	97.4	93.5	98.0	98.0	81.9	94.7
	Entire wheat bread and milk av.	5	96.4	91.9	96.4	97.4	75.3	93.6

THE INCOME AND OUTGO OF NITROGEN IN THESE EXPERIMENTS.

As previously stated, the urine was collected for each experiment beginning with the morning of the first day and ending with the evening of the third day. The amount passed on rising (about 7 A. M.) in the morning of the first day was not kept and that of the morning of the third day was included with the amount collected.

The weights of the urine, the percentage of nitrogen, weight of nitrogen, heats of combustion per gram, and total heats of combustion are given below. The balance of the income and outgo of nitrogen are given on the opposite page.

WEIGHT OF NITROGEN IN THE URINE FOR EACH EXPERIMENT—TWO DAYS.

Number experiment.	Laboratory number.	Weight of urine.	Per cent nitrogen.	Weight of nitrogen.	Heats of combustion, determined.	
					Per gram.	Total.
		Grams.		Grams.		
1	6012	2,142	1.81	38.77		
2	6013	1,550	1.20	18.60		
3	6014	1,545	1.30	20.08		
4	6015	1,509	1.53	23.09		
5	6016	1,443	1.84	26.55		
6	6017	2,279	1.23	28.03		
7	6018	2,505	1.68	42.08		
8	6019	2,550	1.39	35.44		
9	6038	1,408	1.22	17.18		
10	6039	3,488	1.29	45.00		
11	6040	2,433	0.87	21.17		
12	6041	2,745	1.00	27.45		
13	6054	2,334	1.33	31.04		
14	6055	2,046	1.38	28.23		
15	6056	3,450	1.14	39.33		
16	6072	2,749	1.42	39.04	89	244.7
17	6073	2,208	1.69	37.31	127	280.4
18	6084	2,322	1.54	35.76	114	264.7
19	6085	2,530	1.25	31.62	87	220.1
20	6093	2,042	1.40	28.59	107	218.5
21	6094	2,086	1.46	30.46	119	248.2
22	6105	2,723	1.10	29.95	76	206.9
23	6106	2,259	1.22	27.56	82	185.2
24	6125	1,529	1.58	24.16	131	200.3

BALANCE OF INCOME AND OUTGO OF NITROGEN—TWO DAYS.

Number.	INCOME.	OUTGO.				
	Nitrogen in food.	Nitrogen in feces.	Nitrogen in urine.	Total.	Nitrogen, gain+ loss—.	Protein, gain+ loss—.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
1	22.9	2.1	38.8	40.9	—18.0	—112.5
2	13.3	2.7	18.6	21.3	—8.0	—50.0
3	15.0	3.3	20.1	23.4	—8.4	—52.5
4	14.9	3.7	23.1	26.8	—11.9	—74.4
5	24.2	3.3	26.6	29.9	—5.7	—35.6
6	27.6	2.5	28.0	30.5	—2.9	—18.3
7	50.1	4.0	42.1	46.1	+4.0	+25.0
8	36.9	4.0	35.4	39.4	—2.5	—15.6
9	51.6	6.3	17.2	23.5	+28.1	+175.6
10	39.1	4.4	45.0	49.4	—10.3	—64.4
11	45.0	3.7	21.2	24.9	+20.1	+125.6
12	42.8	5.5	27.5	33.0	+9.8	+61.2
13	45.2	4.9	31.0	35.9	+9.3	+58.1
14	58.1	3.7	28.2	31.9	+16.2	+101.3
15	49.5	3.6	39.3	42.9	+6.6	+41.2
16	41.5	1.5	39 0	40.5	+1.0	+6.2
17	42.2	3.6	37.3	40.9	+1.3	+8.1
18	37.9	1.7	35.8	37.5	+0.4	+2.5
19	37.4	1.7	31.6	33.3	+4.1	+25.6
20	31.1	2.4	28.6	31.0	+0.1	+0.6
21	30.3	2.2	30.5	32.7	—2.4	—15.0
22	30.8	3.8	30.0	33.8	—3.0	—18.7
23	28.6	3.5	27.6	31.1	—2.5	—15.6
24	17.8	.4	24.2	24.6	—6.8	—42.5

THE DIGESTIBILITY OF BREAD.

CHAS. D. WOODS and L. H. MERRILL.

The experiments here reported were undertaken for the purpose of ascertaining the comparative digestibility of breads from ordinary bread flour, graham flour and so-called entire wheat flour. Preliminary experiments made by one of us in 1894 had shown that, for (See digestion experiments 1 to 5 and 9 pp. 168 to 170, Report Storrs [Conn.] Experiment Station for 1896) the subject there used, neither bread nor milk when eaten separately were as completely digested as when bread and milk were eaten together. The experiments here reported show that bread and milk are more completely digested than bread alone, (compare experiments 1 to 4 and 5 to 8, 16 to 19 in table on p. 193). In the comparative experiments here reported, the breads were not eaten alone, but were taken with milk, butter and sugar. To reduce the results obtained in this mixed diet to the breads alone necessitated the use of more or less arbitrary factors for the food materials eaten with the bread.

After a careful study of the results of digestion experiments made in this country and Germany, the following factors (percentages of availability) were assumed in calculating the results here reported to bread alone.

	Protein. %	Fats. %	Carbohydrates. %
Milk	98	99	98
Butter	--	99	--
Sugar	--	--	98

The application of these factors to other experiments, as well as these here reported upon, seemed to give results that indicate that these are the approximate percentages of availability for the nutrients of these food materials. These applications to the figures obtained in the digestion experiments reported on pages

183-192 will be readily understood, and are given in the following tables. The table on page 207 contains a summary of the results:

DIGESTION EXPERIMENT No. 5.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM WHITE BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6008	Milk, not digested	.49	.30	.90	9
6009	Milk, not digested	.64	.37	.91	11
	Feces from the above	1.13	.67	1.81	20
6024	Feces, total	20.50	10.40	13.40	113
	Feces from white bread	19.37	9.73	11.59	93
	Nutrients in white bread............	95.00	33.30	585.40	3,284
	Amount of nutrients digested	75.63	23.57	573.81	3,191
	Per cent of nutrients digested......	79.61	70.78	98.C2	96.95

DIGESTION EXPERIMENT No. 6.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM WHITE BREAD.

Laboratory Number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6008	Milk, not digested	.85	.51	1.56	16
6009	Milk, not digested	.92	.54	1.32	15
	Feces from the above................	1.77	1.05	2.88	31
6025	Feces, total	15.90	9.10	15.70	236
	Feces from white bread	14.13	8.05	12.82	205
	Nutrients in white bread............	83.90	21.80	526.60	2,892
	Amount of nutrients digested	69.77	13.75	513.78	2,687
	Per cent of nutrients digested......	83.16	63.07	97.56	92.90

DIGESTION EXPERIMENT No. 7.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM WHITE BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6010	Milk, not digested	1.02	.62	1.55	18
6011	Milk, not digested	1.37	.88	2.13	24
	Feces from the above	2.39	1.50	3.68	42
6026	Feces, total	25.30	9.60	25.30	342
	Feces from white bread	22.91	8.10	21.62	300
	Nutrients in white bread	193.90	16.50	1,030.00	5,509
	Amount of nutrients digested	170.99	8.40	1,008.38	5,209
	Per cent of nutrients digested	88.18	50.91	97.90	94.55

DIGESTION EXPERIMENT No. 8.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM WHITE BREAD.

Laboratory Number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6010	Milk, not digested	1.21	.73	1.83	21
6011	Milk, not digested	1.13	.72	1.76	20
	Feces from the above	2.34	1.45	3.59	41
6027	Feces, total	25.00	18.00	17.10	375
	Feces from white bread	22.66	16.55	13.51	334
	Nutrients in white bread	113.70	9.70	603.50	3,230
	Amount of nutrients digested	91.04	....	589.99	2,896
	Per cent of nutrients digested	80.07	....	97.76	89.67

DIGESTION EXPERIMENT No. 9.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM GRAHAM BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6032	Milk, not digested	1.53	.89	2.39	26
		1.71	1.02	3.06	32
	Feces from the above...............	3.24	1.91	5.45	58
6042	Feces, total.	39.40	11.90	75.30	637
	Feces from graham bread..........	36.16	9.99	69.85	579
	Nutrients in graham bread..........	161.00	20.50	914.80	4,830
	Amount of nutrients digested......	124.84	10.51	844.95	4,251
	Per cent of nutrients digested......	77.54	51.27	92.36	86.02

DIGESTION EXPERIMENT No. 10.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM GRAHAM BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6032	Milk, not digested....................	.92	.54	1.44	16
6033	Milk, not digested.........................	1.80	1.07	3.22	33
	Feces from the above................	2.72	1.61	4.66	49
6043	Feces, total	27.70	10.40	46.60	440
	Feces from graham bread...........	24.98	8.79	41.94	391
	Nutrients in graham bread	108.50	13.80	617.00	3,262
	Amount of nutrients digested......	83.52	5.01	575.06	2,871
	Per cent of nutrients digested......	76.98	36.30	93.19	93.67

DIGESTION EXPERIMENT No. 11.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM GRAHAM BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6032	Milk, not digested	1.88	1.09	2.94	33
6033	Milk, not digested	1.91	1.14	3.43	35
	Feces from the above	3.79	2.23	6.37	68
6044	Feces, total	22.80	7.80	47.00	391
	Feces from graham bread	19.01	5.57	40.63	323
	Nutrients in graham bread	92.00	12.30	525.40	2,788
	Amount of nutrients digested	72.99	6.73	484.77	2,465
	Per cent of nutrients digested	79.34	54.72	92.27	88.40

DIGESTION EXPERIMENT No. 12.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM GRAHAM BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6032	Milk, not digested	1.49	.87	2.33	26
6033	Milk, not digested	1.78	1.06	3.18	33
	Feces from the above	3.27	1.93	5.51	59
6045	Feces, total	34.20	11.50	59.90	541
	Feces from graham bread	30.93	9.57	54.39	482
	Nutrients in graham bread	104.20	15.40	617.30	3,257
	Amount of nutrients digested	73.27	5.83	562.91	2,775
	Per cent of nutrients digested	70.32	37.86	91.19	85.22

DIGESTION EXPERIMENT No. 13.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM ENTIRE WHEAT BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6046	Milk, not digested	1.42	.86	2.19	25
6057	Milk, not digested	1.56	.91	2.43	27
	Feces from the above	2.98	1.77	4.62	52
6051	Feces, total	30 80	12.40	34.20	424
	Feces from entire wheat bread	27.82	10.63	29.58	372
	Nutrients in entire wheat bread	133.40	6.70	743.20	3,895
	Amount of nutrients digested	105.58	....	713.62	3,523
	Per cent of nutrients digested	79.15	....	96.02	90.44

DIGESTION EXPERIMENT No. 14.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM ENTIRE WHEAT BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6046	Milk, not digested	2.06	1.24	3.17	36
6057	Milk, not digested	1.78	1.03	2.76	31
	Feces from the above	3.84	2.27	5.93	67
6052	Feces, total	23.30	6.50	26.00	295
	Feces from entire wheat bread	19.46	4.23	20.07	228
	Nutrients in entire wheat bread	171.00	8.20	950.80	4,989
	Amount of nutrients digested	151.54	3.97	930.73	4,761
	Per cent of nutrients digested	88.60	48.41	97.89	95.45

DIGESTION EXPERIMENT No. 15.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM ENTIRE WHEAT BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6046	Milk, not digested	1.63	.99	2.52	28
6057	Milk, not digested	1.78	1.03	2.76	31
	Feces from the above	3.41	2.02	5.28	59
6053	Feces, total	22.50	8.10	29.40	320
	Feces from entire wheat bread	19.09	6.08	24.12	261
	Nutrients in entire wheat bread	139.00	6.90	777.90	4,093
	Amount of nutrients digested	119.91	.82	753.78	3,832
	Per cent of nutrients digested	86.27	10.43	96.90	93.62

DIGESTION EXPERIMENT No. 16.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM WHITE BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6066	Milk, not digested	.56	.34	.71	9
6068	Milk, not digested	1.33	.76	1.66	21
6071	Milk, not digested	.84	.50	1.17	14
6067	Butter, not digested	.05	1.57	....	15
	Sugar, not digested	....	....	1.06	4
	Feces from the above	2.78	3.17	4.60	63
6069	Feces, total	9.40	5.80	10.80	196
	Feces from white bread	6.62	2.63	6.20	133
	Nutrients in white bread	120.50	25.90	659.70	4,744
	Amount of nutrients digested	113.88	23.27	653.50	4,611
	Per cent of nutrients digested	94.51	89.85	99.06	97.18

DIGESTION EXPERIMENT No. 17.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM WHITE BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6066	Milk, not digested	.56	.34	.71	9
6068	Milk, not digested	1.07	.61	1.34	17
6071	Milk, not digested	.56	.34	.78	9
6067	Butter, not digested	.07	2.21	....	21
	Sugar, not digested	....	....	2.97	12
	Feces from the above	3.26	3.50	5.80	68
6070	Feces, total	22.60	20.40	18.90	447
	Feces from white bread	19.34	16.90	13.10	379
	Nutrients in white bread	150.90	30.70	824.80	4,664
	Amount of nutrients digested	131.56	13.80	811.70	4,285
	Per cent of nutrients digested	87.18	44.95	98.41	91.86

DIGESTION EXPERIMENT No. 18.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM WHITE BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6079	Milk, not digested	1.56	.94	2.45	27
6080	Milk, not digested	1.14	.64	1.63	19
6081	Butter, not digested	.04	1.21	....	11
	Sugar, not digested	....	....	1.19	5
	Feces from the above	2.74	2.79	5.27	62
6082	Feces, total	10.90	5.70	15.90	247
	Feces from white bread	8.16	2.91	10.63	185
	Nutrients in white bread	104.90	27.90	583.50	3,325
	Amount of nutrients digested	96.74	24.99	572.87	3,140
	Per cent of nutrients digested	92.22	89.57	98.18	93.17

DIGESTION EXPERIMENT No. 19.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM WHITE BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6079	Milk, not digested	1.56	.94	2.45	27
6080	Milk, not digested	1.14	.64	1.63	19
6081	Butter, not digested	.04	1.12	....	11
	Sugar, not digested	....	....	1.61	7
	Feces from the above	2.74	2.70	5.69	64
6083	Feces, total	10.80	5.00	16.60	242
	Feces from white bread	8.06	2.30	10.91	178
	Nutrients in white bread	102.00	26.00	564.70	3,218
	Amount of nutrients digested	93.94	23.70	553.79	3,040
	Per cent of nutrients digested	92.10	91.15	98.07	97.85

DIGESTION EXPERIMENT No. 20.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM ENTIRE WHEAT BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories
6088	Milk, not digested	1.11	.75	1.54	19
6089	Milk, not digested	.39	.27	.53	7
6090	Butter, not digested	.04	1.96	....	18
	Sugar, not digested	....	....	2.19	8
	Feces from the above	1.54	2.98	4.26	52
6091	Feces, total	14.70	8.20	20.40	301
	Feces from entire wheat bread	13.16	5.22	16.14	249
	Nutrients in entire bread	117.60	32.70	601.40	3,567
	Amount of nutrients digested	104.44	27.48	585.26	3,318
	Per cent of nutrients digested	88.81	84.04	97.31	96.85

DIGESTION EXPERIMENT No. 21.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM ENTIRE WHEAT BREAD.

Laboratory number.		Protein.	Fat.	Carbohydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6088	Milk, not digested	1.11	.75	1.54	19
6089	Milk, not digested	.39	.27	.53	7
6090	Butter, not digested	.04	2.15	....	20
	Sugar, not digested	....	....	3.70	15
	Feces from the above	1.54	3.17	5.77	61
6092	Feces, total	12.40	7.00	17.20	275
	Feces from entire wheat bread	10.86	3.83	11.43	214
	Nutrients in entire wheat bread	112.50	32.50	578.90	3,424
	Amount of nutrients digested	101.64	28.67	567.47	3,210
	Per cent of nutrients digested	90.35	88.22	98.03	93.77

DIGESTION EXPERIMENT No. 22.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM GRAHAM BREAD.

Laboratory number.		Protein.	Fat.	Carbohydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6099	Milk, not digested	.87	.55	1.19	15
6100	Milk, not digested	.68	.46	.90	12
6107	Butter, not digested	.04	1.50	....	14
	Sugar, not digested	....	....	2.04	8
	Feces from the above	1.59	2.51	4.13	49
6103	Feces, total	23.50	10.10	57.90	558
	Feces from graham bread	21.91	7.59	53.77	509
	Nutrients in graham bread	113.30	47.10	732.00	4,180
	Amount of nutrients digested	91.39	39.51	678.23	3,671
	Per cent of nutrients digested	80.66	83.89	92.65	87.82

DIGESTION EXPERIMENT No. 23.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM GRAHAM BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6099	Milk, not digested	1.02	.64	1.39	17
6100	Milk, not digested	.73	.50	.97	13
6107	Butter, not digested	.05	1.59	....	15
	Sugar, not digested	....	....	3.70	15
	Feces from the above	1.80	2.73	6.06	60
6104	Feces, total	22.00	7.80	49.00	472
	Feces from graham bread	20.20	5.07	42.94	412
	Nutrients in graham bread	89.10	33.00	557.70	3,178
	Amount of nutrients digested	68.90	27.93	515.76	2,766
	Per cent of nutrients digested	77.33	84.64	92.48	87.02

DIGESTION EXPERIMENT No. 24.

NUTRIENTS DIGESTED AND ENERGY UTILIZED FROM WHITE BREAD.

Laboratory number.		Protein.	Fat.	Carbo-hydrates.	Heats of combustion, determined.
		Grams.	Grams.	Grams.	Calories.
6121	Milk, not digested	1.18	.88	1.52	21
6122	Butter, not digested	.02	.55	....	5
	Sugar, not digested	....	....	.80	3
	Feces from the above	1.20	1.43	2.32	29
6124	Feces, total	2.40	1.50	5.40	50
	Feces from white bread	1.20	.07	3.08	21
	Nutrients in white bread	51.30	7.60	285.90	1,515
	Amount of nutrients digested	50.10	7.53	282.82	1,574
	Per cent of nutrients digested	97.66	99.08	98.93	98.67

COMPARISON OF NUTRIENTS DIGESTED AND ENERGY UTILIZED IN BREADS MADE FROM ORDINARY BREAD FLOUR, GRAHAM FLOUR, AND ENTIRE WHEAT FLOUR.

THE RESULTS OF THE EXPERIMENTS WITH BREAD AND MILK CALCULATED TO BREAD ALONE.

Number of experiments.	Kinds of Food.	Subject.	Protein.	Fat.	Carbo-hydrates.	Heats of combustion.
			%	%	%	%
1	White bread alone	H. B. S	90.9	82.3	98.3	93.7
2	White bread alone	H. B. S	80.0	65.6	98.9	92.4
3	White bread alone	L. H. H	81.7	67.5	97.7	91.2
4	White bread alone	I. W. F	75.4	67.2	98.7	91.5
	Average of four experiments		82.0	70.7	98.4	92.2
5	White bread and milk	L. H. H	79.6	70.8	98.0	97.0
6	White bread and milk	H. B. S	83.2	63.1	97.6	92.9
7	White bread and milk	C. W. S	88.2	50.9	97.9	94.6
8	White bread and milk	P. F. F	80.1	....	97.8	89.7
16	White bread and milk	A. J. P	94.5	90.0	99.1	97.2
17	White bread and milk	B. R. M	87.2	45.0	98.4	92.0
18	White bread and milk	A. J. P	92.2	89.6	98.2	93.2
19	White bread and milk	O. W. K	92.1	91.2	98.1	97.9
24	White bread and milk	O. W. K	97.7	99.1	98.9	98.7
	Average of nine experiments		88.3	66.6	98.2	94.8
9	Graham bread and milk	C. W. S	77.5	51.3	92.4	86.0
10	Graham bread and milk	F. H. M	77.0	36.3	93.2	93.7
11	Graham bread and milk	C. D. H	79.3	54.7	92.3	88.4
12	Graham bread and milk	P. F. F	70.3	37.9	91.2	85.2
22	Graham bread and milk	A. J. P	80.7	83.9	92.7	87.8
23	Graham bread and milk	O. W. K	77.3	84.6	92.5	87.0
	Average of six experiments		77.0	58.1	92.4	88.0
13	Entire wheat bread and milk	C. W. S	79.2	....	96.0	90.4
14	Entire wheat bread and milk	P. F. F	88.6	48.4	97.9	95.5
15	Entire wheat bread and milk	A. B. O	86.2	10.4	96.9	93.6
20	Entire wheat bread and milk	A. J. P	88.8	84.0	97.3	96.9
21	Entire wheat bread and milk	O. W. K	90.4	88.2	98.0	93.8
	Average of five experiments		86.6	46.2	97.2	94.0

THE ACQUISITION OF ATMOSPHERIC NITROGEN. SOIL INOCULATION.

W. M. MUNSON.

The remarkable results obtained at the Alabama Experiment Station* from the inoculation of sterile soils with tubercles from various leguminous species, and with nitragin, were referred to by the writer in the last report of this Station.† With the purpose of verifying this work and of comparing several of the "nitragin" cultures with each other and with tubercles from various species of legumes, a series of inoculation experiments was undertaken in the greenhouse during the past season.

For all the work a sterile, sandy subsoil was used. This soil was sterilized once by being placed in a tight box in which was a coil of perforated steam pipe. Steam, at 10 pounds pressure, was passed through the coil for one hour, thus maintaining a temperature of about 200 degrees F. Just before use the soil was again sterilized, for one to one and one-half hours, on three successive days. On these occasions the steam was at 80 pounds pressure. The pots used were all sterilized by steaming for one hour on three successive days and the house was thoroughly sprayed with corrosive sublimate before the pots were put in place. Throughout the test, the water given to the plants was boiled for one to one and one-half hours, on three successive days, before use. Each six-inch pot was given 6.2 grams of complete fertilizer which was first carefully sterilized.

The seed was in all cases soaked for one and one-half hours in corrosive sublimate (1 gram to 1 quart water), placed in a sterilized germinator‡ and moistened with sterilized water.

---

* Bull. 87 Alabama Experiment Station, 466.

† Rep. Maine Experiment Station, 1897, 130.

‡ The germinator consisted of folds of asbestos cloth which were passed through a flame and then placed in a "Geneva tester" which had been similarly treated.

The plants used in the work included red clover, pea, bean, vetch, and soja bean. The results obtained with each are detailed below:

RED CLOVER.

The seeds were treated as above described. After four days, when the sprouts were ¼ to ⅜ inch long, those which were to be grown with nitragin were immersed in a diluted culture of the species desired (1 c. c. nitragin to 20 c. c. distilled water), after which they were planted ¼-inch deep in the sterilized soil, in 6-inch pots. In the soil inoculated with tubercles, instead of nitragin, the tubercles were placed, two or three together, ½-inch deep by each seed. Eight seeds were planted in each pot, and when the plants were well started they were thinned to five in each. The pots were placed on a bench in the greenhouse and a night temperature of 50° was maintained.

In this trial 3 pots were planted without treatment, 3 were given clover nitragin as above; 3 pea nitragin; 3 lupine nitragin; 3 tubercles of *Swainsona galegifolia* and 3 tubercles of horse bean (*Vicia Faba*).

At this writing the plants present no marked differences.

PEA.

Preliminary treatment of soil and seed as for clover. The plants were thinned to four in each pot when about three inches high. The crop was harvested when in full bloom, as the plants were all attacked with mildew and were losing their foliage.

The results are given in tabular form on the following page.

THE GROWTH OF PEAS ON INOCULATED SOIL.

Treatment.	Highest plant —Feet.	Lowest plant —Feet.	Average height —Feet.	General average —Feet.	Total weight —Grams.	Remarks:
Check.						
Pot No. 1	6.0	5.2	5.6			Well developed tubercles were found in all of the pots.
Pot No. 2	6.2	5.2	5.7	5.6	238	
Pot No. 3	6.0	4.9	5.5			
Pea nitragin.						
Pot No. 1	6.0	5.9	5.9			Tubercles rather more numerous than in the check.
Pot No. 2	6.1	4.4	5.0	5.5	238	
Pot No. 3	6.1	4.7	5.5			
Lupine nitragin.						
Pot No. 1	6.3	5.7	6.0			Tubercles well developed, mostly near surface of pots and near where seed was planted.
Pot No. 2	6.3	5.0	5.6	5.7	301	
Pot No. 3	6.1	4.8	5.6			
Clover nitragin.						
Pot No. 1	6.3	6.0	6.2			As in the preceding and more abundant.
Pot No. 2	6.8	4.8	5.8	5.9	273	
Pot No. 3	6.5	4.2	5.6			
Swainsona tubercles.						
Pot No. 1	5.8	4.5	5.1			Root growth less vigorous than in any of the preceding. Tubercles few and small.
Pot No. 2	6.2	4.8	5.3	5.0	266	
Pot No. 3	5.2	4.3	4.7			
Horse bean tubercles.						
Pot No. 1	5.8	4.0	4.7			General condition as in the last.
Pot No. 2	5.5	4.1	4.7	4.8	210	
Pot No. 3	5.8	4.2	4.9			

The highest plants and the heaviest crop were attained from the seeds treated with lupine nitragin. Pea nitragin had no appreciable effect. The pots given tubercles of swainsona and of horse bean, were both inferior to those receiving no germs; but in the pots receiving no germs, tubercles were found, so that there must have been some source of infection,—possibly the drip from the roof.

In general, the differences with the different cultures were so slight as to be unappreciable, and were not greater than those found in the different pots receiving no germs.

VETCH.

Treated in every way as were peas and clover. When just beginning to bloom, the plants were harvested. The results were, in every way, comparable to those from the pea, detailed above. In no case were there sufficient differences to indicate even a possible advantage from the use of the germ culture.

BEAN.

The remarks concerning the vetch will apply with equal force to the bean. With the bean, however, there was no evidence of tubercles in any of the pots. It should be said that the beans were kept in the same house with the other plants, and it is possible the unfavorable temperature may have affected the results.

A duplicate lot, started a month later, was allowed to come to maturity before harvesting. The plants were yellow and showed lack of vigor, because of low temperature. There was, however, no appreciable difference in the size or appearance of the various lots. It is worthy of note that the plants in one pot inoculated with horse bean tubercles produced small spherical tubercles, about the size of a sweet pea seed. Every plant, in soil inoculated with swainsona, produced tubercles, and those in two of the pots given lupine nitragin. Plants from soil inoculated with clover nitragin, pea nitragin, and from the uninoculated soil produced no tubercles.

SOJA BEAN.

The soja bean plants were small and weak in every instance and in no case were tubercles found except upon one plant from soil inoculated with soja bean tubercles. (The tubercles used were from last year's crop and were so dry it was feared they would be of little value.) There was no noticeable difference in the size and vigor of any of the plants.

GENERAL CONCLUSION.

The experiments thus far carried on at this Station do not justify the recommendation of germ cultures for leguminous crops. In no case did the culture of the specific germ of any given species give better results than did a culture of a nearly related type, and in most cases plants from untreated pots were equally as vigorous and as heavy as were those from inoculated soil.

SKIMMED MILK VS. WATER IN BREAD MAKING.

CHAS. D. WOODS and L. H. MERRILL.

At the dairy meeting of the Board of Agriculture in 1897 one of us presented a paper* in which emphasis was put upon the importance of skimmed milk as food from which the following is quoted.

"The value of skimmed 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 skimmed 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 skimmed milk have a greater nutritive value than a quart of oysters; the skimmed 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.

A few of the ways in which skimmed 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 oyster chowders, bisques and stews, skimmed milk will equally well replace the whole milk that the directions for preparing usually call for.

Skimmed milk makes as good white soups as whole milk. Bread mixed with skimmed milk is more nutritious than that made with water. All kinds of quick biscuit, griddle cakes, etc.,

* "Dairy Products Compared with other Food Materials," Chas. D. Woods, Agriculture of Maine, 1897, pp. 216–238.

can be made with skimmed as well as with whole milk. In most kind of cake, skimmed milk will be found a perfect substitute for whole milk. If the skimmed 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 skimmed 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."

The statement "Bread mixed with skimmed milk is more nutritious than that made with water" was made from a knowledge of the composition of skimmed milk and without exact experimental data. The premium list of the British Dairy Farmers' Association includes prizes for bread made with skimmed milk instead of water. Two comparisons of the chemical composition of bread made with water and skimmed milk were the only analyses found. These were as follows:

COMPOSITION OF THE DRY MATTER OF WATER BREAD AND SKIMMED MILK BREAD EXHIBITED AT THE BRITISH DAIRY FARMERS' ASSOCIATION AT LONDON.

	Dry matter—Per cent.	In Dry Matter.			
		Protein—Per cent.	Fat—Per cent.	Carbo-hydrates—Per cent.	Ash—Per cent.
Water bread	60.64	12.05	.20	87.27	.48
Water bread	62.80	15.43	.29	82.37	1.91
Average	....	13.74	.25	84.82	1.19
Milk bread	61.36	14.98	.83	83.73	.46
Milk bread	69.56	14.72	1.15	80.97	3.16
Average	....	14.85	.99	82.35	1.81

There was nothing to show that the same flour was used in the different samples and indeed from the analyses it would seem as though the different breads must have been made from different flours. It will be noticed that the protein in the second water bread was higher than in either of the skimmed milk breads, and, as the results of our investigations show, this could not be true if the same kind of flour was used in making the skimmed milk bread. The marked higher percentages of fat must be accounted for by the addition of shortening or by the milk being only partly skimmed.

The practice of using skimmed milk in the making of bread is said to be quite prevalent in some sections. That the custom does not become more general must be due to a lack of appreciation of the greater food value of skimmed milk bread. In the belief that its employment in bread making is to be encouraged, and for the purpose of calling attention to the readiness with which bread may be improved, the work reported below was planned and executed.

In each of the three experiments four double loaves of bread were made, two with and two without skimmed milk. The work was done by a practical bread maker, who worked from her own formulas, no conditions being imposed except that milk should be used in one case and water in the other. The materials used were portioned out by the eye alone, but were weighed before being used. As the tables indicate, the amounts of the ingredients used varied widely, but probably no more than in ordinary practice.

WEIGHT OF MATERIALS USED IN THE BREAD.

	Water Bread.			Skimmed Milk Bread.		
	Number 6115.	Number 6118.	Number 6190.	Number 6116.	Number 6119.	Number 6191.
	Grams.*	Grams.	Grams.	Grams.	Grams.	Grams.
Flour	782	876	1,287	752	886	1,241
Salt	8	9	10	9	15	10
Sugar	31	24	25	26	26	25
Lard	14	21	15	10	23	15
Yeast	4	4	5	4	4	5

* One ounce equals 28.35 grams. One hundred grams equal 3.5 ounces.

The bread was mixed in the early evening and baked the next morning. On each occasion the milk bread rose slowly, requiring two or three hours more time than the other. The water made a somewhat whiter and lighter loaf than the milk. All the bread showed a fairly uniform texture, and would have been accepted anywhere as a very good bread.

The loaves were cut up, dried at 50 to 70° C, ground and analyzed by the methods of the Association of Official Agricultural Chemists. The results of the analyses follow:

COMPOSITION OF FRESH BREAD.

Laboratory number.	Kind of bread.	Water—Per cent.	Protein. (N×6.25)—Per cent.	Fat—Per cent.	Carbo-hydrates—Per cent.	Ash—Per cent.	Heats of combustion, determined—Calories.	Nitrogen—Per cent.	Carbo-hydrates*—Per cent.
6115	Water bread................	40.40	8.97	1.13	48.59	.91	2,683	1.43	49.41
6118	Water bread................	40.07	8.81	1.05	49.12	.95	2,704	1.41	49.89
6190	Water bread................	37.84	9.02	1.03	51.35	.76	....	1.44	52.16
	Average	39.44	8.93	1.07	49.69	.87	....	1.43	50.48
6116	Skimmed milk bread......	39.66	9.84	.75	48.58	1.17	2,668	1.57	49.47
6119	Skimmed milk bread.......	38.63	9.80	1.10	48.85	1.62	2,752	1.57	49.70
6191	Skimmed milk bread.......	35.62	10.29	.98	52.02	1.08	....	1.64	52.96
	Average....	37.97	9.98	.94	49.82	1.29	....	1.59	50.72

COMPOSITION OF WATER-FREE BREAD.

Laboratory number.	Kind of bread.	Dry matter—Per cent.	In Dry Matter.						
			Protein—(N×6.25)—Per cent.	Fat—Per cent.	Carbo-hydrates—Per cent.	Ash—Per cent.	Heats of combustion, determined—Calories.	Nitrogen—Per cent.	Carbo-hydrates*—Per cent.
6115	Water bread	59.60	15.05	1.90	81.52	1.53	4,502	2.41	82.84
6118	Water bread........	59.93	14.70	1.75	81.97	1.58	4,511	2.35	83.27
6190	Water bread.................	62.16	14.50	1.67	82.60	1.23	....	2.32	83.88
	Average	60.56	14.75	1.77	82.03	1.45	....	2.36	83.33
116	Skimmed milk bread.......	60.34	16.31	1.25	80.50	1.94	4,423	2.61	81.93
119	Skimmed milk bread	61.37	15.97	1.80	79.57	2.65	4,456	2.55	81.00
6191	Skimmed milk bread.......	64.38	15.97	1.21	81.13	1.69	....	2.55	82.56
	Average.......................	62.03	16.08	1.42	80.40	2.09	....	2.57	81.83

* Assuming protein = N×5.7.

A comparison of the average composition of the water-free breads shows that the most important difference is in the amounts of protein which they contain, the milk bread containing about one-eleventh more protein than the water bread.

THE DIGESTIBILITY OF SKIMMED MILK BREAD.

Rehsteiner and Spirig * have made the only experiments upon the digestibility of skimmed milk bread by the natural method which have come to our notice. In two tests of three days each with a diet of skimmed milk bread, butter and tea they obtained the following results:

NUTRIENTS CONSUMED AND EXCRETED IN THE FECES.

	Dry matter—Grams.	Nitrogen—Grams.	Fat—Grams.	Carbohydrates—Grams.
No. 1:				
In food	1,779.81	39.245	333.36	1,098.42
In feces	52.66	2.33	4.73	....
No. 2:				
In food	1,533.00	34.32	267.39	960.99
In feces	58.90	3.84	8.71	....

DIGESTION COEFFICIENTS OF SKIMMED MILK BREAD AS FOUND BY REHSTEINER AND SPIRIG.

	Dry matter.	Nitrogen.	Fat.
Test 1	97	94	98
Test 2	96	92	93

These figures are lower than we have found for bread with a mixed diet, but as noted on p. 196 in this report, we have found bread when eaten alone not as completely digested as when eaten with other food.

Artificial digestion experiments with pepsin solution were used with two lots of the breads here reported upon and no practical difference in the digestibility of the protein was found. The results follow:

* Corbl. Schweizer Aerzte, 25, pp. 705-710.

DIGESTIBILITY OF THE PROTEIN OF WATER BREAD AND SKIMMED MILK BREAD IN PEPSIN SOLUTION.

Lab. No.		% digested.	
6,115	Water Bread,	95.62	
6,118	Water Bread,	93.79	
	Average,		94.70
6,116	Milk Bread,	94.32	
6,119	Milk Bread,	94.10	
	Average,		94.21

CONCLUSION.

Skimmed milk bread contains more protein (muscle forming food) than water bread.

Skimmed milk bread is as completely digested as water bread. The use of skimmed milk in bread making utilizes a valuable waste product of the dairy.

POLLINATION AND FERTILIZATION OF FLOWERS.*

W. M. Munson.

Several years ago the writer undertook the study of some of the problems connected with the pollination of flowers, and some of the results obtained were published in the report of this Station for 1892. Since that time the pressure of other duties has crowded the work out, but it is now thought possible to make a somewhat systematic study of the subject, and the present paper is designed to touch upon a few of the more salient points and bring together data for work during the ensuing year, rather than to treat any one subject exhaustively.

The peculiar situation of the male sexual element at some distance from the female, and the interposition of a mass of tissue through which the former must penetrate, suggest many problems relative to the coming together of these before and after actual coalescense. The first part of these notes will treat of the histological aspect of the case; the second is a summary of previous work attempted by the writer.

NOTES ON FERTILIZATION.

THE PASSAGE OF THE MALE NUCLEUS FROM POLLEN-GRAIN TO EMBRYO SAC.

On the Character of the Pollen-Grain: It is unnecessary at this time to consider the size, form and external markings of the pollen of different species. But, in general, a pollen grain contains, besides the large asexual vegetative nucleus of the cell, a smaller generative nucleus, and a certain amount of nutritive material—starch, maltose, etc.,—together with diastase and invertase necessary in rendering the latter elements available.

* The basis of this paper was presented before the Society for the Promotion of Agricultural Science at the Boston meeting, 1898.

In the Angiosperms the two nuclei are free in the general cell of the grain, but in Gymnosperms there is a different condition. In the latter as shown by Strasburger,* the pollen-grain, while still in the anther, *e. g.* in *Larix Europæa,* or after it reaches the nucleus, as in Taxus, divides into several distinct cells. The steps in this division are as follows: The undivided pollen-grain first separates into a large and a smaller biconvex cell, the latter being crowded against the side of the wall of the pollen-grain. Soon another cell is cut off from the large one, and pressed closely against the first, both being much flattened, then a third much more strongly arched cell is cut off from the large one. This third is placed over the other two, but instead of flattening out, divides later into a small stalk cell (*Stielzelle*) and a larger body cell.

As a result of the above mentioned divisions of the pollen-grains of Gymnosperms, we find then, at the time of pollination, three cells; the large cell which forms the pollen-tube, the small stalk-cell, and the body cell, which later by division gives rise to two cells containing the male nucleus.

On the Germination of Pollen and the Growth of the Pollen-Tube: The first step of the coming together of the male and the female elements is that of pollination, the conveyance of pollen from the anther to the stigma. The time intervening between this transfer, and the actual process of fertilization, may vary from a few hours in some species, to many months in others. According to Schleiden, *Cereus grandiflorus,* with a style six inches long, requires but a few hours; *Colchicum autumnale,* with a style 13 inches long, 12 hours; *Pinus Sylvestris,* almost as many months.

The fact that the pollen grain after falling upon the stigma, goes through a process of germination, in its gross characteristics comparable to that of a seed, has long been known. In 1871 this germination was carefully studied and demonstrated by Van Tieghem,† who compared the phenomenon to the germination of the spores of lycopods and many ferns, the pollen-tube corresponding to the prothallium of the latter.

---

*Strasburger. Befrucht bei den Phanerogamen, 2.

† Van Tieghem: "Recherches physiologique sur la vegetation du pollen," etc. Ann. des Sci. Nat., (Bot.) 5e Ser., Vol. 12, p. 312. (1871.)

As already suggested, the pollen-grain is provided with a liberal supply of reserve food materials, which during the process of germination are changed and made available for the nutrition of the growing tube. Nor is this supply of food materials confined to the pollen-grain, for the connective tissue of the style is also rich in starch, sugar, maltose, etc. The absence of chlorophyll and the abundant supply of elaborated food materials in the connective tissue, render probable an extra-cellular digestion, depending on the active presence of certain enzymes. It has repeatedly been shown that germinating pollen grains have the power of reducing cane sugar,* while the pollen of certain species growing in weak starch paste has been found to liquify the paste and form maltose.†

J. R. Green of Kew,‡ made an elaborate investigation of the subject in 1893-4. Nearly all pollen examined by him was found to contain diastase. Among the genera named are Lilium, Helleborus, Helianthus, Gladiolus, Anemone, Antirrhinum, Tropæolum, Pelargonium, Crocus, Brownea, Alnus, Tulipa and Clivia. Invertase was found in Helleborus, Narcissus, Richardia, Lilium and Zamia. "During the germination of the pollen, the quantity of both enzymes was found to be considerably increased; in some cases four or five fold."§

But what is the value of all this discussion concerning enzymes? As we know, the tube must make its way to the embryo sac by penetrating the intervening tissue. The enzymes appear to have the double office of dissolving the tissues in the vicinity of the tube, and of acting upon the nutritive materials as already suggested. The fact that in certain species the pollen tube goes between the cells, burrowing through the middle lamella instead of penetrating the cell walls, has led to the suggestion of a cytolytic enzyme, not yet demonstrated. Strasburger || mentions this point in connection with several genera of Caryophylaceæ and Malvaceæ. The presumption in favor

* Van Tieghem: "Inversion du Sucre de Canne par le pollen," Bul. Soc. Bot. de Frence, Vol. 33, p. 216, 1884.

† Strasburger: "Uber fraudartige Bestaubung." Jahrb. f. Wiss. Bot., Vol. 17, p. 94, (1896).

‡ Green: "On the germination of pollen and the nutrition of the pollen-tube." Phil. Trans. Roy. Soc., 1894, p. 385.

§ l. c., p. 387; also abstract, Ann. of Bot., VIII, 226, (1894).

|| Strasburger: Befrucht bei den Phan. Cited by Green, l. c.

of this enzyme is supported by the discovery of such a one, in a species of Botrytis, by Marshall Ward.*

It must not be understood, however, that the tube must always experience difficulty in passing through the connective tissue, since in some genera, especially in those of Liliaceæ, there is a distinct central passage—the pollen-canal.†

In the growing pollen-tube of the Angiosperms the large vegetative nucleus first pushes out and takes its position near the end of the tube. Later the smaller generative nucleus passes by the former, after the growth of the tube is nearly completed, and just before fertilization takes place, it divides into two. In some instances a second division of one of these nuclei has been observed, though as a rule only one of the nuclei is concerned in fertilization. In some cases, however, as shown by Strasburger to be true of *Monotropa Hypopitis*,‡ an oösphere may be fertilized by two male nuclei.

In general, the method of fertilization of Gymosperms is not essentially different from that of Angiosperms, a fact first pointed out by Belajeff§ in the case of *Taxus baccata* and later confirmed by Strasburger || as the general rule. In other words, the nucleus of the pollen tube is asexual, and fertilization occurs by the union of one of the nuclei of the two cells, resulting from the division in the cell-group within the pollen-grain.

Previous to the work above cited, it had been supposed that the nucleus of the pollen-tube was the male sexual nucleus, while the cell-group in the pollen-grain was composed of asexual cells. The misunderstanding concerning the nature of the cell-group and the functions of the nuclei, arose from the erratic behavior of the same in artificial cultures. In all artificial cultures, the cells composing the group were found to retain their position in the pollen grain, thus being unable to reach the oösphere; while the nucleus of the pollen-tube being at the end of the tube, would be in the natural position to fertilize the female nucleus. Belajeff, however, in the work above cited, found that on the

* Marshall Ward: Ann. of Bot. II, 319, (1888).

† This is particularly well shown in Yucca. See Webber, Am. Nat., XXVI, 774 (1892); also Riley, Yuccas and their Pollination, III Rep. Missouri Bot. Gard., pp. 99-158.

‡ Strasburger: Befrucht und Zellth, Taf. IV, fig. 130; also referred to Bef. bei den Phan., 64.

§ Belajeff: Berichte der Deutschen bot. Gesellsh, Bd. IX, 290, (1891).

|| Strasburger: Befrucht bei den Gymnospermen (1892).

nucellus the cells of the pollen of Gymnosperms behave differently.

The fertilization of *Pinus sylvestris*, as worked out by Dixon* in Strasburger's laboratory, may serve as an illustration. "In this species about thirteen months intervene between the time of pollination and that of fertilization."† In the ripe pollen-grains are to be seen a small prothallium cell, (the last formed of the cell group already described), and a large nucleus; the latter passes into the pollen-tube which is formed immediately after pollination. The tubes penetrate a short distance into the hard brownish tissue at the top of the nucellus, where they remain quiescent till the following spring, presenting the appearance shown in fig. 1. Late in April the pollen-tube becomes filled with starch, and the prothallium cell divides, as already noted, into a small stalk-cell; the latter soon separating into two cells of about equal size, the male sexual cells. About the same time the wall of the stalk-cell is ruptured, and its nucleus follows the two sexual cells into the pollen-tube.

The growth of the tubes through the brown tissue at the top of the nucellus is very slow, and at this time the tube often branches two or three times, as shown in the cut; eventually, however, but one branch is continued. The cells of this upper part of the nucellus are relatively poor in starch contents, but the tube is often gorged with starch and the action of the enzymes is evident in the way in which the tubes penetrate the neighboring cells, filling them with a brownish substance.

After leaving the brownish portion of the nucellus, the growth of the tube through the thin walled tissue is comparatively very rapid; the nuclei of the pollen-tube and of the stalk-cell begin to degenerate, and in about ten days—about a month from the time active growth of the tube commenced—the embryo sac was found to have been reached, while in many cases, fertilization had occurred. "When the pollen tube reaches the oösphere," says Dixon,‡ "not only do the sexual nuclei pass into the latter,

* Dixon, H. H.; "Fertilization of *Pinus sylvestris*," Ann. of Bot., VIII, 24, (1894).

† This statement is made by Dixon, and is also given by Strasburger in several of his works (See Practical Botany, p. 306, 2d Eng. Ed. by Hillhouse), but in the work here detailed it would seem that the time is nearer 12 than 13 months. The cones are said to be receptive about the end of May, and as shown by Dixon, fertilization takes place about the same season of the year.

‡ l. c., 27.

but even the two asexual nuclei also. These nuclei persist for a considerable time, and are to be found in the protoplasm of the cösphere after its nucleus has divided several times." As before stated, however, only one of the male nuclei fuses with the female.

It is possible, as has been suggested, that the provision of two sexual nuclei is a condition handed down from the time when pollen-tubes normally branched, and there was a probability of two branches reaching different oöspheres. In Cupressineæ, according to Vines,* "one pollen-tube serves for the fertilization of several female organs; consequently several male gametes are produced, the first division of the generative nucleus in the pollen-tube is followed by an aggregation of protoplasm around each of the two new nuclei, so that two primordial cells are formed. Nucleus division is repeated in the primordial cell nearest the apex of the pollen-tube, without any corresponding cell formation, so that several nuclei are to be found in the dilated apex of the pollen-tube; these, with a certain amount of protoplasm, escape as gametes, and each fertilizes the oösphere of an archegonium."

At the time of fertilization the pollen-tube is perforated by a distinct pit or perforation, first described by Hofmeister,† and later by Strasburger.‡ The same phenomenon has been shown to exist in certain of the Angiosperms, notably, *Gnetum Rumphianum* and *G. ovalifolium*.§ Just before fertilization occurs, radial striæ extend from the nucleus of the oösphere into the surrounding protoplasm; likewise from the male nucleus, this phenomenon apparently preceding the re-adjustment of the centrosomes in each case. Then, when the sexual pro-nuclei unite, the new centrosomes formed lie in a plane perpendicular to the longitudinal axis of the archegonium; the first division of the oösphere occurring in a horizontal plane.

On the Method of Entering the Nucellus.—One point of interest in connection with the passage of the male element, is the

* Vines, S. H.: Physiology of plants, 616 (1886).

† Hofmeister: Pring. Jahrb. f. Wiss. Bot., Bd. 1, p. 71.

‡ Strasburger: Bef. bei den Coniferen, pp. 11-14 (1889).

§ Karsten: Cohn's Beiträge zur Biologie der Pflanzen, Bd. VI, Heft 3, p. 367. Cited by Dixon, *op. cit.*

point at which the pollen-tube reaches the nucellus. As is well known, the normal point of entrance is the micropyle. It is an interesting fact, however, that in some genera, the tube enters through the *chalazal* region—a fact first pointed out by Treub in the case of Casuarina.*

A similar phenomenon occurs in Betula, Alnus, Corylus, and Carpinus as shown by Benson,† and in Juglans as shown by Nawaschin.‡ As yet, however, the subject has received but little attention.

SOME SECONDARY EFFECTS OF POLLINATION.

While the primary object of all pollination is the production of fertile seed, there are certain secondary effects which are of interest to the botanist, and which may often be of great practical value. Some of these secondary results have been detailed in previous reports, but the work actually done here at the Experiment Station may be summarized in this connection.

Immediate Effects of Pollen.—Even before the sexual theory regarding plant reproduction was commonly accepted, the question of the immediate effect of pollen on the form and character of the pistillate parent received attention from careful observers. Early in the 18th century it was thought that the flavor and keeping quality of apples might be changed at will by using different pollen. Bradley§ at that time stated that 'if the Codlin be impregnated with the farina of Pearmain, the fruit so impregnated would last longer than usual and be of a sharper taste.' From that time to the present there has been a sharp controversy concerning this point. The writer's work in this connection has been mainly confined to the Cucurbitaceæ and Solanaceæ, in which groups widely varying types have been crossed, but in no instance has there been observed an immediate effect.

* Treub: "Sur les Casuarinèes et leur place dans le système natural." Ann. du Jard. Bot. de Buitenzorg, x, 145-231. Cited by Benson, l. c.

† Benson, Miss M.: "Embryology of British Amentiferæ." Trans. Linn. Soc., Sec. Ser., 3 (Bot.), 413, (1894).

‡ "Ein neues Beispeil der dialazogamie." Botanisches Australblatt, Bd. 63, p. 353 (1895).

§ Bradley: "New improvements in planting and gardening," p. 18, (7th ed., 1739).

The nature of cucurbitaceous plants is well adapted to show the immediate effects of crossing, if such occur. In a mixed plantation many of the flowers on any individual plant, when left to natural processes, would necessarily receive pollen from very different sources. If, now, there were an immediate effect of pollen, we should expect to find fruits of very different character on any vine. We should expect to find the evidences of the pumpkin upon the fruits of squashes; of the melon upon cucumbers; of the different varieties of the several species upon each other. Such is not the case, however. I have repeatedly lookd for this foreign influence in the current generation, but have never seen it; nor has such influence been observed when several flowers on the same plant were artifically crossed with pollen from different varieties or species. This lack of foreign influence was particularly well shown in crossing the field pumpkin with the ornamental gourd. While, in the current generation, all fruits were similar in form and size, the seedlings were exceedingly variable. Crozier* and Bailey† have repeatedly obtained like results.

In our work with tomatoes and egg plants, extending through several years, there has, in no case, occurred an instance of the immediate effect, other than alteration of form due to insufficient pollen. The accompanying figures, used in a previous report,‡ show very clearly the entire absence of immediate effect when some of the most violent crosses are made.

Fig. 3 represents the "Lorillard," each fruit of which has been crossed by the "Currant," (*Lycopersicum esculentum* $\times$ *L. Pimpinellifolium*). The Lorillard is a smooth nearly spherical variety of medium size, usually weighing from two to four ounces. The Currant, (fig. 6,) is very different both in size and habit. As will be observed, the fruit when crossed by the Currant, is still in every respect typical of Lorillard. The offspring from this cross, however, show unmistakable evidences of the influence of the male parent, in the habit of the plants, in the character of the foliage and flowers, and in the size and character of the fruit.

---

* Ag. Sci. I, 227.

† Bul. 25, Cornell Univ. Exp. Sta. 181 (Dec. 1892).

‡ Rep. Maine Exp. Sta. 1892, pp. 37, *et seq.*

In another instance, figure 4, each of three flowers was crossed with pollen from a different source. "The variety used was the Lorillard. Number 1 received pollen of the same variety, number 2 was given pollen of the Currant, and number 3 from the Peach. As in the previous instance, there is no apparent effect on the form of the fruit; and the seeds gave no indication of different parentage—all were apparently typical Lorillard seeds. In the offspring, the differences are marked. The lines are sharply drawn between the crosses with Peach and Currant, the influence of the respective male parents being very evident, while the Lorillard cross is apparently unaffected by either of the others; indicating that there was no error in the operation, also that there has been no transfer of influence along the short peduncles."*

In an extended series of experiments with egg plants, conducted for three consecutive years at the Cornell University and the Maine Experiment Station, the most widely varying types have been crossed. In no instance, however, has there appeared an immediate effect of the male parent. The little Round White, when crossed with pollen from Black Pekin, differed in no respect from other fruits on the same plant. But the offspring of this cross showed very marked variations. The same facts were observed regarding several other crosses.†

Numerous instances have been reported in which the color of flowers was apparently changed by the action of foreign pollen the current season. Such an instance, however, has never come under the observation of the writer, though numerous crosses have been made with different varieties of Tropæolum, Fuchsia, Silene, Phlox, Petunia, Pelargonium, and other ornamental plants.

The statement made in the previous report upon this subject still holds: "It would be unwise at the present time, to assert that the directing influence of pollen does or does not as a rule extend beyond the fertilization of the seed. It seems not improbable that pollen from a vigorous plant may make an

* Rep. Maine Expt. Station, 1892. p. 39.

† Bailey and Munson, Experiences with egg-plants, Bul. 26, Cornell Univ. Exp. Sta., p. 14; also Rep. Maine Exp. Sta., 1892, p. 81.

imprint of its character on the female organism, which shall be different from that of a less vigorous male parent. It is probable, however, that the vigor and inherent vitality of the plant operated upon may determine whether this be manifested. Some species show apparently unmistakable evidences of the influence of foreign pollen,—this is notably true of peas and Indian corn. On the other hand, cucurbitaceous and solanaceous plants seem to resist all foreign influences; while rosaceous plants are in dispute, with the weight of authority tending to show the absence of immediate influence." This point will be the subject of special attention during the present year.

The Stimulating Influence of Pollen.—Focke says, "Pollen has two actions on the female organs, one on the seeds and one in exciting the growth of the fruit."*

It is a matter of common observation that, as a rule, when pollination fails to result in fertilization, or when pollen is withheld, not only the pistil withers, but the entire flower decays and falls. Instances are not infrequent, however, which point to a responsive action on the part of the pistil or other portions of the flower receiving pollen, while from an insufficient quantity of pollen, lack of affinity on the part of the species crossed, or some other cause which remains to be determined, fertilization does not occur. Examples of this are specially common in all of our cultivated fruits and vegetables, particularly garden beans and in the English forcing cucumber, shown in figures 9 and 5, respectively.

The pepino, *Solanum muricatum,* (fig. 7), is also a case in point. This plant blooms profusely and, under proper conditions, sets a considerable amount of fruit, which, however, is invariably seedless. The writer has made repeated attempts to cross this species with other solanums but thus far without success.

Since the work of Koelreuter in 1765,† little has been done toward determining the actual amount of pollen required for the fertilization of any given species; but in our own work the fact that the amount of pollen applied may have great practical importance in determining form and size of the fruit, as well as

* Die Pflanzen mischlinge, 447.

† Cited by Sachs, Hist. of Botany, 408.

the quantity, has been plainly and repeatedly demonstrated. This fact, which is of special importance to the horticulturist, is particularly well shown by the tomato as seen in figures 10 and 11. Upon the same cluster one flower was given a small amount of pollen—10 to 20 grains—on one side of the stigma; the other was given an excess, the stigma being well smeared. This work was repeated many times and in each case the results were the same. The fruit receiving an abundance of pollen was of normal size and nearly symmetrical in form, while the other was small and deformed. It was further found that the position of the flowers in the cluster has no influence in determining this point.

As already intimated the above notes are given for the purpose of briefly summarizing some of the more prominent features of the subject heretofore considered at this Station, rather than as a report of progress. The latter report will appear in bulletins during the ensuing year. The points for special consideration this year are: The growth of the pollen tube; a revision of the list of species supposed to show immediate effects of pollen; the stimulating action of pollen; the possibility of superfœtation.

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. Observations at Orono were begun in 1869 and the almost unbroken record now covers a period of thirty years.

The weather for 1898 was remarkable in but few particulars. While January and April were cooler than the average, all the other months were warmer than usual, the mean temperature for the year being one and one-half degrees above the average. April, which is here the driest month of the year as regards rain-fall, was unusually wet, while May was remarkable for its small rain-fall, less than one-third the average. The snow-fall for January and February was nearly double the usual amount. 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.

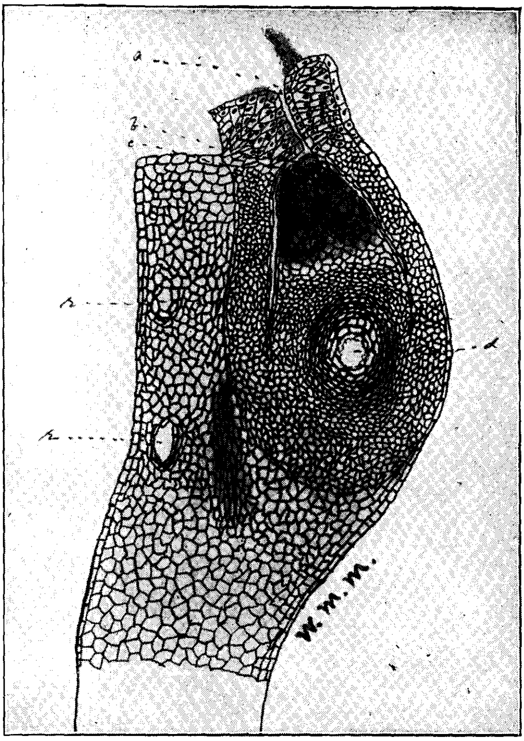


FIG. 1. OVULE OF PINUS SYLVESTRIS, SHOWING THE GROWTH OF THE POLLEN TUBES.

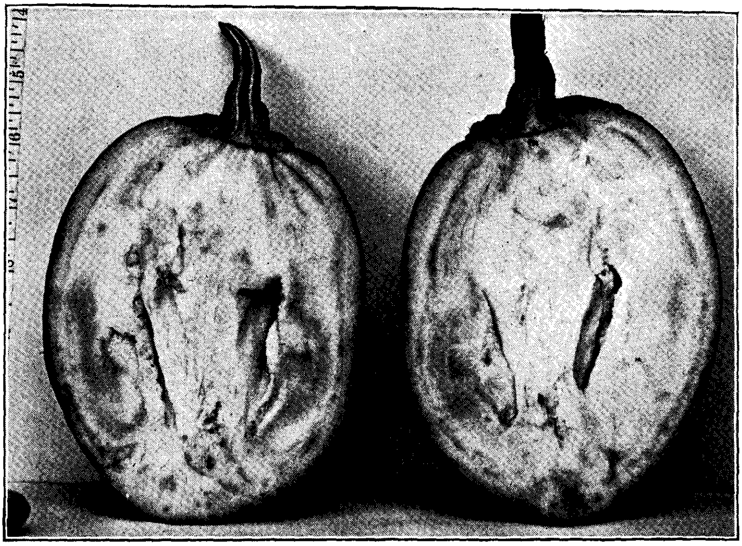


FIG. 2. A SEEDLESS EGG FRUIT.—NOT POLLINATED.

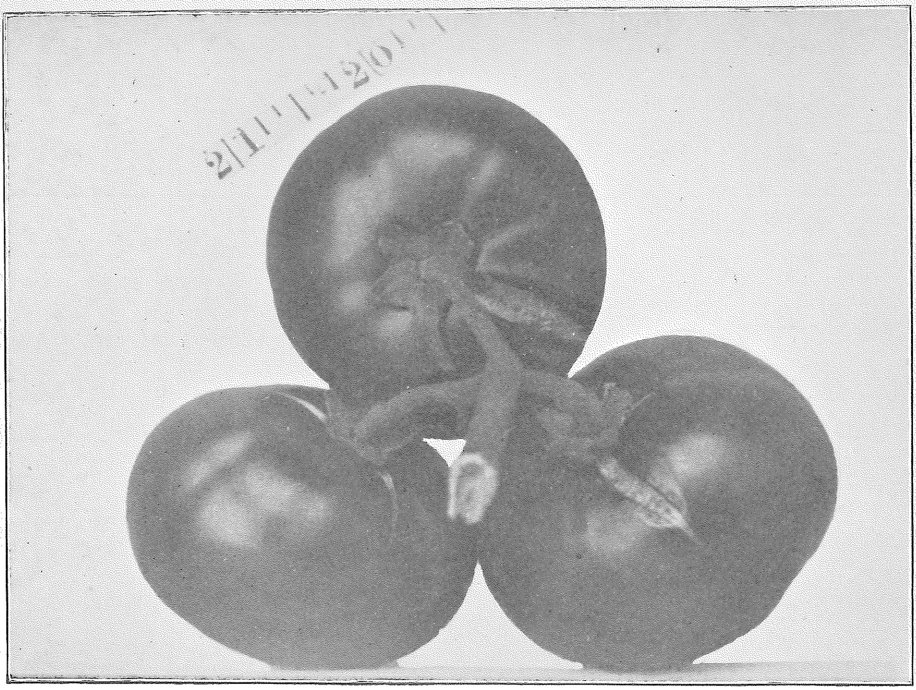


FIG. 3. "LORILLARD" X "CURRANT."—NO IMMEDIATE INFLUENCE OF POLLEN IS SHOWN.

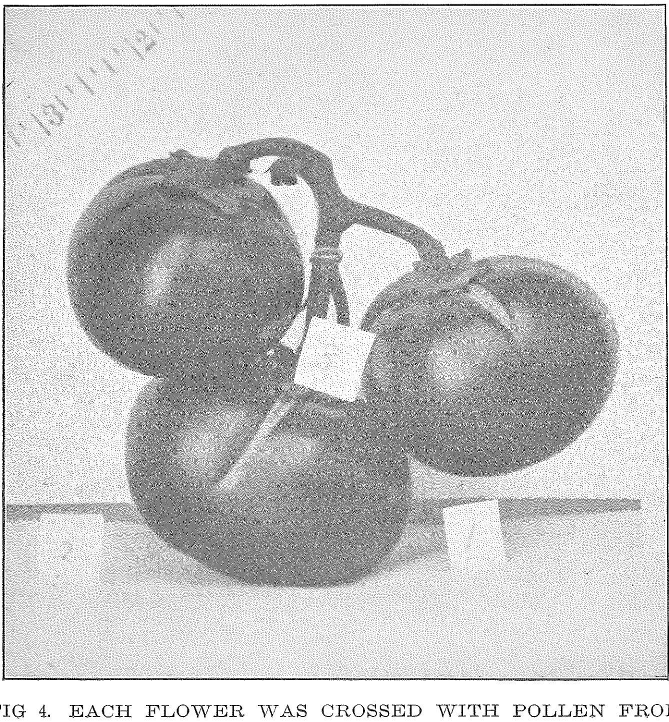


FIG 4. EACH FLOWER WAS CROSSED WITH POLLEN FROM A DIFFERENT SOURCE.

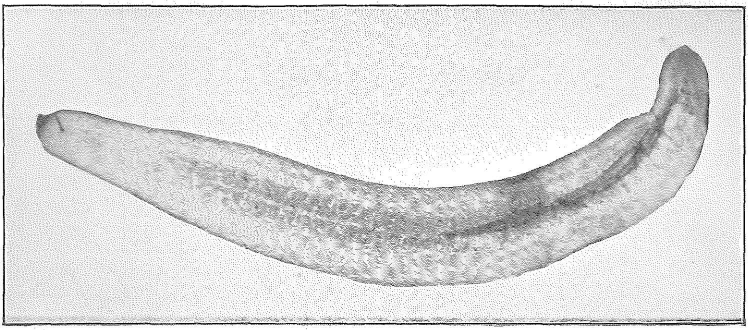


FIG. 5. SEEDLESS CUCUMBER.—NOT POLLINATED.

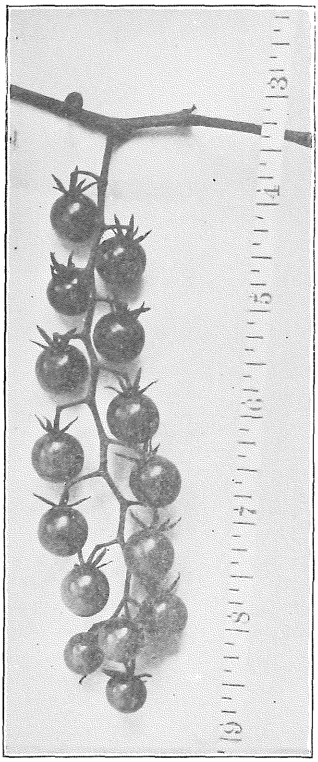


FIG. 6. THE CURRANT TOMATO.

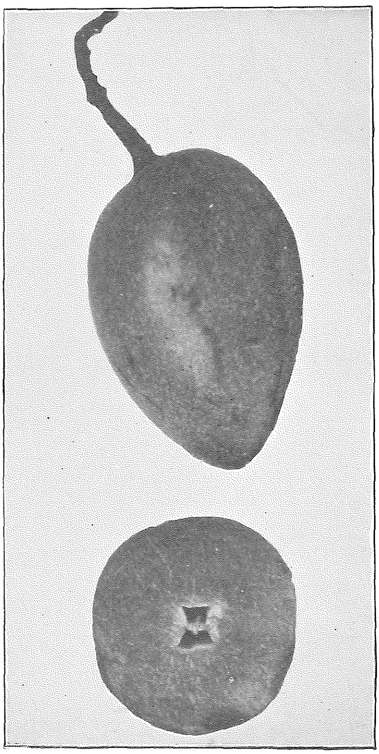


FIG. 7. THE PEPINO.

(*Selanum muricatum*, Ait.)

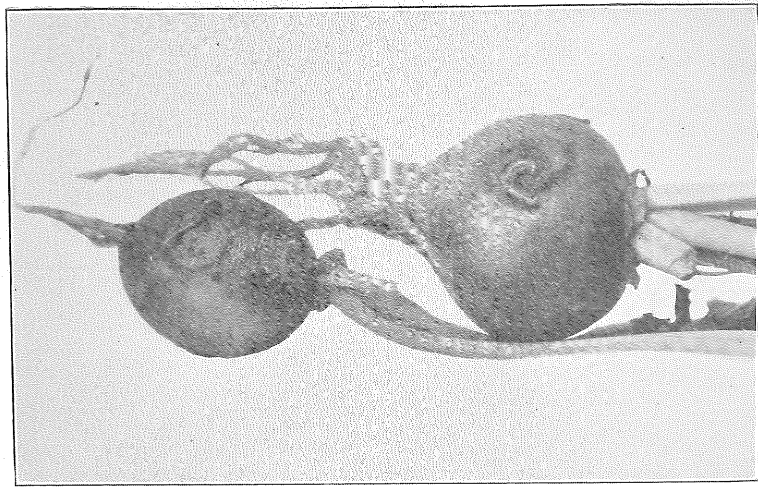


FIG. 8. RADISHES ATTACKED BY MILLIPEDES.

See pages 118 and 163.

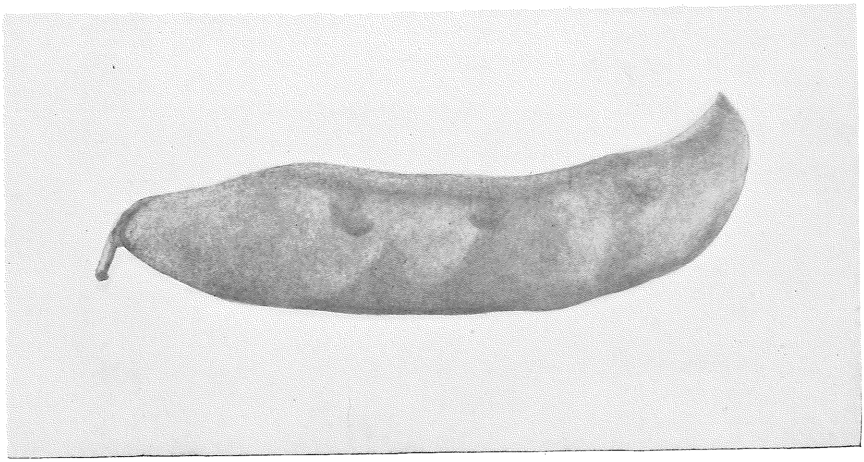


FIG. 9. SEEDLESS LIMA BEAN—NATURAL SIZE.

See page 228.

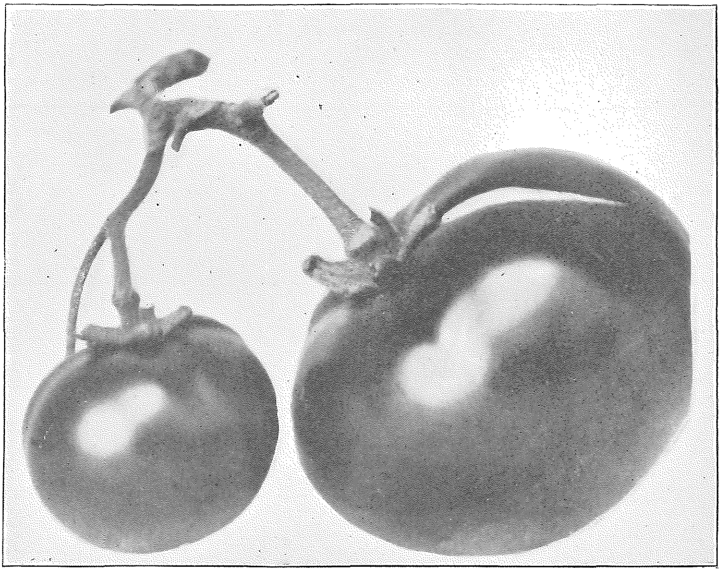


FIG. 10. SHOWING THE INFLUENCE OF AN EXCESS OF POLLEN AS COMPARED WITH A SMALL AMOUNT.

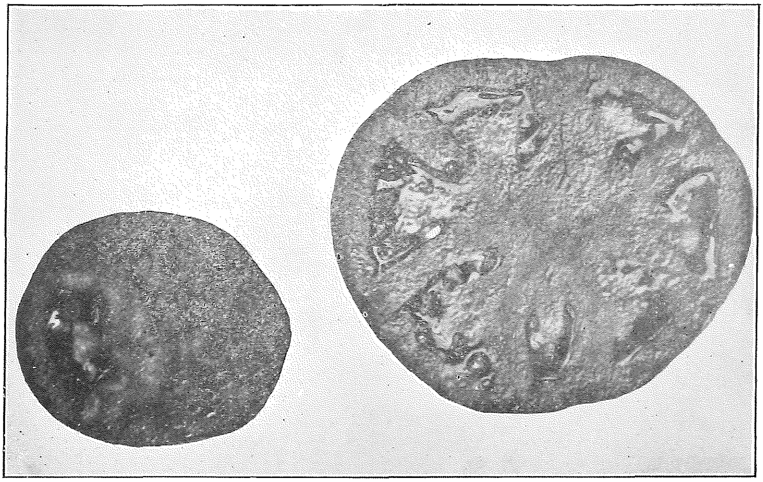


FIG. 11. CROSS SECTION OF FRUITS SHOWN IN FIGURE 10.

METEOROLOGICAL SUMMARY FOR 1898.

Observations made at the Maine Experiment Station.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.	Total.
Highest barometer	30.43	30.43	30.64	30.23	30.19	30.19	30.34	30.10	30.25	30.33	30.35	30.43	30.33	....
Lowest barometer	28.99	28.63	29.33	29.38	29.39	29.15	29.40	29.51	29.45	29.27	29.01	29.02	29.21	....
Mean barometer	29.88	29.89	30.01	29.74	29.80	29.77	29.85	29.79	29.83	29.92	29.81	29.77	29.84	....
Highest temperature	41	47	60	65	76	87	99	85	85	86	55	43	....	....
Lowest temperature	—30	—25	5	9	28	36	39	41	29	19	10	—14	....	....
Mean temperature	13.2	24.3	32.2	38.8	53.1	65.1	68.3	67.3	58.6	47.2	36.3	21.4	43.8	....
Mean temperature for 30 years	16.0	19.3	27.6	40.2	52.4	61.9	66.9	64.9	57.0	45.7	34.2	21.2	42.3	....
Total precipitation in inches	6.32	8.05	2.23	4.95	1.02	5.28	2.44	3.14	2.29	6.19	6.84	1.07	....	49.82
Mean precipitation for 30 years	4.28	4.12	4.17	2.94	3.43	3.59	3.31	3.79	3.38	4.05	4.53	3.78	....	45.37
No. days with precip. of .01 inch or more	9	9	7	12	4	10	5	7	5	7	8	4	....	87
Snow fall in inches	42.5	39.0	13.0	9.0	....	....	....	....	....	....	6.0	7.0	....	116.5
Average snow fall for 30 years	23.6	22.1	17.7	6.2	....	....	....	....	....	1.0	7.8	17.3	....	95.7
Number of clear days	14	8	18	13	12	9	14	12	14	9	7	11	....	141
Number of fair days	4	2	5	5	5	10	7	12	13	10	3	10	....	86
Number of cloudy days	13	18	8	12	14	11	10	7	3	12	20	10	....	138
Total movement of wind in miles	5453	6174	5653	7798	6499	5819	5560	4833	5094	6780	7476	5991	....	....

REPORT OF THE TREASURER.

Maine Agricultural Experiment Station in account with the United States appropriation, 1897-8.

DR.

To receipts from the Treasurer of the United States as per appropriation for the fiscal year ending June 30, 1898, as per act of Congress approved March 2, 1897		$15,000 00

CR.

By salaries:		
(a) Director and administration officers	$1,740 01	
(b) Scientific staff	4,998 29	
(c) Assistant to scientific staff	1,125 85	
(d) Special and temporary services	23 30	
Total		$7,887 45
Labor:		
(a) Monthly employees	$920 00	
(b) Daily employees	381 27	
Total		1,301 27
Publications:		
(a) For printing	$158 50	
(b) Printing annual report	-	
(c) For envelopes for bulletins and reports	217 37	
(d) Other expenses	3 85	
Total		380 02
Postage and stationery		430 63
Freight and express		253 70
Heat, light and water		742 60
Chemical supplies:		
(a) Chemicals	$275 85	
(b) Other supplies	314 19	
Total		590 04
Seeds, plants and sundry supplies:		
(a) Agricultural	$66 65	
(b) Horticultural	371 12	
(c) Botanical	46 15	
(e) Miscellaneous	33 67	
Total		517 59

Fertilizers		$172 32
Feeding stuffs		455 70
Library		179 53
Tools, implements, and machinery		234 27
Furniture and fixtures		295 79
Scientific apparatus		201 08
Live stock:		
(f) Sundries		250 02
Traveling expenses:		
(a) In supervision of Station work	$104 99	
(b) In attending various meetings	60 00	
Total		164 99
Contingent expenses		193 00
Building and repairs:		
(a) New buildings		750 00
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, 1898; 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.

A. W. HARRIS, *Auditor.*

Maine Agricultural Experiment Station in account with Fertilizer Inspection for the year ending December 31, 1898.

Dr.		
To receipts for licenses	$2,515 00	
Balance to account of 1899	20 04	$2,535 04
Cr.		
By collection and analyses of samples	$1,488 80	
Executive and office expenses	700 00	
Balance carried from 1897 account	346 24	$2,535 04

Maine Agricultural Experiment Station in account with Feed Inspection for the two years ending December 31, 1898.

Dr.		
To receipts for inspection tags, 1897	$1,834 66	
Receipts for inspection tags, 1898	1,541 02	
Balance to account of 1899	1,014 01	$4,389 69
Cr.		
By collection and analyses of samples	$1,921 82	
Tags and printing	1,286 62	
Executive and office expenses	1,181 25	4,389 69

Maine Agricultural Experiment Station in account with Creamery Inspection for the year ending December 31, 1898.

DR.

To funds for calibrating glassware	$92 07

CR.

By expense calibrating glassware	$92 07

Maine Agricultural Experiment Station in account with "General Account" for the year ending June 30, 1898.

DR.

To balance from 1896-7	$1,682 73	
Sales of produce, etc	1,158 35	
	269 49	$3,110 57

CR.

By salaries	$1,470 40	
Labor	71 87	
Postage and stationery	21 85	
Freight and express	10 26	
Chemical supplies	103 52	
Seed, plants, and sundry supplies	121 42	
Tools, implements and machinery	24 44	
Furniture and fixtures	51 77	
Live stock	9 87	
Local telephones	76 47	
Buildings and repairs	350 16	
Balance to 1898-9 account	798 54	3,110 57

APPENDIX.

Annual Report of the State Pomological Society.

1898-99.

CONTENTS.

REPORT OF THE SECRETARY.

The phenomenal crop of fruit borne in 1896 was followed in 1897 by a small yield in all parts of the State. Some with good reason claim that the trees were allowed to overbear and in consequence were so exhausted that they were not strong enough to bear another crop without time to recuperate. In 1897 there was a visitation of tent caterpillars (clisiocampa Americana, and clisiocampa sylvatica.) Some fought the insects with more or less success, but in the absence of effective remedies the insects matured and large numbers of eggs were deposited in fruit and forest trees. From these large numbers of insects made their appearance this year, and in many cases the foliage was completely stripped from the trees. Although spraying had been urged as an effective remedy, few were prepared with apparatus to employ it. The result was that many of the largest orchards hardly bore fruit enough for family use. Fortunately all parts of the State were not so much affected by these pests, and some parts not at all. Aroostook county is reported as shipping some fruit to other parts of the State. Waldo, Penobscot, Knox, Lincoln, Northern Somerset, Northern Franklin, Northern Oxford, Sagadahoc, Southern Cumberland and York counties had some fruit, though lacking much of a full crop. The figures representing the fruit crop in the State have been misleading. Some of these placed the yield higher than 50 per cent., but so far as your secretary can learn the crop fell much below their figures. The season was favorable for the growth of foliage and fruit where any was set, and at the close of the season the trees were looking far better than one could expect.

THE PROSPECT FOR NEXT YEAR.

It is believed by many that large numbers of caterpillars were destroyed by some parasites. This in some localities is true, but an examination of the trees shows many clusters of eggs.

In some cases the farmers are prepared to fight the insects, so their ravages are likely to be less. It is too much to expect of our trees that they will not be weakened from being obliged to bear a second crop of leaves. Some of them seem to have well developed blossom buds, but it is doubtful if they will have strength to produce much fruit.

As a matter of fact there are not a large number of our farmers who are making a business of growing fruit. They nearly all have more or less trees, but the culture and care of the trees necessary to insure good and regular crops of fruit are wanting. The secretary observed the contrast in visiting some of the orchards in Nova Scotia, where good culture and care were the rule and not the exception. Seeing how much was being done there suggested that these methods and other methods, for that matter, should be given conspicuous place in the program for the winter meeting. The fruit exhibited from there afforded an interesting object lesson for study and comparison. To the secretary this seems the all-important subject to-day, not more trees, but intelligent culture of those we now have. The specimens shown from Nova Scotia were nearly or quite free from scab. It is not the result of chance, but a skillful use of the spray pump that secured it.

OUR EXHIBITIONS.

As you are aware only the Rose and Strawberry meeting has been held. This occurred at Augusta, the smaller halls of the city building being furnished by the city without charge for the purpose. There is some difficulty in selecting a date that will cover the season of maturity in all parts of the State. The exhibits were of excellent quality, but there were fewer contributors than we hoped in consequence. The flower exhibition was a good one and under the direction of Miss Sanborn was arranged with excellent taste and to good effect. Many people came in to see the exhibition during the afternoon and evening, while those who chose enjoyed the papers and discussions. By courtesy of Supt. Sanborn of the Insane Hospital, those in attendance the day before were invited to spend the afternoon at the hospital grounds. Mr. Allen, the efficient gardener, took special pains to show us over the premises. The occasion was made very pleasant and profitable in consequence of this hospitality and suggests in emphatic terms the desirability of more general field work in connection with our meetings and exhibitions.

The executive committee were unanimous in declining the invitation from the trustees of the State Agricultural Society to hold the usual autumn exhibition in connection with the State Fair. The terms proposed were of such a nature as to make the cost of the exhibition more than our society could afford to pay. A circular in detail was prepared by the secretary and sent out to members, during the summer.

In the absence of authority to do otherwise the executive committee decided to hold the autumn exhibition and winter meeting together, and by invitation of Skowhegan Grange we assembled in their beautiful and well equipped halls. The success of this meeting suggests, that it may be better hereafter to have the annual exhibition occur at a time when it is possible to show the public the superlative excellence of Maine fruit instead of half grown, poorly colored specimens, that can only do the cause of fruit growing irreparable injury in the future as they have done in the past.

LEGISLATION AGAINST INSECTS AND FUNGI.

In several states the injuries sustained by the attacks of insects and the growth of fungi have resulted in the passage of laws to control and so far as possible destroy these common foes. The laws in some cases make it the duty of orchardists and others to destroy the pests found on their own premises. Other states, like Massachusetts and California, have made liberal appropriations with which to fight and destroy troublesome insects and fungi. Feeling that these matters are not local, there are many who are now urging upon Congress the passage of general laws that shall apply to all the states. Fruit growers in other states have solicited the influence of our society to insure the same, but as yet no action has been taken in the matter. The time seems drawing near when there will be a demand for something of the sort.

THE OUTLOOK.

There is one thing more of which I am prompted to speak, as secretary of the society. It has been my pleasure several times in the past to say more or less upon the same subject. It is the outlook for fruit culture in Maine. I am not an optimist, by any means, neither am I a pessimist, when I say that the outlook is good. It is good in just the same sense as dairying or stock-growing. In each, well-directed efforts in this State have paid the farmers well. The richest farming towns in Maine are those in which the most intelligent production of the dairy and orchard have prevailed. They lead now and will continue to lead in the future.

Success here means no chance affair. It will come to him whose skill and industry overcome the innumerable difficulties by which fruit growing is beset. First of all, it does not mean the setting of more trees but it does mean the most skillful culture of those now standing in our orchards. We have trees enough until we know how to make them produce the best fruit. The time has gone by when nature will fill our baskets without effort on our part. There are two things involved in this—one is to raise more fruit from our trees, and the other is to make it better. It is with reference to these things that the program for our present meeting was largely shaped—and the evidence shown you on these points, I hope, will be conclusive.

The second essential is to handle and market your fruits to the best advantage. The efforts of several of our fruit growers to organize an effective fruit growers' association for disposing of our fruits did not meet with general approval. But the time is coming when fruit growers will feel the need of such an organization. The seed sown here will surely grow, and the efforts will not have been in vain. In closing, I wish to emphasize, under this head, the importance of offering for sale honest fruit, i. e., fruit that in all respects shall be just as represented. If it is No. 1 on the barrel head make the fruit so inside. It will do no harm to sell No. 2 or No. 3 fruit, but scrupulous honesty must prevent your getting the No. 2 or No. 3 into the No. 1 barrel. This matter of packing is suggested by some recent reports from the English markets, where scabby apples made their appearance. They did not come from Maine, so it becomes my duty only to emphasize the lesson the loss to the shippers caused. The wisest course is not to allow a barrel of inferior fruit to leave the farm under any circumstances, and the growers, if they will, can control this fully. Your secretary hopes the fruit growers of Maine will do it.

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 county, Edward Tarr, Castle Hill; Cumberland county, T. M. Merrill, West Gloucester; Franklin county, F. D. Grover, Bean; Hancock county, Mrs. S. L. Brimmer, Mariaville; Kennebec county, E. A. Lapham, Pittston; Knox county, Alonzo Butler, Union; Lincoln county, H. J. A. Simmons, Waldoboro'; Oxford county, Lemuel Gurney, Hebron; Penobscot county, W. M. Munson, Orono; Piscataquis county, H. L. Leland, East Sangerville; Sagadahoc county, A. P. Ring, Richmond Corner; Somerset county, F. E. Nowell, Fairfield; Waldo county, Fred Atwood, Winterport; Washington county, J. F. Sprague, Charlotte; York county, 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.

OFFICERS FOR 1899.

President—W. M. MUNSON, Orono.

Vice Presidents—S. H. DAWES, Harrison; D. P. TRUE, Leeds Center.

Secretary—ELIJAH COOK, Vassalboro.

Treasurer—CHARLES S. POPE, Manchester.

Executive Committee—The President and Secretary, *ex-officio;* John W. True, New Gloucester; Miss G. P. Sanborn, Augusta; L. F. Abbott, Lewiston.

Trustees—Androscoggin, John Briggs, Turner; 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, C. A. Arnold, Arnold; 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.

MEMBERS OF THE SOCIETY.

NOTE.—Any errors or changes of residence should be promptly reported to the Secretary. Members will also confer a favor by furnishing the Secretary with their full Christian names where initials only are given.

LIFE MEMBERS.

Andrews, A. Emery.............Gardiner
Andrews, Charles E..............Auburn
Arnold, C. A.........................Arnold
Atherton, Wm. P................Hallowell
Atkins, Charles G..............Bucksport
Atwood, Fred.................Winterport
Averill, David C..................Temple
Bailey, W. G.......................Freeport
Bennoch, John E...................Orono
Bisbee, George E..................Auburn
Blanchard, Mrs. E. M...........Lewiston
Boardman, Samuel L............Augusta
Briggs, John..........................Turner
Burr, John.........................Freeport
Butler, Alonzo.......................Union
Chandler, Mrs. Lucy A..........Freeport
Chase, Henry M., 103 Federal St., Portland
Chase, Martin V. B..............Augusta
*Cole, Horatio G............Boston, Mass
Corbett, Herman............Farmington
Crafts, Moses.......................Auburn
Crowell, John H..............Farmington
Cummings, Mrs. Anthony........Auburn
Dana, Woodbury S..............Portland
Dawes, S. H......................Harrison
DeRocher, Peter.......Bradentown, Fla
Dirwanger, Joseph A...........Portland
Dunham, W. W..................North Paris
Dyer, Milton..............Cape Elizabeth
Emerson, Charles L........South Turner
Farnsworth, B. B................Portland
Frost, Oscar F..................Monmouth
Gardiner, Robert H........Boston, Mass
George, C. H.........................Hebron
Gilbert, Z. A...................North Greene
Goddard, Lewis C.............Woodfords
Grover, Franklin D......................Bean
Gurney, Lemuel.....................Hebron
Hackett, E. C..............West Gloucester
Hall, Mrs. H. A......................Brewer
Hanscom, John..........................Saco
Harris, N. W.........................Auburn
Harris, William M.................Auburn
Harvey, F. L..........................Orono
Hobbs, M. Curtis......West Farmington
Hoxie, James S...........North Fairfield
Hoyt, Mrs. Francis.............Winthrop
Jackson, F. A.......................Winthrop
Johnson, Isaac A...................Auburn
Keene, Charles S.....................Turner
Knowlton, D. H.................Farmington
Lapham, E. A........................Pittston
Litchfield, J. H.......................Auburn
Lombard, Thurston M............Auburn
Luce, Willis A...............South Union
McLaughlin, Henry..................Bangor
Merrill, T. M............West Gloucester
Mitchell, Frederick H..............Turner
Moody, Charles H..................Turner
Moore, William G.............Monmouth
Moor, F. A..........................Waterville
Morton, J. A..........................Bethel
Page, F. W...........................Augusta
Parsons, Howard G.......Turner Center
Perley, Chas. I....................Cross Hill
Pope, Charles S...............Manchester
Prince, Edward M.....West Farmington
Pulsifer, D. W........................Poland
Purington, E. F........West Farmington
Richards, John T..................Gardiner
Ricker, A. S............................Turner
Roak, George M.....................Auburn
Robinson, Henry A...............Foxcroft
Rolfe, Samuel.....................Portland
Sanborn, Miss G. P...............Augusta
Sawyer, Andrew S.......Cape Elizabeth
Sawyer, George B...............Wiscasset
Simmons, H. J. A...............Waldoboro
Skillings, C. W.............North Auburn
Smith, Henry S.................Monmouth

*Deceased.

LIFE MEMBERS—CONCLUDED.

Snow, Mary S........................ Bangor
Starrett, L. F .... Warren
Stetson, Henry ....Auburn
Stanley, Charles .... Winthrop
Stanley, O. E..................... Winthrop
Stilphen, Asbury C................Gardiner
Strout, S. F .... West Falmouth
Taylor, Miss L. L., (Lakeside) Belgrade
Thomas, William W., Jr.. ......Portland
Thomas, D. S...............North Auburn
Thurston, Edwin...... West Farmington
Tilton, William S...........Boston, Mass
Townsend, Mrs. B. T............Freeport
True, Davis P...............Leeds Center
True, John W ....New Gloucester
Vickery, James...................Portland
Vickery, John. ....Auburn
Wade, Patrick.......................Portland
Walker, Charles S ....Peru
Walker, Elmer V ....Oxford
Waterman, Willard H......East Auburn
Wheeler, Charles E.........Chesterville
Whitney, Edward K.............Harrison
Woodman, George W.............Portland
Yeaton, Samuel F .....West Farmington

ANNUAL MEMBERS, 1897.

Bishop, Frank I................. Winthrop
Blanchard, Mrs. E. M........... Lewiston
Carll, E. C............................ Buxton
DeCoster, Virginia........North Auburn
Fairbanks, H. N....................Bangor
Grant, Mrs. Benson. ....Lewiston
Jewell, H. W ....Farmington
King, Mrs. L. M................South Etna
Legrow, Miss G...................Norway
Lemont, J. M ....West Bath
Litchfield, Jennie E............Winthrop
Merriam Ernest............... Brunswick
Miller, Chas. A ....East Union
Nickerson, Eva B.................Houlton
Norris, Mrs. Herbert C .... Wayne
Nowell, F. E.......................Fairfield
Page, F. W.........................Augusta
Ring, A. P..............Richmond Corner
Stanton, Chas. B................ Winthrop
Sturgess, C. G.......................Auburn
Toothaker, L. P ....Simpson's Corner
Whitman, Emerson............. Lewiston
Whittier, Phineas.....Farmington Falls
Wood, Elliot ....Winthrop

ANNUAL MEMBERS, 1898.

Abbott, L. F .... Lewiston
Beal, Lewis...................Skowhegan
Beal, S. H ....Skowhegan
Benson, Mrs. G. S ....Skowhegan
Burr, Perez.........................Freeport
Churchill, E. P..................Hallowell
Cook, Elijah..................Vassalboro
Crowell, Mrs. E. H............Skowhegan
Dudley, J. W....................Castle Hill
Eaton, Anna A ....Augusta
Jewett, Frank W ....Hallowell
Kyes, Mrs. R. W...............North Jay
Litchfield, L. K.............. Winthrop
Macomber, Arthur C...........North Jay
McKeen, B. Walker..............Augusta
Munson, W. M ....Orono
Niles, Silas H.....................North Jay
Nowell, F. E ....Fairfield
Paine, Mrs. E. E ....Jay
Shepard, L. T..........................Orono
Tarr, Edward......................Castle Hill
Titcomb, B. M .... Farmington
Toothaker, L. P ....Simpson's Corner
Wallis, Belle ....Brewer
Young, Bert L.....................Augusta

TREASURER'S REPORT.

RECEIPTS.

1898.		
January 1	Received from Treasurer, 1897............	$63 43
	Farmington National Bank, interest on stock............	8 00
February 1 ...	Farmington Water Company, interest on stock	4 00
	Mary S. Snow, fee as life member..........................	10 00
	Mrs. R. W. Keyes, North Jay, fee, annual member.........	1 00
	Mrs. E. E. Paine, Jay, fee, annual member..................	1 00
	S. H. Niles, North Jay, fee, annual member	1 00
	A. C. Macomber, North Jay, fee, annual member	1 00
March 29, ...	Geo. E. Webber, Clinton, fee, annual member	1 00
February.....	State stipend......	1,000 00
May 25........	Wiscasset Savings Bank	135 84
July 10........	Farmington National Bank, interest on bank stock........	10 00
July 13........	Belle Wallis, Brewer, fee, annual member..................	1 00
	Anna A. Eaton, Augusta, fee, annual member........	1 00
	Frank W. Jewett, Hallowell, fee, annual member.........	1 00
	E. P. Churchill, Hallowell, fee, annual member	1 00
	Bert L. Young, Augusta, fee, annual member	1 00
August 1......	Farmington Water Company, interest on stock............	5 00
October 1.....	Gardiner National Bank, interest on stock..................	3 00
December 30 .	F. W. Page, fee for life membership.......	10 00
	J. W. Dudley, Castle Hill, fee, annual member	1 00
	Edward Tarr, Mapleton, fee, annual member	1 00
	L. P. Toothaker, Simpson's Corner, fee, annual member..	1 00
	F. E. Nowell, North Fairfield, fee, annual member	1 00
	Mrs. G. S. Benson, Skowhegan, fee, annual member.......	1 00
	B. M. Titcomb, Farmington, fee, annual member	1 00
	Mrs. E. H. Crowell, Skowhegan, fee, annual member......	1 00
December 28 .	L. K. Litchfield, Winthrop, fee, annual member	1 00
	L. F. Abbott, Lewiston, fee, annual member	1 00
	E. Cook, Vassalboro, fee, annual member.......	1 00
	W. M. Munson, Orono, fee, annual member.................	1 00
	Percy Burr, Freeport, fee, annual member..................	1 00
	L. J. Shepherd, fee, annual member..	1 00
	B. W. McKeen, Augusta, fee, annual member	1 00
		$1,273 27

EXPENDITURES.

1898.		
January 2 ...	Paid D. H. Knowlton, on account of salary	$100 00
February 17 ..	Premiums at Winter Meeting	36 75
	G. P. Sanborn, expenses as Executive Committee to date.	7 10
	E. W. Wooster, expenses at Winter Meeting..............	10 30
	Chas. S. Pope, expenses as Treasurer	6 30
	W. M. Munson, expenses at Winter Meeting...............	5 00
	Geo. T. Powell, services and expenses at Winter Meeting.	45 00
	F. S. Adams, expenses and services at Winter Meeting ...	4 25
	E. Cook, expenses and services at Winter Meeting	2 80
	Mary S. Snow, expenses at Winter Meeting.	14 80
	A. L. Lane, services and expenses at Winter Meeting	8 35
	D. H. Knowlton, express, postage & expn's as Sec'y to date	17 01
	F. P. Jordan, b'd of officers & speakers at Winter Meeting	24 75
February 18 ..	C. H. George, expenses as Executive Committee to date..	6 10
	A. E. Andrews, expenses as Executive Committee to date	9 60
	J. W. True, expenses as President to date..................	3 40
	Augusta Safe Deposit and Trust Company, box rent......	5 00

EXPENDITURES—CONCLUDED.

March 4	D. H. Knowlton, balance of salary for 1897	$25 00
April 1	Emma L. Holbrook, reporting Winter Meeting at No. Jay.	20 00
April 30	D. H. Knowlton, services as Secretary for the year 1898	50 00
June 1	Deposit, Augusta Safe Deposit and Trust Company	135 84
July 9	W. M. Munson, expenses at Strawberry Meeting	3 30
	L. J. Shepherd, expenses at Augusta	3 30
July 12	D. H. Knowlton, expenses as Secretary	20 60
July 13	Maine Farmer Pub. Co., printing for Strawberry Meeting.	6 00
	Premiums of Strawberry and Rose Meeting	43 50
	Arnold & Pinkham, board of officers and speakers	11 45
	J. W. True, expenses as President	4 35
	C. H. George, expenses as member of Ex. Committee	8 70
August 25	Emma L. Holbrook, stenographer at Strawberry Meeting	8 00
October 12	A. E. Andrews, expenses as member of Ex. Committee	6 50
	B. T. Townsend, expenses as committee on new work	2 85
	W. A. Jackson, storage of exhibition fixtures	5 00
	Smith & Reid, for binding transactions—1897	7 87
	Wm. Barnes, trucking exhibition fixtures for storage	4 50
December 30	R. W. Starr, expenses at Winter Meeting	16 00
	Miss Blanche A. Wright, serv. and exp. at Winter Meeting	8 00
	A. H. Kirkland, services and expenses at Winter Meeting	25 30
	E. Cook, expenses at Winter Meeting	1 90
	W. M. Munson, expenses at Winter Meeting	2 60
	Lucius J. Shepherd, expenses at Winter Meeting	5 20
	Lewiston Journal Company, printing premium list, etc	13 00
	Knowlton, McLeary & Co., printing to date	28 50
	D. H. Knowlton, expenses as Secretary	33 02
	J. W. True, expenses as member of Executive Committee	5 45
	C. H. George, expenses as member of Ex. Committee	7 90
	G. P. Sanborn, expenses as member of Ex. Committee	22 30
	J. O. Smith & Co., printing posters and postage	4 22
	Dora M. Goodwin, services as clerk at Winter Meeting	6 00
	American Express Co., charges on fruit for exhibition	8 55
	Hotel Coburn, bills of officers & speakers at Winter Meeting	50 55
	J. W. True, storage bill on cases and exhibition fixtures	7 00
	D. H. Knowlton, salary for 1898	100 00
	A. E. Andrews, expenses as Executive Committee	5 20
	G. P. Sanborn, expenses to Skowhegan Winter Meeting	1 35
	Chas. S. Pope, premiums awarded at Skowhegan	164 00
	D. H. Knowlton, expenses on Nova Scotia fruit	5 00
	Chas. S. Pope, salary and expenses as Treasurer	32 16
	Cash on hand	46 80
		$1,273 27

PERMANENT FUND.

	DR.
To stock First National Bank, Farmington	$400 00
Merchants National Bank, Gardiner	100 00
Farmington Water Company	100 00
Augusta Safe Deposit and Trust Company	670 00
	$1,270 00
Loss by scale down in stock of Merchants National Bank, Gardiner	100 00
	$1,370 00
	CR.
By 135 life members to January 1, 1898	$1,350 00
Mary S. Snow, Bangor	10 00
F. W. Page, Augusta	10 00
	$1,370 00

CHAS. S. POPE, *Treasurer.*

CERTIFICATE OF AUDITING.

FINANCIAL CONDITION OF SOCIETY.

Bounty due from the State	$1,000 00
Due from the Maine State Agricultural Society	150 00
Permanent fund	1,270 00
Property owned by the Society	250 00
Interest due	30 00
Cash in treasury	46 80
	$2,746 80

No liabilities so far as known to your Executive Committee.

JOHN W. TRUE,
D. H. KNOWLTON,
A. E. ANDREWS,
G. P. SANBORN,
C. H. GEORGE,
Executive Committee.

BUSINESS TRANSACTIONS.

STRAWBERRY AND ROSE MEETING.

July 6, 1898. Met in accordance with announcements in council chamber of City Hall, Augusta. The following resolution was passed:

Resolved, That we hereby extend our thanks to the Maine Central and Somerset Railways for one fare rates over their lines; to the proprietors of the Augusta House and City Hotel for reduced rates; to the newspapers of the State for their notices of this meeting, and to the city of Augusta for the elegant rooms for our meetings.

ANNUAL MEETING.

Held in Grange Halls, Skowhegan, December 27, 28 and 29, 1898.

At the opening session the president appointed the following committees: On Resolutions—Mrs. M. L. Purington, West Farmington; Chas. S. Pope, Manchester; S. H. Dawes, Harrison.

On Unbound Transactions—Prof. Elijah Cook, Vassalboro; Miss G. P. Sanborn, Augusta; Prof. W. M. Munson, Orono.

On Matters from the American Pomological Society, etc.—Chas. E. Wheeler, Chesterville; D. P. True, Leeds Center; F. E. Nowell, Fairfield.

The annual meeting called to act upon the following articles, met in Grange Hall, December 29, 1898, at 10 o'clock, A. M.

Article I. To listen to any reports committees and officers may have to make and take action thereon.

Article II. To elect officers for the year 1899.

Article III. To transact any other business that may legally come before said meeting.

Under article I, the secretary offered an informal report and was given permission to revise and extend so as to include the present meeting.

The treasurer made an informal report showing the balance in his hands at the present time, and it was accepted.

The committee chosen at last winter meeting to consider the new plan of work for the society reported, as follows, by D. H. Knowlton, and the report was accepted.

REPORT.

To the Members of the Maine State Pomological Society:

The following extract taken from the records of our last winter meeting will make clear to you how our committee came into being and the object of its mission.—"After the reading of Mr. Gilbert's paper and discussion thereon, Mr. Andrews made the following motion and it was given a passage: 'That Mr. Gilbert's plan for new work be submitted to a special committee of three with instructions to report at the annual meeting of the society.' The president then appointed D. H. Knowlton, Mrs. B. T. Townsend, Freeport, and Chas. E. Wheeler, Chesterville, said committee."

Again, in view of the failure to perfect satisfactory exhibition arrangements with the trustees of the Maine State Agricultural Society, the executive committee of the Maine State Pomological Society at their meeting held in Auburn, April 26th and 27th, it was voted: "That the special committee appointed on Mr. Gilbert's paper be requested to report to the executive committee at an early day their plan of work for the society."

Your committee, having attended to the duty assigned them, beg leave to offer their report at this time.

Under our incorporation the Maine State Pomological Society was "constituted a corporation for the promotion of fruit culture." The restrictions are contained in the second section, which says: "Said society shall have all the rights, privileges and powers conferred by the laws of this State upon county and local agricultural societies, and shall be subject to all liabilities imposed by existing laws upon such societies, so far as the same are applicable to the objects of this society."

The by-laws require in

ARTICLE III—MEETINGS.

"Section 1. The Annual Meeting of the Society shall be held at the place and during the time of the Annual Autumn State Exhibition, and such notice thereof shall be given as the Executive Committee shall direct. If, from any cause, the regular Annual Meeting shall not be held as above provided, a special meeting shall be held at Augusta in the month of January next following.

"Sect. 2. Special meetings may be called at any time by the Executive Committee; of which meetings each member shall be notified, by a notice properly directed and deposited in some post office at least ten days prior to the time of such meeting."

For many years, or, in fact, since the organization of the society, the larger part of its funds have been expended in payment of premiums and exhibition expenses. Circumstances have so far changed the condition of horticulture in the State that the time seems to have come when the work of the society should be more fully adapted to the fruit and floral interests of the State. While the importance of well organized exhibitions is fully admitted by your committee, we are convinced that the situation now calls for a wider work, so as to stimulate more general interest in producing the choicest fruits and the most beautiful plants and flowers, at the same time greater prominence should be given to the beautifying of our State by making our public grounds, our school grounds, our cemeteries and our highways more attractive, and especially adorning the homes of Maine with pleasant surroundings in harmony with the natural scenery among which they are found. With these things in view the following recommendations for future work are offered for your consideration:

Three regular exhibitions.

1st. An autumn exhibition to be held in the month of October or late enough to show the autumn and winter fruits in their perfection, and chrysanthemums and such greenhouse flowers as may be available.

2nd. An exhibition of winter fruits in connection with the winter meeting, giving the quality of fruit and taste in arranging greater prominence than we have in the past.

3d. A Strawberry and Rose Meeting, for the purpose of encouraging the culture of small fruits in the State.

It seems to us it would be for the interest of the society to have 1st and 3d exhibitions permanently located. The proper place for the 1st would be Portland, as to this market a large part of our winter fruit goes on its way to more remote points in Europe or elsewhere. Augusta would be, so far as we may judge, a good place to hold the 3d or Strawberry and Rose Meeting. Good meetings or exhibitions held in these places regularly would make many strong friends for the society.

We would recommend two public meetings similar to what we now have. One during the Strawberry and Rose Meeting and the other a winter meeting, which should be a sort of "round up" of the year's work, supplemented by the winter exhibition referred to.

General premiums to the extent of the society's means should be or may be offered for the improvement of school grounds, and private grounds; for orchards, small fruit gardens, and vegetable gardens.

It would be well to offer one or more prizes for essays on fruit and flower culture or some branch of the same as funds may permit.

Field meetings—two or more at seasonable dates and favorable localities. The objects being to interest locally and study the general condition of horticultural affairs in the State. Only the secretary and one member of the executive committee need attend these meetings at the expense of the society. It is possible a few prizes might be offered to advantage in connection with these meetings.

It frequently happens that the society can be of great service to the State, if when occasion calls for it, the secretary had authority to prepare and send out brief circulars or bulletins giving timely information in connection with fruit culture. The secretary has frequent inquiries, and some of them could be profitably answered in this way. We believe the press of the State, especially the rural press, would be glad to co-operate with the society in giving such information general publicity in the State.

Last, but by no means least, we would recommend that a general premium list be prepared early in the season, so as to have the widest circulation possible. Of course the dates and some of the locations might not be known at the time, but the list of prizes would give people a chance to plan for the exhibitions. It might also be well in this also to make more or less announcements that would be of interest to the public.

The plan of work contemplated in these recommendations would, if well carried out, open up a larger field of usefulness, increase the membership of the society, and give it greater influence in promoting the important interests for which it was called into existence.

All of which is respectfully submitted.

D. H. KNOWLTON,
MRS. B. T. TOWNSEND,
CHAS. E. WHEELER,
Committee.

WINTHROP, June 22, 1898.

The committee to whom was referred matters from the American Pomological Society, etc., reported the following resolutions, and both were passed:

Resolved, That this society, through its executive committee, arrange for the attendance of one delegate to the biennial session of the American Pomological Society in 1899.

Resolved, That the Maine State Pomological Society endorses the action taken by the National Pure Food and Drug Congress relating to the Brosius Pure Food Bill.

Under article II elected officers for 1899. See page 10.

The committee to whom was referred the disposition to be made of unbound transactions, being unable to make any report at this time were granted further time.

The executive committee were authorized to make such arrangements for exhibitions and other work as in their judgment may seem for the best interests of the society, and make as early announcements of the same as possible.

The committee on resolutions reported as follows, and their report was accepted:

Resolved, That we give thanks to the Skowhegan Grange for their hearty and cordial welcome extended by Bro. Ansel Holway, also for the use of their beautiful and convenient hall.

Resolved, That we extend thanks to the hotels for reduced rates, and also to the local committee for their successful endeavor in finding pleasant homes for the strangers within the gates.

Resolved, That we hereby extend thanks to the railroads for reduced rates.

Resolved, That our thanks be extended to the speakers for their interesting and instructive addresses, and also to the choir for their excellent music.

The following resolution was also given a passage:

Resolved, That we commend to the favor of the people of our State the efforts of Supt. Stetson to organize the children of the public schools into School Improvement Leagues, for the purpose of improving the school grounds, decorating the schoolrooms and supplying the schools with good books. We believe the efforts put forth deserve the co-operation of all good citizens.

MEETINGS OF EXECUTIVE COMMITTEE.

Auburn, April 26, 27, 1898. The president and secretary were instructed to wait upon the officers of the State Agricultural Society and arrange terms for the annual exhibition. After a protracted interview they reported that they had failed to effect any agreement. The next morning Messrs. Andrews and George were instructed to confer with the trustees, and announced that a proposition would be presented by the secretary of that society. Shortly after the following proposition was presented: "That the Maine State Agricultural Society will give the Maine State Pomological Society $500, with the stipulation that their premium list shall be substantially the same as in 1897, and that the claim for $150 be declared off, and that if the premiums awarded by the said pomological society shall fall below $875, the said falling off shall be deducted from the said $500 to be paid by the said Maine State Agricultural Society."

The executive committee unanimously declined to accept the proposition.

The secretary was authorized to obtain suitable engravings for the transactions.

The invitation to hold a Strawberry and Rose Meeting in Augusta, and the programme and date were referred to the president and secretary, and the local arrangements to Miss Sanborn.

The executive committee were given permission to remove the society's property from the exhibition building, and it was voted to remove the same.

The committee on Mr. Gilbert's paper, appointed at the Jay meeting, were requested to make their report to the executive committee at the Strawberry Meeting.

Augusta, July 5, 1898. The report of committee on Mr. Gilbert's paper was presented by the secretary, and accepted.

The president and secretary were requested to ascertain whether satisfactory arrangements can be made for an autumn exhibition.

Auburn, October 6, 1898. The following item appears in records for this date: "It is here recorded as a part of the doings of the committee that the property of the society stored in the State Agricultural Society's exhibition building, consisting of twenty-one cases, a cooler and several bundles of racks was removed for storage to the storehouse of W. A. Jackson, Lewiston, where the same is now held for safe keeping."

The president and secretary reported informally that it had not occurred to them as feasible to hold an autumn meeting or exhibition early in the fall, and that they had no positive recommendations to make.

It was then voted to hold the annual autumn exhibition and the annual winter meeting together early in December.

Invitations were presented from Geo. M. Roak to hold the meeting in Auburn Hall; from the secretary to hold the meeting in Farmington with tender of hall and other courtesies; from Geo. M. Twitchell with tender of City Hall, Augusta; from A. S. Chadbourne, tendering the use of the new City Hall, Hallowell, and from Geo. N. Holland to hold the meeting in Town Hall, Hampden.

The premium list was revised for the winter meeting.

President True was authorized to remove the exhibition property of the society from Lewiston to his home in New Gloucester for storage.

The location of the winter meeting and the program for same were referred to the president and secretary.

The reduction of the capital stock in the Merchants' National Bank fifty per cent was announced, and the treasurer was authorized to send in certificate belonging to our permanent fund and exchange for a new one. [In consequence of this reduction the permanent fund loses $100. At the time the stock was purchased it was worth a premium.—Secretary.]

Skowhegan, December 29, 1898. Mr. Andrews and Miss Sanborn were appointed to audit the treasurer's accounts.

PUBLIC MEETINGS

OF THE

Maine State Pomological Society.

PAPERS, DISCUSSIONS, ETC.

STRAWBERRY AND ROSE MEETING—City Building, Augusta, July 5 and 6, 1898.

ANNUAL EXHIBITION AND WINTER MEETING—Grange Hall, Skowhegan, December 27, 28 and 29, 1898.

PUBLIC MEETINGS.

STRAWBERRY AND ROSE MEETING HELD IN AUGUSTA, JULY 5 AND 6, 1898.

PROGRAMME—TUESDAY, 2.30 P. M.

Field Day. By courtesy of B. T. Sanborn, M. D., superintendent of the Insane Hospital, the members of the society and their friends are cordially invited to visit the grounds of the hospital, and look over the decorations, the greenhouse and the garden.

TUESDAY EVENING.

There will be a meeting of the executive committee at the Augusta House, at 8 o'clock.

WEDNESDAY, A. M.

Arrangement of the exhibition of fruit and flowers.

WEDNESDAY, 2 P. M.

Our First Field Meeting—What we saw—What we want to remember—Opened by Prof. Elijah Cook, Vassalboro.

Our Exhibition—Its Ouality—The Varieties—The Plants and Flowers—Opened by L. J. Shepard, Maine Experiment Station.

How to have a Flower Garden—By Miss Anna Eaton, Augusta.

WEDNESDAY, 7.30 P. M.

Some Useful Shrubs and Herbaceous Perennials—Prof. W. M. Munson, University of Maine.

To be followed by discussions of fruit and flower topics.

ANNUAL EXHIBITION AND WINTER MEETING HELD IN SKOWHEGAN, DECEMBER 27, 28 AND 29, 1898.

TUESDAY EVENING.

Informal reception to the members of the society by Skowhegan Grange; address of welcome, Ansel Holway, Skowhegan; response; other remarks.

WEDNESDAY A. M.

President's annual address, John W. True, New Gloucester; talks on small fruits: How to Get Large Crops, Lucius J. Shepard, Orono; The Varieties I Like, Charles S. Pope, Manchester.

AFTERNOON.

Among Nova Scotia Fruit Growers, D. H. Knowlton, Farmington. [An exhibit of apples from the Cornwallis Valley, N. S., will be shown to illustrate results of fruit growing there.] Nova Scotia Methods by a Nova Scotia Fruit Grower, R. W. Starr, Wolfville, N. S.

EVENING.

Floriculture, Mrs. Georgia A. Toby, Skowhegan; Teach the Young to Enjoy Fruits, Flowers and Shrubs, Prof. Elijah Cook, Vassalboro.

THURSDAY A. M.

The annual meeting of the Maine State Pomological Society will be held in Grange Hall, Skowhegan, Thursday, December 29, 1898, at 10 o'clock A. M., to act upon the following articles:

Article I. To listen to any reports committees and officers may have to make and take action thereon.

Art. II. To elect officers for the year 1899.

Art. III. To transact any other business that may legally come before said meeting.

AFTERNOON.

Some Useful Ornamental Plants for Maine, Prof. W. M. Munson, Orono; Modern Methods of Spraying, Illustrated by Colored Charts Showing Insects and Their Damage, Prof. A. H. Kirkland, Assistant Entomologist of the Massachusetts Board of Agriculture.

EVENING.

Refining Influences of Plants and Trees in Public Places, Rev. Blanche A. Wright, Livermore Falls.

OUR FIRST FIELD MEETING—WHAT WE SAW—WHAT WE WANT TO REMEMBER.

Prof. Elijah Cook.

In visiting the hospital grounds yesterday we saw a great many things that must have a more or less lasting effect upon our minds. We saw the grounds beautifully laid out; laid out with a great deal of taste and good judgment and the grounds nicely kept. We saw them adorned with plants and flowers in great profusion, and we could but feel a great deal of pride in the fact that the Pine Tree State has an institution of so much real merit, so nicely conducted and so ably cared for in every respect.

The strawberry, the best fruit, as has been said, that God ever made, is there cultivated to a large extent for the use of the patients who are found in the asylum, and I think the surroundings of those patients as they look out upon the grounds, or walk over the grounds, must have a great influence over them. Their environment must have a great deal to do in restoring the mind to its normal condition. Our surroundings always affect us more or less and with such surroundings as the patients have there, had they enjoyed them from their youth up, it may be it would have kept them from the sad calamity that has befallen them.

It is a thought that cannot be too deeply impressed upon us, that the flowers and fruit that God gave us in such abundance are calculated to give health to the mind and body. The more our thoughts are absorbed by the beauties of nature the more they are taken from those perplexing or serious subjects that make the patient insane. Every flower is a tender thought of the Creator to the created, and the surroundings have a great deal to do with the character of the individual; a great deal to do with the man or woman in after life.

We saw there also a magnificent farm, one of the best in the State; the best perhaps in the State. A farm conducted upon scientific principles; a farm provided with almost everything to make it a success. That is something in which we are interested. It is well that with such a state institution the farm should be large and well conducted to serve as an object lesson for the farmers of the State, and this is certainly that. It is an object lesson that will pay the farmers of the State to see. We saw a magnificent herd of cows kept in the very best condition possible, and we as citizens of the State of Maine should be proud that our insane are provided for in such a manner.

While I was walking over those grounds, I thought of the great progress in civilization—what a wonderful amount of progress has been made during the past hundred years; and nothing shows this progress better than the great number of institutions of this kind to take care of the unfortunate. In the land where Christ lived while here on earth they had no insane asylums; the poor unfortunate man who lost his mind was caged and cared for almost like the brute or worse. How different in this land of ours from what we find it there, in fact, from what we find it in a very large part of the earth where the insane are cared for and every possible thing done to restore them to their normal condition. I think that we may say that Maine, although occupying only this little corner of the country, is not behind in this respect. We want to remember with gratitude that we have an institution of the kind conducted as it is with so much ability. Whether we want to remember or not we always shall the kindness, and the courtesy of Mr. Allen and Dr. Sanborn, in connection with the occasion.

OUR EXHIBITION—THE VARIETIES—THE PLANTS AND FLOWERS.

Opened by L. J. SHEPARD.

Our exhibition is something to be proud of. The plants and flowers are very good. Our exhibition of strawberries is very good, although only about one-third as large as last year. The season is a little late for strawberries in this section, at our place it is just about the right season. We have about twenty-one varieties.

As to the varieties, that is a matter of mere diversity of opinion. I might name a great many varieties and if you should look in the seed catalogues you will find them so highly praised, that if they were as good as they say they would drive all others from the market. What a difference in looking at the strawberries and then in going out on the street and looking at the strawberries the people are supposed to buy. To raise a good article requires work and effort. To know how to grow them, I know of no better way than to go among some of our growers and see how they do it. You saw the berries brought in by Mr. Pope. To grow those berries requires cultivation. The soil should be thoroughly pulverized. Set the plants in good order and do not cover the crown.

Mr. KNOWLTON—I have in my mind so many good things in connection with the opportunities we enjoyed yesterday that I hardly know what to say at this time, but I am glad that we had the opportunity of visiting the grounds of the hospital with special reference to horticultural work as it is being done there.

The pomological society for a great many years has been organized for this horticultural work in the State, and for various reasons it has been working along just about the same lines in which it started. It seems to me that the work begun at the start, while it was of good character and probably exactly the work that a society of our kind ought to do in the State, yet with every other institution growing and increasing in usefulness and power, the time has come when our society ought to do a great deal more than it is doing, and this initiatory field meeting was something I looked forward to with a great deal of pleasure. I regret that a larger number could not have been present to look over the work they are doing there.

It is very gratifying indeed that the public institutions in our State, as a rule, are inclined to do so much horticultural work and especially that which is of a decorative nature.

The hospital grounds are very favorably situated for work of that kind and the work done there is very complimentary to the skill of Mr. Allen, the gardener, and to those who direct his work.

The work of our society should reach out and encourage just this sort of thing in the State. There are several things in which our society is very deficient and it seems to me we are almost culpably so in some respects. For instance, I do not know the exact number of school-houses in the State of Maine, but we have a great many. In the first place, many of them are on small lots of land. Many of them are on lots of land absolutely neglected and uncared for. Others, while on larger lots of land, nothing is being done to beautify them and make them attractive. It seems to me one thing our society ought to do is to encourage the decoration, the embellishment, the beautifying of school-house grounds.

One of the brightest and prettiest spots to visit in the city of Boston is the school grounds of Mr. Clapp's school where he has a great variety of wild flowers growing. He gives the pupils the opportunity of growing the flowers, and while growing them they are studying their botanical nature. Those boys and girls really know more about the wild flowers of Massachusetts than the people of the country who have lived all their lives among them. The lessons they are learning there will be invaluable. If we could have something of this kind started in this State, how much brighter the lives of the boys and girls would be for learning to love and care for them, and learning what they are made for and thus opening their eyes to observe as they go about the beauties of nature which are created for our enjoyment and appreciation. I hope the time will come when our society may, some way actively, either in premiums or otherwise, encourage the schools in the State to do something of this work of embellishment and decoration.

In regard to neglected cemeteries, although I think there is an opportunity for our society to do a great deal of work in that direction, there is a great need of work around our churches too. A great many good people think a place of worship is only a place of worship and that is all that is necessary, however bald and naked the walls may be, and however neglected the surroundings. Let us urge the planting of trees and vines about these sacred edifices, and our children will learn to love them.

OUR EXHIBITION—ITS QUALITY.

Prof. MUNSON.

It was very much better than last year in the floral display and I am certainly very much pleased with the general effect of the display and it is very evident that we can hold a successful summer meeting of the society.

Concerning the floral display, I note quite a number of plants that have been started in the greenhouse and have come along very much earlier than is usually the case. That leads me to note that the people are coming to grow ornamental plants very much earlier. Our stocks, for instance, are very much earlier than usual. They usually require ten weeks in which to bloom.

I have been especially pleased with the remarks of Prof. Cook and Mr. Knowlton concerning the influence of flowers upon the home in general. No man or woman that is an admirer of plants or flowers but what is elevated, is ennobled, and I wish if possible to emphasize the importance of bringing about an improved environment for our young people.

Concerning the varieties of fruits, I wish to mention just a few. The Clyde speaks for itself; a few of the other varieties might be called to mind some of which are not shown. The Greenville is really one of the important ones at the present time for home use and for the market. The old Sharpless and Crescent are always worthy of a place in that connection. One variety that does not receive as much attention as it ought to for a market berry is the Warfield. It is very dark and firm and deserves very much more attention than it gets. Another variety which is well worthy of attention is the Dayton.

In the matter of fruits, as your president wished me to say something about the quality of the exhibit, I might, perhaps, call attention to the tomatoes of the college exhibit as showing something of plant breeding. You know how much attention is paid to breeding by our stock raisers, and we as horticulturalists are beginning to understand that we must do a little breeding too. The one pet we have especially was a little past its prime so we could not exhibit that. A few years ago we made a cross between the little Currant Tomato and the Lorillard. The idea being to get the earliness of this little fellow with the size and productive qualities of the other. The Peach and the Lorillard were then crossed to get, if possible, a yellow tomato that should blush.

I might suggest a few roses which are very desirable in this State. One of the most satisfactory roses for general purposes is the Madame Plantier. It blooms but once during the season but the blooms last for two or three weeks and it is one of the most satisfactory white roses grown. The Marshall P. Wilder, a rich cherry in color and very satisfactory. The Rothschild should receive attention and is a valuable choice.

Mr. Cook—I was very glad to hear our secretary propose a wider range of influence for this society in decorating the grounds, not only public grounds but the private grounds of the home and farm as well. One thing that has occurred to me since that meeting at Bangor, is this: a gentleman in talking with me said, "I never put a seed into the ground and see it grow and develop without thanking God for ever calling my attention to this line of business." I think no one, boy or girl, man or woman who practices to any considerable extent the development of flowers and cultivates the small fruits as well, but must have better, higher, holier thoughts, but what must have a better character on account of the occupation, and this society can do nothing better than to extend its influence over the State in regard to these things, the cultivation of flowers and fruit. I was glad to hear the suggestion made in this exhibition here to-day.

I saw a sight this morning which it seemed to me was a vast improvement on anything I had ever seen in connection with the flowers, they were so abundant, so beautiful, and so perfect, growing with such vigor, and yet there was no expense laid out other than might be on almost every farm in the State, and if sufficient influence could be thrown out from the pomological society in regard to the cultivation of the better fruits and more of them, in regard to cultivating more flowers, in regard to surroundings of the children while at school or at home it would be doing a grand work, and I hope in the future this may be realized.

Mr. MUNSON—In connection with extending the work of this society it seems to me that these field meetings are perhaps the work of the society in one way. We go to some place, to some leading orchardist's place, and there we learn in a practical way what somebody might tell us about from now till doom's day and we would not take it in. I wish this society, next year, might meet at some place and take some of these practical lessons. In Connecticut some of the most important meetings of the society are held at the home of Mr. Hale, in his strawberry field. Here and now, I should like to ask the members of the society to come over to the University for a summer meeting next summer. I shall be very glad to have a field meeting held at the University and we can discuss what the Experiment Station can do for the society and the society for the Station.

DISCUSSION.

Q. Will Mr. Pope tell us something about the strawberry which he exhibits without any name?

A. Two years ago our little girl was out in the field looking for strawberries and discovered one plant whose berries were much larger than the others. So she brought it up and put it in the garden and that is the first fruit we have had from it. What it will amount to of course we can't say. The size is pretty good, the quality very good.

While I am up I want to say a word about the quality. I went to the row this morning with the spade to take up those plants, I said, those berries are most too small, but perhaps they will help out the exhibition. The Clyde, I had a dozen or more come from New Hampshire last year as I wanted something to give pollen to fertilize the blooms of the Greenville and Crescent which generally give us the most fruit, but it is necessary to have them fertilized by some other plants. We were pleased when we found this Clyde, it is a strong grower so we have to set the plants in rows three feet apart and the berries are very large. They will give us not only what pollen we want to fertilize the other berries, but give us a large amount of fruit, perhaps full as much as the old Crescent.

The Enhance is a fair berry, gives a fair amount of fruit but is not handsome. Very seedy, not a pretty berry and does not give us as much fruit as some of them.

Q. What would be your choice for market?

A. Remember one thing, what would be my choice and give me the most fruit would perhaps give very little fruit on my neighbor's ground. For us, we would probably get as much fruit from the Crescent, and Greenville with the Clyde for a fertilizing plant as from any other.

The Parker Earle is a good berry and almost equal in flavor to the field berry.

The Marshall, grown free from rust, is a berry for quality above anything I have seen.

Q. What is your best early berry?

A. There is not so much difference as a great many people imagine between early and late berries. I have been disappointed in setting what were called early berries. The Beder Wood we will get, perhaps four or five days earlier than the Crescent. Then the Crescent a week before the Greenville. The Greenville will give us as late fruit as we shall have. You cannot prolong the strawberry season a great many weeks.

Prof. Cook—There is one lesson I want to call your attention to. How many little girls finding an unusually large strawberry would do anything to develop it in the future. How important that children should be taught the powers of observation and thought, and how important that we as children of larger growth should cultivate these powers also. It makes a wonderful difference in life whether we see things and look for them, or pass them by without notice. Edison's success is due to just that thing. He met a sand bar on the New Jersey coast. He looked at it and examined it and kept on until he not only made a million of dollars out of it for himself but gave work to those who but for him would have had to go West for employment. We cannot pay too much attention to what we meet with in the world, especially in the world of nature.

Dr. Twitchell—The work started by this pomological society a few years ago, seems to me, was at the time and is to-day beyond the comprehension of the members of the society in its magnitude. Unconsciously, I believe, and yet as a result of the agitation of the question through the press and by the pomological society we are finding that far more attention is being given to the decoration of the lawns and yards about the rural homes than at any time in the past. I have been surprised during the last month in driving forty or fifty miles through the country to find the number of farm homes where you will find the lawns graded, more or less, and closely cut and something being done in the way of decoration. I have also been pleased to see how some of our florists are agitating the display of flowers about the house, both for decoration and for bloom. At any rate it seems to me that this is a step in advance of what they have been doing in the past. There is no way to extend the influence of the society so quickly as by object lessons. I remember down in the provinces as I was driving along, I came to two houses exactly alike, on opposite sides of the road. In the yard and room of one house I saw plants in bloom, in the door of the other house stood a hog. I think we can always judge something of the home by its surroundings. I remember in Aroostook how I was impressed in driving among the French settlements to see the flowers and plants around those homes and I certainly think they had some appreciation of the beautiful.

I think a society that can strengthen that love for the beautiful, as well as for the useful, for the fruits as well as for the flowers, and enlarge the scope of thought and purpose in this good old State of ours will do a work the benefit of which to the State is beyond computation. It means earnest, persistent effort, beginning as the society has with the field meeting at the hospital and this little exhibition of fruits and flowers. I was very glad as I stepped into the hall to hear the secretary speaking of giving more attention to the cemeteries, school buildings and churches. Why should our churches stand without some outside adornment; why should they not be made perfect with running vines, and blossoming plants; why should not our cemeteries without the expense of professional decoration, but by the effort which each one is able to make be made more beautiful?

President TRUE—One thing which will do more than anything else to increase the usefulness of the society will be to have its membership enlarged. That will add to the permanent fund and the society can only use the income from it. In that way I think we can increase the usefulness of the society.

Professor MUNSON—The Crimson Rambler has been grown to quite an extent; is a very profuse bloomer and well worthy of attention where you wish for block work or wish to conceal anything. The Yellow Rambler has not been tried that I know of in Maine.

Secretary McKEEN—I have been very much pleased in looking over the fruit and flowers in the room adjoining. I believe the pomological society is doing a good work in taking up this subject and that it should be presented to the minds of the people more than it has been done.

AT THE WINTER MEETING IN SKOWHEGAN.

ADDRESS OF WELCOME.

By ANSEL HOLWAY of Skowhegan.

"In behalf of the members of Skowhegan Grange and citizens of the town of Skowhegan, I extend to you, Mr. President, to the members of your noble society, and all visitors who are with us to-day, a cordial welcome to our town.

"While we do not claim the culture of apples and small fruits upon so large a scale as some other portions of our State, yet we have in our vicinity some progressive and successful orchardists. There is one orchard of from 1,800 to 2,000 trees; another of 1,700 or 1,800 trees, one of about 1,000 and still another of 1,300, about one-half of which is bearing fruit. All owners of these orchards and scores of others join with me in welcoming you to our town.

"Twenty-six years ago last October, at a meeting of the board of agriculture in this town, the organizing of a pomological society was freely discussed and a committee consisting of Z. A. Gilbert, J. A. Varney and A. L. Simpson was elected to prepare articles of incorporation and to be present at a meeting to be called at the town of Winthrop, January 14, 1873. At that time and place, the Maine State Pomological Society was born. So you meet with us, not only as an annual exhibition, but it is also the 26th anniversary of your organization, lacking only a few days. Knowing full well we shall be much benefited by the wise teachings and practical lectures by the members of your noble organization, we again extend to you a hearty welcome and trust that these meetings will be mutually helpful."

The response was made by Secretary Knowlton, who tendered the speaker and the good people of Skowhegan the thanks of the society for the courtesies they were enjoying on the present occasion. He briefly reviewed the work of the society and the purpose for which they were meeting in Skowhegan. Some of the best fruit grown in the State comes from the fertile hillsides of Somerset county, and some of the most skillful fruit growers are producing the fruit. It has been a matter of regret that scores of these growers have not united with the society in promoting the industry. Possibly it may, in a measure, be the society's fault, inasmuch as it is meeting in the county for the first time. This year the time seemed favorable for the holding of the meeting here, and the programme prepared for the occasion is one that bears on the present condition of fruit culture in the State. It is a matter of congratulation that you have grown so much fruit the past year when other parts of the State have had little or none, but the foe may reach you next year and the lessons taught at this meeting may be helpful to you. It is the hope of the officers of the society that you may gain the most advantage possible from this gathering here. Pleasant recollections will be carried away from this meeting and the best wishes of the society for your future success in fruit and flower culture will remain with you. Thanks for your cordial invitation, thanks for your kind assistance, thanks for your hospitality that has thrown open the doors of your beautiful halls and made Skowhegan a favored location for a winter meeting of the pomological society.

THE PRESIDENT'S ANNUAL ADDRESS.

By John W. True, New Gloucester.

Ladies and Gentlemen:

The Maine State Pomological Society has come together at its twenty-fifth annual meeting. Another year has passed, and the fruit-grower has not been exempt from the varying conditions of success and failure throughout our State. The Maine State Board of Agriculture in its bulletin for November gives some counties as low an average on quantity of fruit as 16%, and as high as 118% for Aroostook county, where until within a few years it was thought apples could not be raised. Other counties were given as high as 79% and 85%; in our own locality it is probably no more than 10% of a full crop, and perhaps less than that was harvested, so that we would call the apple crop a failure in our section. So, with two failures in succession, the apple raisers are not very enthusiastic over the subject and are very much inclined to neglect their trees, claiming that there is a more regular and steady profit to be derived from other branches of farming. We are inclined to think it a mistake, where farmers already have orchards, to neglect them, for in many cases where fruit trees have been well cared for a fair crop has been gathered the past season. In our own case, we are still setting trees, and giving to those already set all the time and dressing we can afford and carry along our other farming operations. What was the cause of such a wide-spread failure is hard to tell, as the bloom was very good; but probably it was the condition of the weather at the time of blossoming, as in our section of the State we had very little sun and the bees and other insects were out but two or three half-days and for that reason the blossoms may not have been fertilized or the rain may have washed the pollen out. Early fruit was plenty, and as that usually blossoms a few days in advance of winter varieties, the surroundings may have been more favorable.

Spraying was given more attention the past season, but the rain, coming as it did every day, partially defeated its good effects, and we are inclined to the opinion that successful apple culture will "simmer down" to those who give the business special attention, in cultivation, pruning and spraying every year, fruit or no fruit.

Advice is given to farmers to diversify their operations, so that if this or that crop fails, they will be sure of something; but we must all remember, in that case, not to attempt too much in any one line, so that each shall receive its full share of attention.

In some parts of our State the tent and forest caterpillars have damaged the trees to a great extent. Some orchardists have worked hard to keep their trees clear of the pest, while their neighbor just over the fence has not spent a moment in that direction. Such a situation is very discouraging, and we would like to raise the question whether or not legislation on the subject is expedient. As a means of warfare against them the ordinary "Gold Dust," dissolved in water and applied with a swab on the end of a pole has been found to do very good work, doing no injury to the tree. This is where spraying is not practiced. Thorough spraying with paris green while the caterpillars are young will clean the trees.

Another pest made its appearance in our section, which appeared to be either the bud moth or the leaf roller. In its early stages it was a green worm about one-fourth inch long, rolled up at the tip of every twig of the tree, eating the new bud as fast as it grew. Later it turned to a brown color, and so did the trees, small trees set one or two years losing every leaf and being obliged to start out anew and make their growth late in the season. Question: Were others in other parts of the State troubled in the same way? What was it, and what shall we do for it?

Yet another pest that it said to be coming this way and was treated at one of our recent meetings is the "San José scale." The question we would raise in regard to it is this: Is it practical to ask for legislation to have all nursery stock, scions, etc., inspected on coming into our State or require a certificate to accompany every order coming into the State, saying that it is free from the pest? It seems to us that something should be done at once on the old theory that "an ounce of prevention is worth a pound of cure."

The trypeta is still advancing, more disastrous to our fruit than ever before, and as yet no help in sight. Pound Sweets, Nodheads and Spys, as well as all of our earlier fruit, were entirely ruined, and we propound the question to the professors of our Experiment Station at Orono, *What shall we do?*

In still another direction our hopes have been rudely shaken, and that is, in the form of black knot on the Japan plum trees, the Burbank suffering quite badly; so that if tree agents claim that they are exempt from the scourge, remember that in all probability you will still have it to fight, although it is our opinion, founded upon what little experience we have had, that it is not nearly as susceptible to this disease as are the European varieties. Some of the varieties of "Japs" are proving to be shy bearers, and the advice given by some of our fruit growers, to go slowly, is good and will bear inspection.

We have seen the advice of a number of fruit growers the past year on varieties to plant, and in every case they say stick to the old and tried kinds. In spite of the thousands of new varieties of winter apples, or rather *market* apples, the old Baldwin is still at the front with a good lead; the Ben Davis, with all its imperfections of quality, is second; so the old advice still holds good, to let the experiment stations and those who can well afford it do the experimenting with the new and untried kinds that show off to such good advantage on paper. Every year our own experience emphasizes the fact that we should *not* plant the Baldwin direct from the nursery, but set some other variety, then graft to Baldwin in the limbs. The trees that have been set fifteen years already show signs of weakness where the limb unites with the trunk. In choosing a stock at least three things are very essential. First, a trunk that will grow as fast as the Baldwin scion, so that there may be no weakness at the union of stock and limb. Second, a hardy tree that will withstand our cold, trying winters. Third, one that has its limbs firmly set to the trunk with no tendency to split down. With either one of those three esentials lacking, your tree will surely be short lived. We have some very fine trees on the Red Astrachan stock. The Talman Sweet and Northern Spy are excellent.

The Ben Davis may well be set directly from the nursery, and with good cultivation and care is as sure a crop as corn, and a good crop of them is good property along in March or April. The trees can be set a little nearer than Baldwins and should be headed up quite high, four to five feet, as the limbs have a tendency to droop and would interfere with cultivation.

We would like again to call the attention of our fruit growers to an organization that was formed a year ago, with a name something like this: The Maine Fruit Growers' Association. It was formed for the purpose of furnishing a better market for our fruit, and we would suggest that during these years of scanty fruit it would be a good time to perfect the organization, for we believe there is just as great a demand for such an organization now as there was at that time, and if we wait until the heavy crop is here it is then too late to be of the most benefit to us. We believe the officers were chosen and instructed to do certain things. Let the fruit growers hear from them and if possible let them report progress.

During the past year our society has changed its usual course of procedure in so far as it relates to the autumn exhibition with the Maine State Agricultural Society. The reasons therefor were printed in circular form by our secretary and distributed to each of our members. The object for which our society was brought into existence was to advance the interests of fruit culture, and not to distribute the State stipend and our income from our permanent fund. And so far as we could see, for the past few years, there was very little of the educational feature prevailing at the usual autumn exhibition. The same people were there, and apparently some of them, at least, for the same purpose, to get what money they could out of the society's funds. And one of the arguments for an exhibition with the State society was that the people could bring something, and take premiums enough from our society to pay their expenses while attending the fair. In our opinion the society has been localized too much; it should be spread out. Give the people in different parts of the State the benefit of the money taken from them in taxes and not give it all to one set of people. There has hardly been an exhibit from York county at our State fair exhibition for the last five years,—I could almost say, for the last *ten* years. And if you should attend an exhibition where people from the southern part of the State made an exhibit of fruit, apples, pears, and plums, we are very confident that anyone could see at a glance that they were not nearly so far advanced in fruit culture and the knowledge of varieties as the fruit growers of some other parts of our State where the influence of this society has been felt. We have seen exhibits with the stems of half the specimens pulled out, and the other half would be wormy apples; again, there will be two plates of the same variety but with different names in the same collection. We are confident that this state of things could be materially changed by the efforts of this society expended in the right direction. Take such a meeting as this; it is something new to the locality, the officers and many members of the society will be here, and any errors in naming varieties will be corrected, if known, and in other ways the fruit growers in this locality may be able to learn something, and we are sure that very much learned with the object lessons directly before us will be remembered and used to advantage. Therefore it would seem best that all of the larger exhibitions of the society should be held in different parts of the State. We are still in favor of the summer meetings. The strawberry and rose meeting of the past season was not as successful in point of numbers as we could wish. It is possible that some other locality would have given us a better attendance.

There are many ways in which the fruit growers' interests can be advanced in a more directly educational line than it possibly can be in the old way of having one fixed exhibition held at such an early date as has been the custom for the past few years. Therefore it is hoped that our successors will give this subject careful attention, to the end that the primary objects of the society may be accomplished.

We would not turn a "cold shoulder" to the floral department, for the presence of flowers enlivens and enhances the beauty of every fruit exhibit. But we must not lose sight of the fact that this society was formed and brought into existence for the purpose of fostering and advancing the interests of the fruit grower, and that the floral department is secondary and must always be so considered. The two should work in harmony and we see no reason why they can not do so, and in that way the greatest good can be accomplished for all concerned. We hope the members and others present may take up some of these questions and discuss them and in that way we hope some good may come from these few thoughts that have come to us during our daily toil on the farm.

VARIETIES OF SMALL FRUITS I LIKE.

By CHAS. S. POPE, Manchester.

Mr. Pope placed the strawberry at the head of the list for a home fruit and for market. The returns were quickest from this fruit. At the head of the list of varieties he placed the old Crescent, after a trial of a dozen years. He advised a trial of a number of varieties in different localities as there was a great variation in the profitableness of varieties in different localities. These traits could be ascertained only by a trial. He next named the Bubach as a good market berry, but somewhat deficient in quality. The Greenville was a good berry. The Parker Earle was another good one.

A new one he had tried was the Clyde, a great grower but not with him the best quality, but an attractive sort for market. In answer to a question Mr. Pope said he planted the vines three feet apart, in rows four feet apart, and let the plants gradually fill the space, keeping the plants thinned out.

* * * * * * * *

The raspberries were apt to winter-kill in our climate, hence hardy varieties should be set. The Turner was a good berry but small. The Cuthbert was large and a good berry. He laid his vines down in winter, covering the top slightly to protect them.

The Schaffer was a great grower and good bearer, and a fine berry to can. It was a difficult sort to lay down in winter. He protected by boughs, cutting the canes to about five feet, tie tops together and place boughs about them for protection. He let his plants grow through the summer and cut back in the spring. Planted the rows seven feet apart and three feet apart in rows. A row 100 feet long produced two bushels.

Some planters got more profit from raspberries than from strawberries. He planted in long rows and cultivated with the horse. The fine earth made a good mulch. It is essential to keep the rows clear of weeds and grass.

A gravelly loam was good for raspberries. The strawberry would adapt itself to a wider variety of soil.

* * * * * * * *

He had tested the Snyder and Agawam blackberries and advised the Snyder as preferable when left to mature on the bushes. To procure the best fruit raise it rather than depend on the market. He advised everybody to grow all the small fruit the family can consume. A little labor in growing strawberries, raspberries and blackberries will produce a bushel of these fruits as easily as a bushel of potatoes.

* * * * * * * *

The currant is one of the best of fruits and one easily grown and it was a surprise to him why more farmers did not grow this healthy fruit. The great drawback was the currant worm, but this was kept in check easily by the use of hellebore.

Fay's, White Grape, Wilder, the Victoria, were named as valuable sorts. Mr. Pope had tried the Red Cross and given it up. The Prince Albert was a strong-growing sort and apparently a good variety.

For market, he planted the Wilder; for home use, he preferred the White Grape. Advised planting two or three varieties for family use, a few White Grape; for jelly, Prince Albert, then the Wilder.

* * * * * * * *

For plums we should have several varieties. The McLaughlin, Reine Claude, Green Gage were three good varieties. The Lombard is a good bearer. The Burbank was a good canning plum but lacked in quality. The Abundance had not succeeded well with him. The Satsuma was a good plum for canning and of fair quality.

To head off the curculio advise planting in the hen yard, if that could not be done depend upon jarring the trees and catching the bugs on sheets.

Spray with the Bordeaux mixture to prevent fruit rotting, beginning as soon as the buds begin to swell, again after the leaves are out and after the fruit has set. Destroy all the mummied fruit in the fall or whenever it is seen. Spraying should be continued up nearly to time the fruit begins to turn. Thought spraying was helpful to prevent black knot.

Advocated thinning the plums when bearing excessively, picking off half the fruit. It is better for the quality of the fruit, and vastly better for the tree. He emphasized the statement that thinning was absolutely necessary to best results in growing plums. Spoke well of the Bradshaw, but condemned Moore's Arctic.

AMONG NOVA SCOTIA FRUIT GROWERS.

Secretary Knowlton has been making somewhat of a study of fruit growing in Nova Scotia. His first acquaintance with Nova Scotia fruit was three years ago at the International exhibition held in St. John, where he acted as judge of fruit. The two following exhibitions he served in the same capacity, and this year and last he acted as judge of fruit at the Provincial exhibition held in Halifax. At St. John there was a large predominance of Nova Scotia fruit, and at Halifax the fruit was all from Nova Scotia save one exhibition from Prince Edward Island. The excellence of the fruit the past two years, especially while in Maine the few apples raised were either wormy or covered with scab, led him to the conclusion that Maine people needed a better knowledge of cultural methods and care of the trees. The purpose of the paper was to state some interesting facts he learned from the fruit growers there and the orchards he visited.

As an illustration of the quality of fruit raised there this year, he had before him an exhibition of thirty of the most popular varieties of Nova Scotia apples put up for the occasion by Mr. R. W. Starr, who for years has been identified with fruit growing in that province.

The Annapolis and Cornwallis valleys produce more fruit than any other section of the island, though some of the best fruit on exhibition was grown in other parts. In these valleys conditions seem favorable for orcharding. On the north of the island from Digby to the Basin of Minas there is a high and continuous hill along the coast. It is known as the North Mountain, while a few miles away, running nearly parallel, are the South Mountains. The two valleys lie between these mountains, the Annapolis extending east from Digby until it merges into the Cornwallis valley, whose outlet by sea is over the Minas Basin out into the Bay of Fundy. These mountains protect, in a large degree, the trees from the cold winds of the north and the heavy winds from the south.

For the most part the orchards are not very large, perhaps in consequence of the high price of the land. The growers are inclined to cultivate well, few trees, rather than to have many neglected ones, which Mr. Knowlton thinks is very good doctrine for Maine growers.

From his observations he is convinced that Nova Scotia conditions are much the same as along our coast in Maine, and he believes that the same skill in care and culture of the trees would enable our shore towns to produce their own fruit, and possibly some for the rest of the world.

The Gravenstein is the popular apple there, and if it were possible for the grower to find a market, there would be few other varieties grown. As it is, they have the idea that it is necessary to begin marketing them before they are fully matured, and this, no doubt, is the reason why the fruit is so inferior in coloring to our own Gravensteins. Gravensteins served at the hotels in Halifax and St. John were too green to be good, and many in the local markets there were of the same quality.

The Gravenstein is a great bearer there, and has a record which well nigh gives it the championship. In one orchard in King's county there is a tree that produced 18 barrels in 1878; 25 barrels in 1880; 23 in 1884; 24 in 1886; 27 in 1888; 20 in 1890; 21 in 1892; 26 in 1894. It is an interesting variety for study and experiment. Several sports have become fixed in type and do not revert. The Bank's Gravenstein is one of these. It is higher colored, not quite as large, and possibly a little better in quality. This and another sport are grown largely to color the original variety by their presence among them in the barrel. Some of these sports were grafted into Maine stock last spring, and they will be watched with interest.

Other popular and profitable varieties are the Blenheim Pippin, the Ribston Pippin, Nonpariel, Golden Russet, Tompkin's King, Fallawater, Ben Davis, Baldwin, Northern Spy, R. I. Greening and Wagener.

The fruit was of excellent quality. The growers in Nova Scotia have all the difficulties that Maine has. Insects and fungous diseases abound, but they have bravely met them and are largely conquering. The general appearance of the fruit trees showed their health and vigor. Now and then there is an orchard neglected, and its condition was recognized far away—care and culture are the rule and not the exception.

As an illustration of the methods, reference was made to the Hillcrest orchards, owned and operated by Mr. Ralph S. Eaton, at Kentville, which Mr. Knowlton had the pleasure of visiting with Mr. Eaton, who is the largest and one of the most intelligent and skillful fruit growers in the Province. For several years he was a successful teacher but his love for rural pursuits and good health led him to purchase a farm some twelve years ago. He now has sixty-two acres in orchards. One orchard was set on land covered with a second growth of trees of various kinds. It must have been a great task to accomplish what he has in the years since he began. His orchards now contain 5,000 apple trees, 3,000 plum trees, 1,100 of which are Burbank; 3,000 cherries, 500 pears, 1,100 peach, 300 quince, and the same number of apricot trees.

In one orchard the trees have been set within ten years. The oldest of these trees are beginning to bear. This orchard he has plowed or cultivated five or six times during the past season, and at the time of visit the clover sown for a green manure was just making its appearance. Next spring he will plow the clover in. Five times during the year he had sprayed his trees. On the outer edge of this orchard was one row which had not been plowed, the trees standing in grass land and being thoroughly mulched with hay. Mr. Knowlton, when he saw the trees, asked Mr. Eaton why they were so inferior to the adjacent trees, and was assured the culture made the difference, though the trees had not been set quite as long. Down through the centre of this orchard was one row that had not been sprayed at all. First, the foliage of the trees was very different in its color and perfection; secondly, there seemed to be more inferior fruit on this row of trees than on all the others. They were wormy and scabby, and lots of poor apples were under these trees. The lesson was indisputable, and would satisfy any observer of the efficacy of skillful spraying.

Mr. Eaton in 1897 raised about 2,000 barrels of apples and this year he expected about 500 or 600 barrels.

Mr. Knowlton in closing his remarks spoke of the important agencies at work in the Province to encourage the industry. First, there is the Nova Scotia Fruit Growers' Association, an organization that is well officered with active fruit growers who neglect no opportunity that will encourage the growers, or extend the popularity of their favorite fruits. The second agency grew out of the first. It is the horticultural school organized some years ago at Wolfville. Last year there were in attendance sixty-five pupils, who under the direction of Prof. Sears, were making a study of the science and art of fruit growing.

The people of Nova Scotia are enthusiastic in the matter of fruit growing. They believe in its possibilities, because so many of them thus far have found it profitable. They are well informed in methods, and eager to "catch on" to any ideas calculated to aid them. They are our nearest competitors for the European markets, and it is important for our fruit growers to study their methods and make our own methods better and so far as possible more profitable.

NOVA SCOTIA METHODS BY A NOVA SCOTIA FRUIT GROWER.

By R. W. Starr, Kentville, N. S.

We were growing largely potatoes and raising beef, the other was a side show, but the Western beef growers cut the market over our beef, and your own men destroyed our potato market in Boston and New York by growing more potatoes yourselves, and putting a large duty on to ours. I can't blame you for that. We were then deprived of these markets and were forced to look over other markets and other produce. We had been working quite largely in improving our fruit not only in our way of growing them, but in the varieties grown. This helped us to alter our system. The orchards were planted largely, and everything was pushed to the utmost to grow kinds to suit the market. Systems of planting were taken up and studied, and given out in our association meeting. We tried to plant by the best methods which would give the best results. Coarse manure was put on in the fall. If we applied it in the fall, in the spring it was ready to be taken hold of and made use of as soon as growth commences, and the soil is in condition to allow that tree to ripen its wood and buds, making it in good condition to get through the next winter's process.

The farmers use a sort of sled, like a flat bottomed boat, that is hauled by a pair of horses. I have seen a great deal of injury done by manuring with green crops late in the spring, the latter part of May. Supposing June and July is dry and it comes off wet towards August and September with the half rotted manure the soil gets up a strong fermentation, and creates a secondary growth in the late season, and the action of the frost on that unprotected fruit is one of the most destructive things that we have to contend with, and that is why we so vigorously ask that all cultivation be made so that the trees shall ripen as early as possible in midsummer. We can't control nature always, but we can do a great deal towards it.

Somebody was speaking to-day about growing Baldwin trees, that it was almost impossible to grow Baldwin trees on its own roots. I think that depends altogether upon a system of pruning. When the Baldwin tree is taken from the nursery and set into the orchard, and you cut off all but one leading branch, and you make all the other branches subordinate to it for the first five years, then you will not be troubled with splitting limbs. If you allow four or five, it is only a question of time when the limbs will split. The Baldwin isn't the only tree that will do that but the Gravenstein will also. You have got to watch all your trees in pruning. I have seen a Baldwin tree that came from a nursery with a very handsome top on it pruned to a whip stock, and some men would have thought that tree was ruined, but that tree would make the best one in the orchard.

For spraying we allow four pounds of Paris green to forty gallons. We insist upon using it weaker than that if it is to be used very often.

In carting from the fruit house many persons will load them on to an ordinary hay wagon. Many of our farmers haven't got spring wagons, but they find what does very well instead of springs, and that is a foot or two of hay in the bottom of the wagon.

Q. You let them remain how long in the barrels before you ship them?

That depends altogether on the demand. We sometimes can only let them remain a few days, but we calculate to let them remain two or three days before they are shipped, but sometimes I have known them to only stand over night. An order may come in sooner than you expect, and a man may have to put up fifty or 100 barrels of apples to go on board the cars, and to have perhaps not over forty-eight hours to do it in, and in that case we have to put more pressure on the screw in putting the head in. We can always allow something on the time in which the apples have settled.

If we are putting up a barrel of Gravenstein out of apples that have had no time to settle, we will put a cushioned head on. The barrel is shaken down well and you put a screw on the top of it, and calculate to settle it down an inch with the screw. If they have stood four or five days, three-fourths of an inch.

Q. If apples are put into a cool cellar do you leave them in a barrel?

A. All apples that are shipped before the holiday season we calculate to put right into the barrel in the orchard and never disturb them. To be sure that they will be sound, every apple is picked up off from the ground before we do anything else. If any apple has laid on the ground for any length of time, it isn't safe to ship across the Atlantis. If it has only laid over five hours, on ordinary soil that apple is injured during that time, it will turn brown and rot will commence there very much quicker than anywhere else.

Year before last there were a great many Stark apples, we had an enormous crop as you did, and farmers were crowded off their feet to take care of them, and they didn't use the care and skill in packing that they should have done.

Q. The later varieties that you put into your cellars, do you put them into bins?

A. We used to put them into a bin and pick them out, but lately we pick most of them into the barrels and pack them away. If we do put them in a bin and they have stayed some time, they are put on a packing table and picked over.

A man can do a great deal better on a table than to have them poured out into a bin.

Q. How do you grade your apples?

A. The most particular men are those who grade for color as well as for size, and by keeping them in barrels you can grade by color, because some trees will be much brighter than others. If they are put into bins they are all mixed up.

Q. Then the sorting as a rule is done at picking time?

A. Yes.

Q. How small an apple do you consider a number 1 apple? Take a Baldwin for instance?

A. A number 2 Baldwin one year is almost a number 1 another year. The Baldwin is not a favorite apple with us, although we grow a great many of them. You can beat us in growing Baldwins.

Q. What is your favorite eating apple to ship to Liverpool?

A. We don't ship much to Liverpool but mostly to London. One of our best apples between the Gravenstein and the Pippin is the Ribston Pippin, it is a regular bearer. It has some faults; this year there are some faults that are rather more prominent than usual. It is what we call dry rot; it commences under the skin, you can scarcely distinguish it, but you cut into it and you find a kind of a rot running way down to the core, and we also find it on the Greening. I really think the Greening is more subject to it than the other.

I have a list of our ten best standard apples:

The Gravenstein, the fruit should be smooth, high and evenly colored, and in quality should rank good, or best for both the table, kitchen and market.

The Gravenstein we think has more good qualities than any other taking it in its season, but being an early apple we can't expect so good a price for it as later ones, although we have received just as high prices in former years, perhaps more. I remember one time when I was farming with my father, we sent a hundred barrels Gravenstein to Halifax, and they netted $4.00 a barrel. The Ribston, the Blenheim, the King; these are the three kinds that are wanted in the London market up to this time of the year. The last shipments are supposed to leave Halifax in time to be into London the 20th of December, and they are the last we make until the shipment that is calculated to arrive there on or about the 7th or 8th of January. Any apples that arrive between these dates, you can't do anything with them, they are considered stale if they have to stand over.

After these are gone in the market, we commence shipping: Baldwins, Greenings, Northern Spys, Fallawater, Golden Russet. These ten we consider our staple apples.

Then we have the Wagener, which is coming into favor. It wants to be very highly fed or it will bear itself to death. It seems to be a tree that doesn't take up its food as readily as others, wants to be coddled.

The Ben Davis, as a rule, I think, you can grow it better than we. If they could get it from the Western farmers in London, there would be no call for ours.

The Mann. Then we have one or two English apples that are very much liked over there. Cornish Aromatic. You may keep it until next June and it will be just as good flavor as to-day; it is a good bearer but has a feeble habit of growth.

The other is Cox's Orange Pippin, over there it is considered the highest class apple on the market for dessert. It has a very high flavor, and is in season from the first of December until February. It is rather a small tree and a feeble grower, but is one of those trees that requires very high culture, and it wants well-drained, warm, light soil.

Then we have the Ohio Nonpareil, an American apple, that I think would be well for you to test. I think you would call it a good apple.

Q. Is it an apple that will hang on the tree and not drop very much?

A. It will hang on as well as the King, you might mistake it for a King.

Q. A better bearer than the King?

A. That depends, we usually consider the King the better of the two. I find that we consider the King a better bearer than you do in most parts of the United States.

Q. Do you give the King high culture?

A. Yes, but not higher than the Ribston. Those who get the highest culture are those which bear the best.

Q. How deep as a rule do you plow?

A. A tree that is four or six inches through has usually got its roots all over the soil. But when an orchard is first set out, we put the plow down just as deep as we can. I have plowed eleven inches deep, but not very long.

Q. How far apart do you set your trees?

A. Our rule is thirty-three feet.

Q. In starting your trees from the nursery you let it run run right up to one limb?

A. If it is a Baldwin I cut off all but one and afterwards let the leading limb dominate.

Q. How low do you start your limbs as a rule?

A. We start them so that when there is any crop we can drive our horses close enough to cultivate well.

Q. I would like to ask if you think spraying is injurious. The man who raises the best crop of apples that I know of, doesn't spray, he said a man told him that his orchard had been injured by spraying?

A. You can take every leaf off your orchard and do it in twenty-four hours after it has been sprayed if you use Paris green strong enough. You have got to use a good deal of judgment. The insect that has been the most trouble to us is the canker worm.

Q. What is the best poison to use?

A. Paris green if you can get it pure. If you spray early enough in the season, when the canker worm isn't very strong, there is no trouble about killing it with Paris green; but if it is left until after the blossom has fallen, your canker worm has got so strong that it takes a good deal to kill it, and if there is enough to make it distasteful put on, he would pass round, and only eat the leaves that have got the least amount of poison on it, and by eating a little at a time, he will keep on until he ends his natural existence. If you only put your Paris green on early enough in the season you are sure to kill the canker worm.

Q. What strength then would it require?

A. Four ounces to forty gallon cask. Later you may use one-half pound or even three-fourths pound to accomplish the same purpose, but if you have to do that you are almost sure to bring off the leaves.

Q. Do you always use lime with it?

A. Yes.

Q. Do you ever use it without lime?

A. Not nowadays, but they used to get desperate and would take every leaf off to kill the worms. Since we have used the lime there is not so much injury to the trees, and now you seldom see a tree injured. Spraying is universally used where I live.

The apple we call the Nonpareil came from England over 130 years ago, it is a Russet of the same family as your Roxbury Russet, and by many considered the same article.

Q. Have you had any experience in marketing apples in any other packages than barrels?

A. Yes, we have tested a good many other cases, but have always gone back to the barrel. We manufacture our own barrels. We have been agitating for some years a legal size for an apple barrel, and to make it a limit of measure, so that it could be used for anything; the only difficulty now being to get the different provinces to unite on a size.

Q. As a rule do your farmers themselves pack their apples?

A. Yes, unless a buyer when he makes his bargain, says that he will pack them. Most of our farmers pack them themselves, or employ a packer whom they consider able to do it better than themselves.

Q. Do you calculate to keep your orchards plowed every year?

A. Yes, every year.

Q. How near do you plow to the trees?

A. Just as close as we can.

Q. Aren't you afraid of the roots?

A. No, for we have a plow we can govern. In setting a young orchard the first fall, after that orchard is set, we bank the trees, the second fall we bank the trees and the third fall we bank the trees.

Q. How high?

A. Usually about a foot. It is done for two reasons, to protect the tree from swaying in the ground, and forming a hole round the tree and then when frost comes the hole filling with ice; and the other reason is to protect from mice. There is no danger of mice injuring a tree if you have a foot of earth round it.

FLORICULTURE.

By Mrs. Georgia A. Tobey.

To make the cultivation of flowers a success, three things are necessary: Sunshine, water and a love for our work. If we love flowers and are interested in them, we are, under ordinary circumstances, sure of success. So let us select a spot where sunshine is not wanting, and the other elements can be supplied. After carefully spading, rake off all the hard lumps, stones and roots, then put on two or three inches of well rotted, rich compost and enough good earth to raise about three inches above the surface of the lawn to insure good drainage. Plenty of compost will give a sandy soil, greater consistency, and at the same time render a clayey soil more open and porous; in the latter case it is better to dig in sharp sand so as to render the soil lighter and more friable at once without having to wait for the slow action of the compost. If annuals or tender plants are grown in the bed it should be cleared off after the frost has killed the plants and a two inch coat of strawy stable litter dug in as it will have all winter to decay. Follow this with a coat of well rotted compost in the spring and the bed will be in the finest possible condition. It is possible to make a bed too rich but with the exception of burning from the compost not well rotted this seldom occurs. You can easily tell when the bed is too rich by the strong rank growth of the plants, without a proportionate amount of bloom. In such a case withhold enriching for a season. In cloudy, damp weather the plants will grow excessively; for this reason the bed should be raised above the surface as described, for it is much easier to supply a deficiency of moisture than to reduce an over supply in a rainy season. In planting a bed of spring flowering bulbs, such as tulips, crocus, daffodills, iris, etc., in the fall do not dig any compost into the soil unless it is poor but after freezing put on a three inch coat of strawy stable litter as by this time the strength will be filtered into the soil. Do not plant a bed when it is dry—the best time is when freshly dug. If this is not convenient, water well in the morning and transplant your seedlings in the evening, and water well, or what is better, there are usually cloudy days just suitable for transplanting. The hardy annual such as asters, balsams, stocks, pansies, etc., make a more satisfactory growth if started in seed boxes and transplanted into the beds while phlox, putunas, candytuft, alyssum, etc., are better sown in the open bed as their roots are so fine they are often injured by transplanting. Keep the soil loose and free from weeds, breaking up after each hard dashing rain. To keep a bed looking well cut all the flowers as soon as they begin to fade and trim off all straggling branches that spoil the symetrical form of the plants. If the plants are too thick thin them uot, as it is a mistake we often make by crowding and the result is spindling plants with fewer flowers. Of annuals there is an endless variety to select from; the nasturtiums and sweet pea should be planted early, but for the majority of them we should wait until the ground is warmer.

In the cultivation of the sweet pea, that beautiful climber which we so much admire, many sometimes make a mistake in loosening the soil about the roots. After the seed is sown the earth should be pressed down firm and hard, and never loosened, unless it is a hard, clayey soil. But as the season advances it is a good plan to add more soil which should always be pressed down firmly. Experiènce has taught me never to plant my sweet peas two years in succession on the same ground. No flower garden is complete without the summer flowering bulbs. Of these the dahlia leads, followed closely by the gladiolus to which we may add the canna, the tuberose, tuberous begonia and many others. After the first frost comes these bulbs should be carefully dried and packed in dry sand or sawdust to preserve them for next year's planting. Let us not forget the standby of the old time garden,—the perennials; their beauty and growth are bringing them again into general cultivation. They require little attention and respond generously to increased care and thorough cultivation. It is a good plan to raise the plants in the vegetable garden the first year where they can be frequently hoed and kept free from weeds. In the fall after the annuals have been killed by the frost they can be removed to the flower-bed where they are to bloom next year, being careful to set them a little deeper than they were before. On the approach of cold weather cover with a coarse litter to protect them from being thrown out by the freezing and thawing during the fall and spring. Of course no true lover of flowers would think of a flower garden without roses and now that the ever blooming varieties are to be obtained at a reasonable price, we can have them from June until frost. Of course they require a larger amount of care than annuals yet with frequent spraying with whale-oil soap or kerosene emulsion, they can be kept free from insects, and if rich enough the ever blooming varieties will give almost continual bloom. Many of these are hardy and with protection will withstand the rigors of our northern winters, while many of the hybrid varieties have to be removed to the cellar. I often wonder why the beautiful moss rose is not in more general cultivation as it is thoroughly hardy and blossoms profusely if it has proper care. This rose is a sport from the old cabbage rose, although some pretty legend has attributed its mossey fringe to angels' gift. There comes a time when the earth is closed in darkness and the wind sleeps, that Jack Frost creeps into our garden and does his mischievous work. Are we to have no more flowers until spring? No, we have been mindful of this during the summer and have our window garden already prepared. Some will say I have no sunshine to give them, then you can cultivate ferns, palms, begonias, ivies, etc., as they do not require much sunlight. The geranium, carnation pink, primrose, calla lily and many others will thrive in an ordinary sitting room. We should start new plants for winter bloom as no plant that has blossomed all summer can be expected to blossom all winter. If a plant is to do duty a second winter cut it back and pinch off all buds during the summer, and you will have a profusion in winter. In potting plants for winter, use about one-third rich compost, one-third sharp sand, and one-third wood mold. The latter will render the soil still lighter and more porous, and increase the capillary power for retaining and distributing moisture. Plants must be studied and watched and their wants supplied, some require a great deal of water, others very little; some a great deal of fertilization while others not as much. But one very essential thing is their drainage, as all water not needed by the plants must pass off quickly or the soil will get heavy, hard and sour. Another trouble in household cultivation is the aphis which multiplies very quickly and feeds upon the under side of the leaves or on the young shoots and if left undisturbed soon weakens the vitality of the plant. One of the best remedies for this, where fumigation is impossible, is to give a thorough bath in strong soap suds, and after a few minutes rinse in clear water. After all of our care in planting our flowerbed or potting our plants it will be almost useless if left to grow uncared for. They must have care and with it every lover of flowers will receive reward for her labor. Now that we have our flowers, let us not be selfish with them. I often think for every flower plucked two are sent to replace it. So let us give generously, and the recording angel, only, knows how many hearts are made light and how much pleasure we bring to others by a handful of our flowers.

TEACH THE YOUNG TO ENJOY FRUITS AND FLOWERS.

Professor Elijah Cook of Vassalboro followed Mrs. Toby in an earnest and interesting talk, his subject being the importance of teaching the young the care and to love fruits and flowers. He spoke of the power of influence in changing the habits and thoughts of children to high and noble purposes. He spoke of the influence for the bad by the perusal by children of some forms of literature of the day. He spoke of the evils of intemperance and the use of tobacco, but the influence of pernicious literature was worse than either. Gave an example of a boy in New York who was now in prison for the committal of a crime induced by reading yellow-covered novels.

Instances were given to show the power of influence to higher and better living in the young. The influence of the ethical side of flowers and plants in the home was great. The demands of the soul which lives forever should be met in the young in the home.

A flower is a thought. A landscape is a picture. Every forest is a fairy land. Every child should have its thoughts turned to these pictures of ennobling influences.

We should teach our boys and girls to love the flowers and fruit and their cultivation. There is something to be learned all the time. There is beauty in fruit. Then we want the best. It doesn't pay to do things by halves, but it does pay to produce the best.

SOME ORNAMENTAL PLANTS FOR MAINE.

W. M. MUNSON, University of Maine.

(Abstract.)

One of the most striking traits of the American people is the *spirit of unrest.* It is the element which leads us to clear the forests and settle new states. It is the spirit which drove the emigrant's wagon across the desert to California, which leads men to forsake the classroom, the counting house and the pulpit and risk life and limb in the gold fields of Alaska; which over-runs and takes possession of an empire while the cabinets of more conservative nations are considering whether or not it is necessary to interfere and restore the balance of power.

On the other hand, the *spirit of unrest* followed into society and the home makes of man a feverish being in whose Tantalus' cup *repose* is the unattainable drop. Unable to take root any-where, he leads, socially, and physically, the uncertain life of a tree transplanted from place to place and shifted to a different soil every season.

American people are specially fond of the word *settle.* Every year large numbers of our young men and women go west to *settle,* while those already west move to new parts to *settle* again. So truly national is the term, that all business transactions of the country, from state debts to farm produce, are closed only by being *settled.*

Yet, as a people, we are never settled. In this country a man builds a house to spend his later years in and sells it before the roof is on; he brings a field into tillage, and leaves other men to gather the crops; he embraces a profession and gives it up; he "settles" in a given place and soon after leaves in order to carry his longing for change elsewhere. If his private affairs leave him any leisure, he plunges into politics. If, perchance, he has a few days vacation he will travel hundreds of miles to shake off his happiness. Much as we admire the quality of energy, the love of order, obedience to law, the love of home and of particular localities endeared by birth or association are no less valuable and are in a measure antagonistic qualities.

This being the case, whatever tends without checking due energy of character, but to develop along with it the virtues that shall keep it within due bounds may be looked upon as a boon, not only to the individual but to the nation.

The difference between a son of Ishmael and the man who has the strongest attachment for the home, is the beginning one of outward circumstances. The one is bound to a given place by ties no stronger than the cords which hold his tent to the earth, the other is held by sentiments which make a given bit of soil, too insignificant for general notice, the most attractive spot on earth.

One of the problems with which we are constantly met is: How shall we keep the boys on the farm? One of the surest methods is to "give the boy a chance." Observe coöperation. Make the home attractive, not alone by kindly sympathy and interest but by providing for the physical, mental and social welfare of the young people. More people are driven from the farm by its isolation, loneliness and lack of tasteful surroundings, than by any other cause. Satisfactory results cannot be expected if the boys and girls are regarded in the light of domestic animals, costing so much to feed and clothe them and saving a certain amount in the labor account. In general, farmers above all other classes have the best opportunities for making the home attractive at small cost, and because of their isolation should, above all other classes, exert most effort in this direction,—yet, as is well known, no class with the same intelligence and enterprise in other directions is so universally careless and negligent in this respect.

As Maine grows in popularity as a resort for people from the cities during the summer months, the importance of a more systematic effort to ornament rural homes becomes apparent. During the past ten years much ornamental planting has been done in the vicinity of the larger towns and cities with the effect, which always follows, of greatly enhancing the value of the property thus treated.

Not only from a financial point of view, and to attract summer visitors, is the ornamentation of rural homes important, but the comfort and pleasure of one's family should be sufficient incentive for such work.

In general it may be said to get satisfactory results, shrubs and other flowering plants should receive as good treatment as corn and potatoes. When once established, shrubs and perennial herbs require much less care than do animals, but during the first year or so, careful attention will be well repaid.

In determining what to plant, several points must be considered: First of all, the plant must be hardy. Some of the finest shrubs of Massachusetts and New York are utterly unsuited for the climate of Maine. For this reason the use of native plants is to be recommended so far as possible and few exotics are superior to the common viburnums, dogwoods, elders, sumachs and laurels. Other points to be considered are: season, habit, beauty of foliage, flower and fruit. If possible, such a selection should be made as will afford a succession of bloom or other attractive qualities through the season. For instance, among flowering shrubs the earlier spiræas may be followed by double flowering plum, Tartarian honeysuckle, and Japan quince, these in turn by lilacs, weigela, and later by roses, mock orange and hydrangea. To this list may be added the common high bush cranberry and the dwarf Juneberry or shadbush from the pasture.

For beauty of foliage, the Golden Elder, and the Golden Syringa are unsurpassed. Purple Berberry, *Spiræa Thunbergii,* and the common Staghorn Sumach are also to be recommended. The last is specially valuable for its rich coloring in the fall. For the best effects it should be planted in masses on rich soil and cut to the ground each year. It will then grow up six to eight feet each season, and give a rich tropical effect. Other native plants which may be mentioned in this connection are the Thimble Berry (*Rubus odoratus*), with its large, rich, green leaves; Dogwood or red osier (*Cornus stolonifera*), which is specially valuable in winter for the contrast afforded by the bright red shoots.

SOME OF THE BEST TREES.

The trees named below have been growing on the University campus for several years and have proved reliable in this section of the State.

The Elm: Several species of elms are found in New England but the most valuable for ornamental purposes is the native white or American elm, *Ulmus Americana,* which has justly been called "Queen of American Trees." A somewhat moist location is best suited for this species, which where uninjured, grows very rapidly and is of most attractive form and habit.

The English elm (*Ulmus campestris*) is somewhat larger than the American species and is of very different habit—in this respect resembling the oaks. The leaves are smaller, more regularly cut, and darker; the bark is also darker colored.

The Scotch or Wych Elm (*Ulmus montana*) is one of the most valuable of the foreign species, but it is little known in this country. There are on the Campus some interesting hybrids between this and the American species.

The Maple: The maples are among the most valuable and popular of trees for ornamental planting. The Sugar Maple (*Acer saccharinum*) is too well known to require description. It is most at home and grows most rapidly on gravelly soil. The White or Silver Maple (*Acer dasycarpum*) is not quite as early in leaf as the sugar maple, nor is the general appearance so pleasing. It is, however, of very rapid growth and will thrive in a variety of soils. A variety of this species, Wier's Cut Leaved Weeping Maple, is also valuable. The Red or Scarlet Maple (*Acer rubrum*) is not so widely planted as its merits deserve. Like the silver maple it grows naturally on low wet ground, but it will thrive in any soil or situation. Its bright red buds in spring and its scarlet foliage in fall, combine to make it specially desirable. All of the maples named, except Wier's are to be found growing wild in the forests throughout the State.

The Beech: Although of very different style, the beech (*Fagus ferruginea*) ranks with the elm as a hardy and attractive ornamental tree. Its roots grow near the surface and it will thrive in rocky soil.

The Chestnut: The native chestnut (*Castanea Americana*) one of the glories of the rocky hill-sides of Southern New England, is perfectly hardy in Maine and is well worthy of attention. It is particularly adapted to rocky situations or loose gravelly soils.

The Linden: The American Linden or Basswood, (*Tilia Americana*) is valuable for use where an immediate effect is desired. It is hardy, of good form and grows rapidly. The

European species, *Tilia Europea,* is of smaller size and has smaller, darker foliage than the other.

The Birch: The lightness, grace and delicacy of the birches commend them to the attention of every planter. The Cut-leaved Weeping Birch, *Betula Alba* var., is a general favorite wherever planted. The American species start into leaf very early in the spring and many of them will grow under the most untoward circumstances.

The Ash: The ash is a common forest tree in some parts of the State, and is useful in certain localities. It, however, is late in putting forth its leaves. The White Ash, *Fraxinus Americana,* is the most valuable native species. It requires a deep, warm, dry soil. The Black Ash, *Fraxinus sambucifolia* will thrive in wet, cold ground, but it has no special value for ornamental planting.

The Poplars: The poplars are all rapid growers and are valuable for giving an immediate effect—some species often making a growth of six feet in a single year. All are short lived, however, and their greatest beauty is attained while young.

The Oak: While oaks which have attained large size are among the most attractive of trees, the finest species are late in leaf and of slow growth. The most valuable native species are the White Oak, *Quercus alba,* and the Scarlet Oak, *Quercus coccinea.*

THE MOST VALUABLE SHRUBS.

The number of flowering shrubs which will thrive in Maine is comparatively limited. The following have proved satisfactory on the grounds of the University for several years. It is worthy of note that the shrubs which are the most commonly known, and that may be obtained the cheapest, are generally the best, or have the greatest number of good qualities.

The Spiræa: Of the spiræas, the best are *Spiræa Thunbergii* and *Spiræa Van Houttei.* The first has narrow yellowish green leaves and blossoms very early in the spring, before the leaves are fully out. The other blooms about the middle of June and is specially valuable. The flowers are white and appear in great profusion. *Spiræa Reevesii* is similar to the Van Houttei, but a little earlier. *Spiræa Bumalda* is one of the best pink varieties. It commences to bloom about the middle of June and continues all summer. *Spiræa prunifolia,* "Bridal Wreath," is another very good white variety; one of the earliest.

The Lilac: This old favorite is again popular. *Syringa vulgaris*, the true old garden lilac, has varied greatly under cultivation and there are now more than twenty-five named varieties of this species. Some of the best of these are Charles X, Louis Spath, Princess Marie and Senator Vollard, among the purples; and Marie Legraye, and Dr. Stockhardt among the whites.

Syringa Persica, the Persian lilac, has loose graceful heads of flowers in great profusion. The habit of the plant, as well as of the flower cluster, is more open and graceful than that of the common lilac. The white form is specially valuable. *Syringa Josikæa* is a very different species, with large shining foliage and dark, lilac colored flowers. It blooms after many others are out of flower. *Syringa Rothmagensis* is similar in habit to the Persian lilac, but the flowers are dark, reddish purple. It is said to be a cross between *Syringa vulgaris* and *Syringa Persica.*

The Viburnum: Besides the old fashioned Snowball, *Viburnum opulus,* var., *sterilis,* which is always popular and needs no description, the best are: *Viburnum Nepalense,* which is a strong grower, though of compact form, and having large thick leaves; *Virburnum prunifolium,* "Black Haw," a large growing shrub bearing flat clusters of white flowers early in June, followed by black fruit in the fall; also the Maple Leaved Viburnum (*V. accrifolium*) a low growing shrub bearing flat heads of white flowers about the middle of June. The last is excellent for growing in masses, especially in shady places. The Japanese snowball (*Viburnum plicatum*) is one of the best of shrubs. Of upright bushy growth, firm dark foliage, and bearing its white flowers in great profusion, it well deserves a place in every collection. It is in many ways much superior to the old snowball, one special point in its favor being its freedom from lice.

The Hydrangeas: The garden hydrangea, *Hydrangea paniculata grandiflora,* so well known as to require no description, is specially fine for massing. It may be cut back nearly to the ground every year. Rich soil is necessary to give the best effect. *Hydrangea vestita* is a good shrub coming in bloom about June 20th. It is a little smaller than the last named species, and has flat flower clusters like the highbush cranberry.

The Mock Orange: The mock orange or "Syringa" (*Philadelphus*) is one of the finest of shrubs, whether grown singly or in masses. It is hardy, early in leaf, and graceful in habit. *Philadelphus coronarius* is the one most commonly grown, and it has fragrant orange-like flowers, which appear late in June in this locality. *P. zeyheri* is more vigorous and has larger, but less fragrant and less abundant flowers than the preceding. Gordon's Syringa, *P. Gordonii,* somewhat smaller and more slender than the others, blooms a month later but its flowers, though large, are scentless.

The White Fringe: The Fringe or White Fringe, *Chionanthus Virginica,* is valuable not only for its showy, white flowers in early summer, but for its rich, glossy, magnolia-like foliage. When grafted on the ash it sometimes attains the height of twenty-five feet, but as grown at the University, it is a shrub of medium size.

Some other shrubs which have proved valuable at the University are: Bladder Senna (*Colutea*) Flowering Currant (*Ribes aureum* and *R. Gordonii*), Japanese rose (*Rosa rugosa*), Golden Elder (*Sambucus canadensis aurea*), Thimble Berry (*Rubus odoratus*), Tartarian Honeysuckle (*Lonicera Tartarica*), Weigela (*Diervilla florida*).

TRIED AND FOUND WANTING, OR OF DOUBTFUL VALUE.

Among the trees and shrubs which thus far have proved unsatisfactory in Eastern Maine the following may be mentioned: Green Ash (*Fraxinus viridis*), the Magnolias except *Magnolia Soulangeana;* the Japanese chestnuts; Tamarisk (*Tamarix Africana ?*); Cornelian cherry (*Cornusmas*); Deutzia (*D. scabra* and *D. gracilis*); Golden Bell (*Forsythia*); Burning Bush (*Rhus cotinus*).

A FEW HERBACEOUS PERENNIALS.

The number of herbaceous perennials commonly grown in this State is comparatively limited: some of the most valuable, however, are the peony, iris, lily-of-the-valley, "Bleeding Heart" (*Dicentra*), and foxglove.

The peony is specially valuable when planted in masses. It gives a profusion of bloom about the middle of June, and is perfectly hardy. It is valuable alike for landscape effects and for cut flowers. There are more than a hundred named varieties but for ordinary purposes unnamed sorts answer very well, and are much less expensive.

For a short time in early June, before the peonies appear, the varieties of *Iris Kaempferii* are specially valuable. Like the peony, and most other herbaceous perennials, this should be planted in September.

Among the plants which bloom very early in the spring, "Christmas Rose" (*Helleborus niger*) and "Bleeding Heart" should not be forgotten. The first, if protected by a box, will often bloom before the snow is off; and the bright pink blossoms of the latter are always attractive. Feverfew or Pyrethrum, *Chrysanthemum Parthenium,* is another plant that should be in every collection. Its pure white double flowers contrasting with the delicately cut foliage, add much to the border. The tall Pyrethrum, *Chrysanthemum uliginosum* (*Pyrethrum uliginosum*) which blooms in September, is also a valuable plant. It grows about three or four feet high and its large daisy-like flowers are very conspicuous. It is a vigorous grower and may readily be propagated by dividing the clump.

The gas plant (*Fraxinella*) should not be omitted from the list of useful perennials. The handsome ash-like foliage is attractive at all seasons, and the white flowered form is specially showy.

Golden Columbine, *Aquilegia Chrysantha,* is one of the most valuable yellow flowering plants for summer. The double sunflower, *Helianthus Multiflorus,* which grows about three or four feet high, is also valuable. Later in the season the Japanese anemones with their single dahlia-like flowers are valuable. In this connection the dahlia may also be mentioned. Though the roots must be taken up each year, this plant is justly popular. Lily-of-the-valley, foxglove, phlox, larkspur, and some other old garden favorites, easy of culture and prolific of bloom have not been mentioned, nor has anything been said of the numerous species and varieties of lilies. These, however, may well be included in every collection.

MODERN METHODS OF SPRAYING.

A. H. KIRKLAND, M. S., Assistant Entomologist to the Gypsy Moth Committee, Malden, Mass.

In the labor-saving devices and methods now adopted in every branch of human industry, we find ample evidence to show that many of the "luxuries" of one generation easily become the "necessities" of the next. The telephone and typewriter in the office find parallels in the mower and horse-fork on the farm, each having passed through the gradual process of trial, criticism and modification until its present place in its proper sphere has been reached. In testing modern discoveries, both business man and farmer have practiced the old gospel of "prove all things; hold fast that which is good," and out of this testing process have come devices and methods that annihilate space, lengthen life through time saved and often make one day's labors more productive than those of a week, a generation ago. Few in this audience will have difficulty in recalling the time when a spraying pump was a rare luxury and spraying itself as a means of controlling insect damage was practiced by few, criticised by many, and unknown to the majority of our agriculturists; to-day it has become an essential factor in the production of high-grade fruit, a kind of "plant life insurance," as Hale aptly puts it. In fact, so necessary is this work that we accept it as a part of the regular routine of fruit growing and devote no small part of our attention to studying the most effective and economical methods for carrying on the combat with our insect foes.

In discussing the topic assigned by your secretary, we will consider the principal insecticides, the methods best adapted for their economical use and the treatment indicated for the more common fruit and shade tree insects. Because of the limitations of my own study and experience, I shall be obliged to confine myself quite closely to the entomological side of the question, leaving the treatment of fungous diseases to the botanist or mycologist. Even then the field is ample in extent and fertile in opportunity; by far too large a part is yet unexplored.

THE BEST INSECTICIDES.

The insecticides generally used by the fruit grower fall readily into two classes, internal poisons (usually arsenicals) and external irritants (emulsions, soaps, etc.), the first class being used against leaf-eaters and the second against sap-consumers. Of the arsenicals, Paris green has long been the favorite remedy for the potato beetle and more recently has come into general use against many fruit and shade tree insects. Aside from the killing effect, the qualities to be desired in Paris green are freedom from soluble arsenic, fineness and uniformity of composition. With standard grades of Paris green, one pound may be used to 150 gallons of water without danger to the foliage. A less amount of water makes a stronger solution and increases the danger of "burning" the leaves. Paris green kills promptly but is easily washed from the foliage by rain. In using any arsenical, the danger to the leaves is in direct proportion to the soluble arsenic present in the spray and a small amount is always found in Paris green.

A recently discovered arsenical compound, arsenate of lead, bids fair to supersede Paris green as an insecticide. It has about the same killing effects as the former but will not injure the most delicate foliage when applied at any practical strength, is white in color, hence it is conspicuous on the foliage and remains for a long time in an effective condition on the leaves. Another feature of superiority over Paris green is that arsenate of lead is easily kept in suspension in the spraying tank, thus insuring a uniform spraying mixture. In our work against the gypsy moth we have found arsenate of lead to give better results than any other arsenical, and use tons of it annually. Against the common leaf-eating insects it is most effective and I have no hesitation in recommending it as superior to Paris green for which it may be substituted in nearly all cases. Recent experiments indicate that it may be safely and effectively used in connection with Bordeaux mixture.

As yet arsenate of lead cannot be bought ready made in the market, but the ingredients for making it are cheap and the process is easy. Eleven parts by weight of white sugar of lead are dissolved in hot water and four parts of arsenate of soda dissolved in hot water in another receptacle. When the complete solutions are mixed, arsenate of lead is formed as a curdy, white precipitate. The receptacles should be wooden, as the chemicals act upon metal. The total weights of ingredients will give about one-half that weight of arsenate of lead. Thus, if eleven pounds sugar of lead and four pounds arsenate of soda are used, the resulting amount of arsenate of lead will be seven and one-half pounds, a quantity of poison sufficient for 400-500 gallons of water.

The cost of arsenate of lead thus prepared is somewhat greater than that of Paris green, but since when thoroughly applied no respraying is necessary, in the course of the season the actual expense generally will be less than when Paris green is used. In all cases one may use arsenate of lead, properly prepared, without fear of injury to foliage. I might add in passing that the use of arsenate of lead as an insecticide was first proposed by a native of this State, Mr. F. C. Moulton, a former chemist to our gypsy moth committee.

Contact insecticides are used generally against plant lice and scales. As these insects do not take solid food but depend for nourishment upon plant juices which they obtain by means of their slender beaks, they are not susceptible to the remedies used against leaf-eaters; hence, in these cases we make use of oily or soapy washes that close the breathing pores of the insects.

The contact insecticides most generally used are kerosene emulsion and whale oil soap. Kerosene emulsion is made by dissolving one-fourth pound hard soap, cut fine, in two quarts of hot water and adding to the soap suds while still hot, one gallon kerosene oil. The whole mixture is churned or stirred until cool, when a thick, white emulsion is formed. This emulsion can be kept indefinitely and for use on plants should be diluted at the rate of one part to nine of water. Whale oil soap is a heavy, dark colored soap, made from fish oil and is used for the same purpose as kerosene emulsion. It also has an especial importance as a means of treating the San Jose scale, a matter to be referred to later.

THE SPRAYING APPARATUS.

To a large extent, simplicity of mechanism should govern in the selection of a spraying outfit for orchard and farm use. So far as the various complicated tank outfits now in the market are concerned, the average farmer, by the use of a little ingenuity, may turn out as efficient a product and at a less expense. For the general farmer and orchardist, I have seen, as yet, nothing more efficient at an average cost, than a straight tubed brass "Johnson" or "Gould" pump with hose coupling attachment, mounted in a 15-20 gallon keg or a half barrel. A strap or iron handle should be fastened to either side of the keg. The pump should be clamped to a cross piece and the strainer should clear the bottom of the keg by about one-half an inch. Each outfit will require at least fifty—better one hundred—feet of hose, a spraying pole and a good nozzle. After years of experiment in our work against the gypsy moth, we have adopted for use the ordinary white woven cotton hose; this we find gives us the best value for the money invested, is lighter and hence more easily handled. The spraying pole should be practically a continuation of the hose; a quarter-inch iron gas pipe ten feet long with a hose coupling at the lower and a nozzle coupling at the upper end. It may be reinforced by light wooden strips for convenience in handling.

In the matter of nozzles, the market offers a large assortment, yet but few of them are of great practical value. The best pattern is that involving the cyclone principle such as is found in the so-called "Cyclone," "Riley," and "Vermorel" nozzles. The mistake generally made by nozzle makers—and sometimes by nozzle users as well—is in the direction of applying large quantities of the spraying solution. This is all wrong. The spray should be applied as a mist and the nozzle giving the best mist-like spray is the best for the orchardist's purpose. Any of the above mentioned nozzles will give this desired effect. For our own use we have found it necessary to modify the "Cyclone" nozzle by the insertion of a large cylindrical strainer to prevent clogging, and with this modified nozzle we are able to spray continuously for a day at a time without the annoying and costly delays formerly necessary for clearing the nozzles.

In spraying, begin at the top of the tree and work downward and when there is a wind, work from the windward side. Spray until the leaves commence to drip and then move the nozzle. The most costly mistake one can make in spraying is to throw large quantities of solution on the foliage and allow perhaps seventy or eighty per cent of it to run off. Thoroughness is especially profitable in spraying and, so far as possible, both upper and under sides of the leaves should be treated. Another matter of prime importance is that the spraying mixture should be kept well stirred.

Having described a spraying outfit suitable for the general farmer and fruit grower, let us consider the matter from the standpoint of the large orchardist or park official having large numbers of trees to be sprayed. In this case, it would be economical to have a larger tank, a more powerful pump and more hose. The tank should be of at least 100 gallons capacity and the pump capable of supplying two lines of hose, each 100 feet long. In very extensive spraying operations, a steam spraying outfit may prove in the end the most economical. In any case, the spraying poles and nozzles recommended for use with the smaller tank are just as serviceable here. Many orchardists use a molasses hogshead of 150 gallons capacity and a double-acting "Douglas" pump. Unfortunately the majority of the pumps now on the market, suitable for two lines of hose, require two men to operate them most effectively. Referring again to our experience in Massachusetts, we have found it necessary to have made pumps of a special pattern, requiring but one man each to furnish power. With our outfits as described and using large quantities of arsenate of lead, we have been able to spray old first growth oaks and elms at an average total expense of forty-nine cents each and ordinary forest trees at fifteen to eighteen cents each. Orchard trees may be sprayed at a much less cost, since the greater part of the spraying can be done from the ground. Having now discussed insecticides and the means of applying them, let us consider the treatment of the common insect pests of the fruit farm.

TREATMENT OR APPLICATION OF INSECTICIDES.

The bud moth: This is the insect that is largely responsible for the gnarled and distorted growth of many of our apple trees, particularly in old orchards. This insect hibernates as a partially grown caterpillar which, with the advent of spring, seeks out and destroys the unfolding buds, frequently the terminal ones. At the completion of the caterpillar stage it transforms within a leaf and soon gives rise to a small brown moth which later deposits eggs upon the apple leaves. From these eggs, tiny caterpillars develop and feed upon the leaves, becoming about half grown at the time the leaves fall. Then these insects prepare for hibernation on the twigs, covering themselves with a silken cocoon, and so pass the winter, emerging to attack the buds in the spring, as did their predecessors. Where this insect is present in orchards, a thorough spraying with arsenate of lead, applied before the leaves unfold in the spring, will prove an excellent remedy.

Soon after the time of blossoming, the codling moth—a tiny brown moth—is on the wing in nearly all our apple orchards. This moth was formerly thought to deposit its eggs in the calyx end of the apple, but recent researches by Slingerland and Card have shown that the eggs may be deposited on any part of the apple and sometimes on the leaves. However, it seems evident that the young larvæ, hatching from the eggs, enter the apple from the calyx end. They feed therein until mid-summer or later, and as a result, produce the wormy apples which are particularly abundant in every neglected orchard. The transformations between the larval and moth stages are passed in tiny cocoons spun on the trunks or branches of the trees. This insect, to my mind, is one of the most serious pests with which the orchardist has to deal. The financial loss caused by it is enormous and continuous. The codling moth may be effectually controlled by a liberal use of arsenical spray, thoroughly applied after the petals have fallen from the blossoms. It is unwise to spray trees in blossom as many bees and other insects useful in pollenizing the flowers may be killed. Several years ago, Professor Webster ascertained that not only were bees killed by taking honey from trees sprayed while in blossom, but also that the honey which they carry to the hive and feed there to immature bees causes the death of the latter. A spraying of apple trees after the petals have fallen brings about a thorough poisoning of the outer skin of the apple and the consequent death of the young apple worms when they attempt to burrow into the fruit.

Throughout Massachusetts—and I presume the same is true in Maine—the unsightly webs of the tent caterpillar are only too familiar objects in the spring months. Occasionally this insect is an apple tree pest of the first order. The eggs are laid in bands covered with varnish, on the twigs of apple or cherry trees in July, by the reddish-brown parent moth. Here they remain intact through the fall and winter, hatching the following spring and producing young caterpillars which feed upon the unfolding buds and leaves and soon spin a web in some convenient fork of the branches. By the latter part of May or early in June, these webs grow to remarkable proportions and their hungry inmates swarm out over the trees, frequently devouring all the foliage in their vicinity. The pupal stage of the insect is passed within a yellow cocoon, in some sheltered spot, and by the middle of July the moths emerge and deposit the eggs for the next year's brood. Of course every farmer knows how easily this insect may be disposed of by the destruction of the egg-clusters during the winter. Where this work has been neglected, the insects are easily destroyed by the use of an arsenical spray. I do not advise the farmers to burn the webs of the caterpillars—a practice which is too generally followed. I have seen numbers of fine apple trees that have been badly injured by the use of the torch in incompetent hands. Where it is impossible or undesirable to spray, an able-bodied man equipped with a pair of leather mittens can easily crush the webs and destroy the insects more effectually than where the torch is used.

"Canker worm years" are of undesirable frequency throughout the greater part of New England. The wingless female parents of the canker worm ascend the trees both in the fall and in the spring and deposit their eggs in masses on the branches. From these eggs, by the time the leaves unfold, the young canker worms develop in multitudes, the effect of their feeding causing the tree to appear as if burned. Fruit, of course, has no place on a tree attacked by canker worms, and soon falls to the ground. No insect may be more easily controlled than the canker worm by the use of arsenical sprays. The banding of large street trees with tree ink or tar is often very effective. For orchard trees, however, it would be cheaper to spray.

Cherry and pear trees frequently suffer from the attacks of the so-called pear slug, a slimy insect larva that consumes the soft parts of the leaves in the early summer months. When these insects are full grown they descend to the ground and emerge as four-winged saw-flies about mid-summer. These latter insects give rise to a second brood which does not complete its transformations until the following spring. The destruction of the first brood should be the chief object aimed at and as soon as the slugs are abundant on the trees, they should be treated to a thorough spraying with arsenate of lead. In the case of the second brood it may not be desirable to use arsenical poisons because of the size of the fruit and at this time the insects may be destroyed by the use of kerosene emulsion.

Of the scale insects common in our orchards, but three species are particularly injurious. The oyster-shell bark louse and scurfy bark louse have similar habits and are seldom injurious except to young trees. With both species the young lice hatch in the early summer from eggs which are secreted beneath the female scale and swarm over the trees. When they have found a suitable spot on the bark, their slender beaks are inserted into the tissues and, feeding on the sap, they soon secrete shell-like coverings. The sexes mature in the fall and the females, after fertilization, deposit large numbers of eggs beneath their scales. They may be destroyed by spraying or washing the infested trees in the winter with whale oil soap, used at the rate of two pounds to one gallon of water. They are more easily killed by spraying with kerosene emulsion in the spring at the time when the young lice are hatching and swarming over the trees.

The San José scale, a comparatively new insect to the eastern United States, does not readily yield to remedial measures and is one of the most dangerous of all fruit tree pests. It is possible that you have had no experience with it as yet in Maine, but it hardly seems probable that you will entirely escape from it. It was first noticed about 1870 in California and from its damage to fruit trees, attracted wide attention. It reached the east on nursery stock sometime between 1884 and 1887 and is now generally distributed throughout the country. In the south, as well as on the Pacific coast, large orchards of fruit trees have been entirely destroyed by this insect. It was thought that it would not prove very injurious in the northern states, but in Massachusetts many trees have been killed by it and I can see no good reason why it may not prove highly injurious in Maine as well. It certainly is a pest to be carefully guarded against and no nursery stock should be purchased unless the same is accompanied by a certificate of inspection from a competent entomologist. The farmer will do well to carefully scrutinize all nursery stock before planting. Should any of you be so unfortunate as to have this scale on your trees, it will be the part of wisdom to promptly dig and *burn* them if you can possibly afford the sacrifice. Where owners are unwilling to destroy their infested trees, the scale may be controlled by a thorough use of a strong mixture of whale oil soap and water (two pounds to one gallon) applied as a winter wash late in November and again in March. In some cases it would appear that the scale has been eradicated by this treatment. From our own experience in Massachusetts, we consider it a palliative measure only and one that must be repeated at intervals.

FRUITS OF THE ORCHARD.

Having considered the principal fruit pests that may be controlled by spraying, perhaps I may be pardoned for a considerable digression while I speak of some valuable friends of the orchardist. I would like to emphasize the usefulness of birds in destroying noxious insects. While in no way versed in bird lore, I have seen enough of the habits of these creatures to convince me of their great value to mankind, particularly to the agriculturist. The insect parasites that fill the most important place among the natural checks upon the increase of injurious species, stand in no especial danger of harm from human hands, while birds suffer abuse in a hundred ways and are often most wantonly sacrificed by those who should protect and foster them. The winter birds are perhaps the most valuable; birds like the chickadee, nuthatches and creepers are continually working over orchards at the time when the trees are bare and prey upon the bud moth, the codling moth, scales, and more particularly, canker worm eggs. In the gizzard of a nuthatch I once found 1,629 eggs of the fall canker worm, representing at the most not over one day's feeding. The summer birds are equally valuable in destroying canker worms, tent caterpillars and other larvæ. The time is not far distant when the more general adoption of nature study in our schools will lead to a new era in bird life. In the meantime, by protecting your birds and teaching your employees and your young people to do likewise, you will reap ample returns from the time thus spent.

In order that the farmer and the entomologist may best work together, the farmer should familiarize himself with the habits of the most common insects, by observation and reading or studying some accurate, popular work upon the subject. The treatises by Saunders, Weed and Smith are of this class and cannot be too highly recommended. The Experiment Station entomologist can furnish advice as to the habits and the remedies necessary for the destruction of the various insect foes of fruit and other crops. The farmer to get the most benefit from the Station should freely consult the Station experts. Probably Maine farmers do not make the mistake so common among Massachusetts farmers, who do not avail themselves as they ought of the advice of the Experiment Station workers and teachers in the agricultural college. But, to be candid, I have sometimes feared that here in Maine you did not appreciate entomological work as highly as you ought, otherwise you would not have allowed one of the country's most distinguished entomologists to leave this State in order to assist Massachusetts farmers in solving their entomological problems. However, we would not criticise you in the least for Maine's loss has been Massachusett's great gain; and when such fears come to our minds we soon realize that they are indeed groundless, since were you unappreciative you would not have secured the services of so able and learned a man as your present hard-worked Station entomologist. And here let me venture the assertion that should you avail yourselves more freely of his advice and counsel, the ledger of your fruit growing transactions would show a larger balance on the right side.

Finally, let me impress upon you the profitableness of giving your best thought and most careful attention to the problem of combatting insect enemies. By the use of a spraying outfit you may for example, increase the value of your apple crop from fifty to one hundred per cent. A few dollars invested in such an outfit may prove the turning point in a fruit grower's career. Others have profited thereby; why not you? Whatever you do, bear in mind that eternal vigilance is the price of good crops and that careful attention and intelligent treatment of the crop are the chief factors in successful fruit growing.

REFINING INFLUENCES OF PLANTS AND TREES IN PUBLIC PLACES.

By Rev. BLANCHE A. WRIGHT, Livermore Falls.

The time was when capital punishment was meted out to all who were guilty of any serious violation of law. Petty offenders received punishment all out of proportion to their crimes. We do not have to look back far in history to read the records of the time when the chief motive operative in the treatment of criminal classes was to make it impossible for them to injure the public. Whether this was accomplished by killing them or by close imprisonment mattered little, since the welfare of the criminal did not enter into consideration. Meanwhile the making of criminals went on without much restraint. We have taken a long stride forward. We have discovered that the best way to secure protection against criminal classes is to transform them into good citizens by such kind and intelligent treatment as will bring about this reformation; and that better than the work of reformation of criminals is the work of prevention of crime. In this age of splendid philanthropies such a promising field of operations could not fail to be cultivated. The value of education is recognized and the best possible school advantages are opened to children of all classes. Churches are alive to their opportunities and minister in many effective ways to the people in their precincts. Whatever can contribute to the elevation of the masses is rapidly being discovered and put to their use.

* * * * * * * *

We do not stop there. Recognizing the close relation existing between all classes of society we believe that whatever tends in any degree to the refinement and culture of a part of humanity, helps the whole. We are all of us more or less in need of reformation. We all have capacities for good only partially developed; all have finer natures than we have half lived up to. We recognize the value of all those influences that can stir these into full life. Music and art have begun their ministry. The power of architecture is just beginning to be felt in America. One of the most effective agencies for good has had little opportunity to show its power in those sections where it is most needed—nature.

* * * * * * * *

It is a suggestive fact that in the parts of our cities where poverty, intemperance and crime are most prevalent, there are no parks in which the grass and trees can speak their messages. In the part of Boston where the population is most dense and vicious a little abandoned burying ground is the only bit of green, and all the large and beautiful parks of New York are massed in the upper part of the city where the wealthy live. We who have the plants and trees always with us cannot understand how much they contribute to the joys of life nor how closely they are associated with our best and holiest qualities. The little child forgets its fear of a stranger as it eagerly siezes the flowers in his outstretched hands; the hard and cynical face of the prisoner is softened to tears as he receives a bunch of flowers from a compassionate visitor; the modern prodigal turns his footsteps homeward in penitence as the sight of some simple flower calls his thoughts back to the old-fashioned garden his mother tended in the days of his innocent boyhood; the poet turns away from the haunts of man and the things of his creation to find inspiration for his choicest rhymes under the sheltering branches of some grand old tree in nature's voiceless solitude.

* * * * * * * *

There is no place for coarseness or vulgarity in the heart of him who has learned to love and appreciate the works of nature. He who keeps a grassy lawn, borders it with trees and brightens it here and there with flowers, is a philanthropist. He who can and will not, is guilty of crime. But we have no jurisdiction over him. Only by the gentle compelling of education and example can we work his cure. But the public places are ours, ours and posterity's. Let us make them beautiful with nature's offerings. Long after you are forgotten by those who frequent them, every tree and shrub with its tireless voice will be revealing the wondrous beauty and love of Him who gave life alike to them and us.

INDEX TO AGRICULTURAL REPORT.

INDEX TO EXPERIMENT STATION REPORT.

INDEX TO POMOLOGICAL REPORT.

ANALYTICAL SUBJECT-INDEX.

The abbreviation "Sta" signifies the Experiment Station Report, and the abbreviation "Pom." the Pomological Report.