PUBLIC DOCUMENTS OF MAINE

BEING THE

ANNUAL REPORTS

OF THE VARIOUS

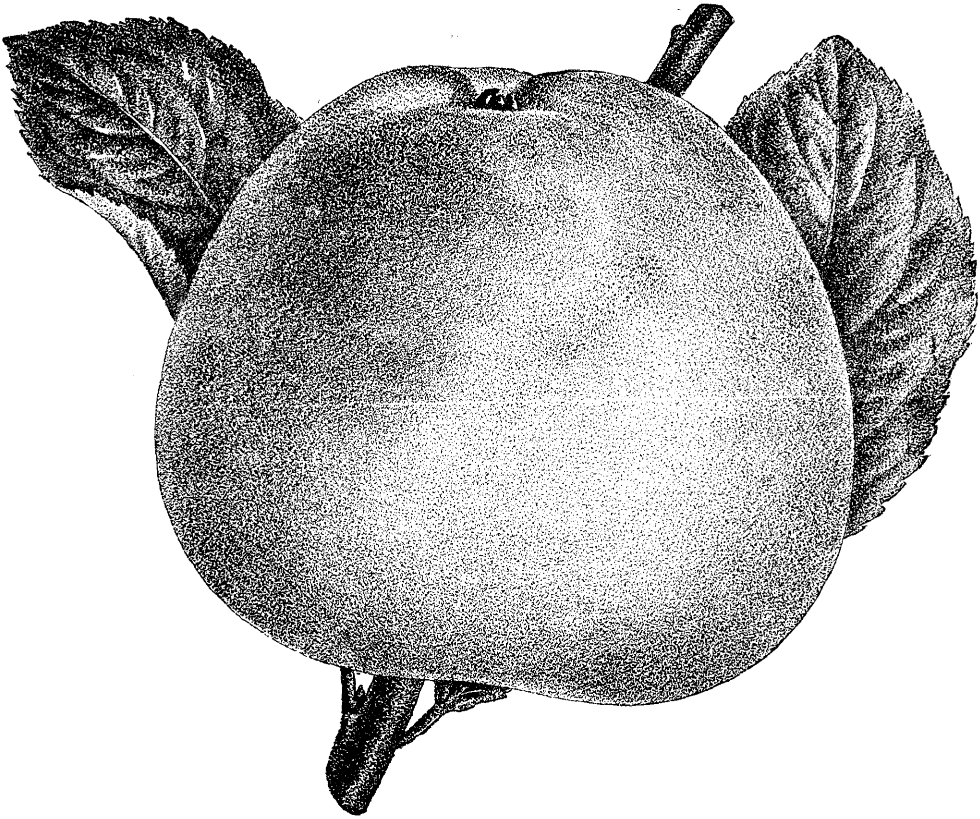
Public Officers and Institutions

FOR THE YEAR

1890.

VOLUME II.

AUGUSTA:
BURLEIGH & FLYNT, PRINTERS TO THE STATE.
1892.



RUSSELL.

A Maine seedling. For history and description see Pomological Report, pages 136-7.

AGRICULTURE OF MAINE.

THIRTY-THIRD ANNUAL REPORT

OF THE

SECRETARY

OF THE

Maine Board of Agriculture,

FOR THE YEAR

1889-90.

PRINTED BY ORDER OF THE LEGISLATURE.

AUGUSTA:
BURLEIGH & FLYNT, PRINTERS TO THE STATE.
1890.

To the Honorable, The Governor and Council of Maine:

In compliance with the law of the State, I have the honor to present the report of the doings of the Maine Board of Agriculture for the year 1889.

Z. A. GILBERT, *Secretary.*

AUGUSTA, January 17, 1890.

MAINE BOARD OF AGRICULTURE—1889.

OFFICERS.

R. W. ELLIS, PRESIDENT.
D. W. CAMPBELL, VICE PRESIDENT.
Z. A. GILBERT. SECRETARY.

MEMBERS CHOSEN BY COUNTY SOCIETIES.

				Term expires Dec. 31.
Androscoggin	County,	L. H. Blossom,	Turner Center,	1889
Waldo	"	R. W. Ellis,	Belfast,	1889
Kennebec	"	S. C. Watson,	Oakland,	1889
Lincoln	"	E. W. Stetson,	Damariscotta,	1889
Washington	"	D. W. Campbell,	Cherryfield,	1889
Cumberland	"	W. W. Harris,	Portland,	1890
Oxford	"	B. M. McKeen,	West Fryeburg,	1890
York	"	J. W. Deering,	Saco,	1890
Somerset	"	G. J. Shaw,	Hartland,	1890
Sagadahoc	"	F. S. Adams,	Bowdoin,	1890
Piscataquis	"	Thomas Daggett,	Foxcroft,	1891
Penobscot	"	B. A. Burr,	Bangor,	1891
Franklin	"	S. R. Leland,	Farmington,	1891
Knox	"	F. L. Mansfield,	Hope,	1891
Aroostook	"	A. L. Haines,	Maple Grove,	1891
Hancock	"	Vacancy.		

MEMBERS FROM STATE COLLEGE.

President, M. C. Fernald, Orono.
Professor of Agriculture, Walter Balentine, Orono.

ELECTED BY THE BOARD.

Z. A. Gilbert, North Greene, Secretary.

MAINE BOARD OF AGRICULTURE—1890.

OFFICERS.

THOMAS DAGGETT, President.
B. W. McKEEN, Vice President.
Z. A. GILBERT, Secretary.

Members Chosen by County Societies.

				Term expires Dec. 31.
Cumberland	County,	W. W. Harris,	Portland,	1890
Oxford	"	B. W. McKeen,	West Fryeburg,	1890
York	"	J. M. Deering,	Saco,	1890
Somerset	"	G. J. Shaw,	Hartland,	1890
Sagadahoc	"	F. S. Adams,	Bowdoin,	1890
Piscataquis	"	Thomas Daggett,	Foxcroft,	1891
Penobscot	"	B. A. Burr,	Bangor,	1891
Franklin	"	S. R. Leland.	Farmington,	1891
Knox	"	F. L. Mansfield,	Hope,	1891
Aroostook	"	A. L. Haines,	Maple Grove,	1891
Androscoggin	"	B. F. Briggs,	Auburn,	1892
Waldo	"	Freeman Atwood,	Monroe,	1892
Lincoln,	"	E. W. Stetson,	Damariscotta.	1892
Kennebec	"	H. O. Nickerson,	Readfield,	1892
Washington	"	Edward A. Moore,	Machiasport,	1892
Hancock	"	Vacancy.		

Members from State College.

President, M. C. Fernald, Orono.
Professor of Agriculture, Walter Balentine, Orono.

Elected by the Board.

Z. A. Gilbert, North Greene, Secretary.

REPORT.

ANNUAL MEETING, 1890.

The annual meeting of the Maine Board of Agriculture was held at the office of the Secretary, at the State House, agreeably to the provisions of the statutes, January 15 and 16, 1890. The meeting was called to order by the Secretary at 11 o'clock, A. M., and the call for the meeting read, after which the member from Oxford, B. W. McKeen of Fryeburg was called to the chair.

The member from Sagadahoc, F. S. Adams, moved the appointment of a committee on credentials and the following were appointed:

F. S. Adams,	*Committee*
F. L. Mansfield,	*on*
M. C. Fernald,	*Credentials.*

The committee subsequently reported the following members duly elected: B. F. Briggs, Auburn, for Androscoggin county; H. O. Nickerson, Readfield, for Kennebec; E. W. Stetson, Damariscotta, for Lincoln; Freeman Atwood, Monroe, for Waldo; Edward A. Moore, Machiasport, for Washington.

The report was accepted and the above-named were declared entitled to seats on the Board for three years.

On motion of the member from Androscoggin, B. F. Briggs of Androscoggin, B. A. Burr of Penobscot and A. L. Haines of Aroostook were appointed a committee to receive, sort and count votes for the necessary officers for the ensuing year, and the following were elected:

Thomas Daggett, *President.*

B. Walker McKeen, *Vice President.*

On motion of the member from Sagadahoc it was

Voted, That the member from Androscoggin cast the ballot of the Board for A. H. Whitmore for messenger, and the same being done he was declared elected messenger.

A messenger appeared from the Valuation Commission, now in session, inviting the Board to hold their session for the reading of the paper by the Secretary, announced in the order of business, in the senate chamber.

Voted, To accept the invitation.

Professor Balentine of the State College was appointed a committee to report the action to the Commission and arrange for the meeting, and subsequently reported that he had attended to that duty and had arranged for the reading of the paper at 2 o'clock in the afternoon.

On motion of member from Oxford the following Committee on Pay-Roll was appointed by the chair:

B. W. McKeen,
Walter Balentine,
B. F. Briggs, } *Committee on Pay-Roll.*

The Secretary made suggestion that the Board elect an executive committee to act for the full Board at all times when the Board is not in session, explaining that while the law makes the Secretary the "chief executive" officer of the Board yet it is frequently the case in carrying on the business of the Board and in planning and arranging its work the counsel of the Board becomes desirable. As it now is there is no law, authority or means for calling the Board together for consultation except in annual meeting. The suggestion is that an executive committee, a body less in numbers and which can easily be called together or consulted by the Secretary, be elected and clothed with the full powers to act for the Board in all matters that may come up in the interim between the meetings by statute provided.

After discussion of the matter, on motion of M. C. Fernald, member from State College it was

Voted, To elect an executive committee of two to act with full powers in the place of the full Board in the interim between the annual meetings, such committee to serve for one year.

On motion of member from Sagadahoc, H. O. Nickerson was instructed to cast the ballot of the Board for

Thomas Daggett,
B. Walker McKeen, } *Executive Committee.*

And they were declared duly elected.

On motion of member from Oxford adjourned to 2 o'clock P. M.

AFTERNOON SESSION—WEDNESDAY.

Met at time of adjournment, President in the chair. On motion an adjournment was made to the senate chamber in accordance with the action of the forenoon where the Secretary of the Board read the following paper, the members of the Valuation Commission being present:

SHRINKAGE IN VALUE OF FARM REAL ESTATE.

By Z. A. GILBERT, Secretary.

[Paper read before the annual meeting of the Maine Board of Agriculture, Jan. 15, 1890].

Every one living in a farming town and interested in farm property, whether as owner or dealer in the same, is well aware there has been going on a shrinkage in value of farm lands and their attachments for some time all over the State and throughout New England. This made itself apparent a full score of years ago. At first its effect was so slight as to be hardly apparent, but year by year it has made its advances with increasing ratio, fully down to the present time, and now has reached a stage truly alarming. Still the end is not in view, and the further contraction in waiting may well arouse the deepest concern, not only among the holders of the property, but with all who have the welfare of the State at heart, and are interested in the general prosperity of her citizens. The unavoidable depression following this alarming shrinkage of farm values has already advanced to a stage where farms have hardly a selling value. When here and there, by death or otherwise, a farm is forced to a sale, the public estimate hardly gives it a value, and it is quite apparent that were any considerable number in any locality forced to a sale at one time, they would not find purchasers. This is not a healthy condition, and already it is plainly showing its inevitable effects. If these values are to shrink to still smaller proportions, and carry with them an increasing effect on all who are directly concerned therewith, as would surely be the case, the resulting effects will be a dark picture to draw. Certainly so grave a matter may well command the attention of the economist, whether within or outside the ranks of those in possession of this real estate.

It is everywhere conceded that agriculture is the basis of the prosperity of a people. This accepted, then first of all, the agriculture of a people should be carefully guarded, and its conditions intelligently studied. It is quite time, then, that the extraordinary conditions in which farming and farm property are now found should command public attention. The farmers themselves, though all the time cognizant of what has been coming upon them, have borne it bravely and without flinching. With their property shrinking in value day by day and year by year, there has been little whining and no sounds of complaint. Neither has there been appeals for help. Too much it is characteristic of farmers to accept what falls to their lot without question. The present crisis is such that, notwithstanding the absence of signs of embarrassment, public attention should be directed to means of relief.

CAUSES.

Every effect must have its cause, and before attempting a remedy the cause must be sought out. In this matter of depressed values of real estate there are several causes which have combined to work the results now under consideration.

1—INFLATED VALUES.

During the war, and the few years following, in which the country was again being filled up with its needed products, farm real estate, in common with everything else, bore an inflated value. It was then worth the prices it bore. As prices again gradually resumed their former relations, farm property took its place in the new schedule of values. This, of course, caused a shrinkage, and was the first step in the down grade.

2—PUBLIC SENTIMENT.

But in case of farm property the shrinkage did not stop on reaching the level of ordinary values. The downward tendency thus started kept on with the farm property. There must, then, have been other causes affecting the problem. Public sentiment came in here to keep up the momentum already begun. Without stopping to trace out how it came about, a western land craze took possession of the country. Unmeasured areas of land were for sale and were advertised to everybody's attention. Books, magazines, papers, publications of every kind, were filled with praises of the West, and the cheap lands there awaiting an owner. Public halls, post offices, stores, and places of business, school-houses, fence posts, show yards, and every place where paste would stick, was placarded with western land for sale. Everybody and everything has been stuffed with the idea of the surpassing value and unrivalled cheapness of these lands. The very air has been loaded with it. A generation has been reared in these surroundings. The idea has been schooled into them that New England was played out, that its soil was old and worn and unproductive, and that only the golden lands of the West were worth the owning. Such sentiments as these pervading everything, coming at a time when, for other reasons, farm values were already on the down grade, had a powerful effect in keeping up the momentum.

3—MONEY.

Of course young, middle aged and old must go West. Property has been sacrificed, homes broken up, parents deserted, and with them has gone our money. The amount of money that has gone out of New England to build up the West is simply beyond measure, and our State has supplied its full share. This drainage of our means in hand has been a serious draft on the loose capital of the State for many years, and is at the present time absorbing the principal part of it. Loan and Trust Companies have been chartered in every considerable town in the State, whose principal business is to gather up the loose capital for western investment. Every man whose industry and economy have gained him a surplus, is shadowed by agents of these companies and labored with till their object is gained. What with private loans, farm mortgages, mortgage loan companies, land speculation companies, and our chartered loan and trust companies, the wonder is that even the land is left for occupancy.

4—SAVINGS BANKS.

But this is not all. In our State there is forty-five millions of money deposited in savings banks. A large proportion of this was dug out of the soil by industrious farmers. As soon as the frugal farmer gets a surplus in hand, no matter if it be but little, it goes into the savings banks where taxes are nominal and security supposed to be safe. A large part of these forty-five millions is also invested in western securities, and adds its part to the other uncounted millions in building up a competition against our home industries. The result of this is that country towns are drained of their money. It has gone into a western mortgage or into the savings bank for a like purpose. The result of all this is easily seen. A young man of limited means wishes to buy a farm. He can find no money in town to help him out for it is all in the savings bank. He goes to the bank and finds it has all gone West. Savings banks will not loan money on country farm mortgages. Western paper is taken freely, *but money cannot be raised on the home farm.*

Now what on earth can a young man do that has a spark of ambition in him for business, but go West? We are absolutely driving him off the farm and out of the State, literally and truly. He must go where the money is available, and where the people want him to do something. Land is worth nothing anywhere without men and money to go with it. Every man that goes West and every dollar that goes with him increases the value of land there and shrinks its value here.

5—TAXATION.

Taxation, as now administered, has a powerful influence in shrinking the value of farm property. In our system of taxation the discrimination against farm property, and especially that of farm real estate, amounts to an outrage too glaring to be endured. Those who have not investigated the bearings of the system as now applied, are not aware of the magnitude of this injustice. Never in the history of the State has it borne with such severity as during the last decade, and in no year so heavily as at the present time. All of course are familiar with our system. Once in ten years a valuation is fixed by the State on which the State and county taxes are annually assessed during the next decade. Assessors of municipalities make a valuation annually, on which all taxes for the year are apportioned among the tax payers of their town or city. All farm property is visible and none escapes the assessors' lists. Ordinarily in country towns and rural districts, for reasons there is not now time to refer to, the assessors' valuation of farm real estate is listed at the highest bearable figures. This is generally found true. These lists go into the hands of the State decennial commission and form the basis for the State valuation. True this is not necessarily so by law, but practically so in fact, for how senseless for a commission to say to the assessors of a rural town that the valuation made by themselves is too high!

None of this applies to invisible property as found in trade, manufactures, mortgages, stocks, banking, &c., nor does it prevail with real estate in cities and manufacturing towns. In the farming towns the valuation lists aggregate more than the property valued will cash for; in the cities and in all circles aside from the farms, no one will pretend to deny but the list is far short of full value. In so far as municipal expenses are concerned it matters not how high the valuation, provided it is evenly placed. But not so with State and county taxes where the rural town is pitted against the city and its half-hidden values. In my own town for several years past the State and county tax together has been just about twice the municipal expenses. Hence this injustice applies to much the larger part of the tax assessed.

For each of the two last decades this discrimination against farm property has borne with especial force, and particularly so in the last ten. The shrinkage of farm real estate in the last twenty years has reached full fifty per cent of its value. In the last ten of these years the shrinkage has been thirty-three per cent with hardly a selling demand left.

In these same ten years the property and business investments in the growing town and city have increased, in the aggregate, at a low estimate, at least twenty-five per cent. With an under valuation on the increase on the one hand, and an over valuation on the decrease on the other, it is easy to figure that farm property is paying more than double its just share of taxes. Besides, the man in business will put five, ten, fifteen or more thousands of dollars additional into his business and no notice is taken of it by the assessors, but if a farmer puts a new shingle on his house (figuratively speaking) he is taxed for it. Is the man of means going to invest his capital in farm real estate under these conditions? Not he! If he studiously shuns such investments he aids in the shrinkage of farm values and in the general depression around him.

6—REMEDIES.

These are some of the thumb screws that are being set on the farmer and his property, and all that time will allow to be noticed in this paper. It is not strange that farm real estate is not salable. It is not surprising that productive lands are ignored and men seek business in town. It is plain to see why young men leave the State and go West. And these are reasons enough why farms are not appreciated. The "deserted farms," of which so much has been said and written, and the "decline of New England farming" what there is of it, over which the metropolitan papers have been so deeply interested, are accounted for under these same heads.

The remedy for this alarming condition of the agriculture of the State is in a reversal of the causes which have brought it about:

1. Money must be kept at home and in the town where it is made.
2. Investment in farm enterprises must be promoted.
3. Agriculture must be fostered by the State.
4. The discrimination in taxation must be reversed.
5. Public sentiment must be corrected.
6. Home advantages must be written up, talked up, taught up and posted up, and western bubbles blown up, and the children brought up with an appreciation of our own surroundings.
7. Capitalists must seek investments in our own State.

Can all this be done? Yes, if men in earnest set about it. The valuation commission now in session can do much towards relieving taxation. The tax commission now investigating taxation can devise a way to release mortgaged farm real estate from taxes, and the next legislature can make it a law. These are steps whose effects would be promptly felt. Others would easily follow when men awake to the fact that we have an agriculture to save, and that faithful citizens have a responsibility in its welfare. Already there are signs of improvement in certain directions. There is a more hopeful sentiment cultivated over our home resources. The western drift of our young blood has been checked. We have only to cultivate these favorable conditions and add still others to their influence to hasten on this improvement, and work a rapid change.

The importation of colonies of foreigners to make these *cheap lands* their homes is not what is wanted and can never reach the case. Re-establish a public sentiment that shall recognize the real productive and intrinsic value of these lands, encourage an appreciation of the many advantages by which we are surrounded, employ our money in home industries instead of keeping the vision fixed on distant objects, remove the discrimination of taxation now crippling farm investments, and we shall have *no cheap lands*. Values will return, and when again established there will be no dwellings wanting occupants, no lands awaiting owners.

After the reading of the paper an adjournment was made to the secretary's office for the resumption of business. The subject of the paper being before the Board remarks were made by Adams, Mansfield, Nickerson, Fernald, Burr, Moore, Harris, Briggs and Stetson.

On motion of the member from Sagadahoc, a committee of three was appointed by the Chair to consider what further steps the Board will recommend in connection with the subject of the paper read, and make report to-morrow morning. F. S. Adams, F. L. Mansfield and E. A. Moore were appointed that committee.

Professor Balentine member from State College moved to proceed to the election of a member of the Advisory Board of the Experiment Station, which was carried and Z. A. Gilbert unanimously elected to the place. Mr. Gilbert declined to accept the office and B. Walker McKeen was elected.

Adjourned to 9 o'clock Thursday morning.

THURSDAY MORNING.

The Board met at time of adjournment and the records of the previous day were read and approved.

The report of the committee on the paper on Shrinkage of Farm Values, read by the secretary, was called up and read by the chairman as follows:

We recommend that the Board select its secretary as a representative to present this matter of valuation and taxation of farm property, still further before the Valuation Commission now in session and also before the commission authorized and provided for by the last legislature for the investigation of our system of taxation, and that he present the matter at such time and in such manner as shall be by him considered best; and we would especially recommend that the attention of the Valuation Commission be called to the discrimination in favor of the timber owners of our State, and we would also recommend that the attention of the tax investigation commissioners be called to methods of relief of farm property from bearing more than its due share of taxation.

F. S. Adams,
F. L. Mansfield,
E. A. Moore,
Committee.

The report was accepted and its recommendations approved.

The Committee on Pay-Roll made their report and the same was accepted and approved.

Professor Balentine from the State College then brought up the matter of introducing elementary instruction in agriculture into the common schools of the State and discussed the matter at some length. He advocated special text-books and the doing away of some of the work as now conducted. The boys and girls should be taught the principles of soil formation, fertilization, plant growth, animal nutrition, insect life. There should be an interest created in these things. Children should be led in early years to study nature's work and become familiar with her laws.

Member from Oxford supported the proposition and claimed there was ample time in the common schools for the introduction of the elements of the sciences relating to agriculture if we wish to take it.

President Fernald of the State College said if there was a demand for text-books the supply would be forthcoming. Caution was necessary that the opposition of the educational workers of the day be not raised. No doubt, however, but wisdom would prevail for it would be unprofitable to make any radical change that would precipitately overturn the present system.

Secretary Gilbert said this matter of elementary instruction in the sciences relating to agriculture had been several times before presented to the attention of the Board of Agriculture and by some of our most eminent educators.

To-day a general feeling pervails that we should now take decided steps in the matter. The action of the State Grange at its recent annual meeting indicates the drift of the thought of the public. Parents have not yet demanded this line of instruction. When they do, the work will commence. Here is where we want to direct our efforts. What we aim at is the elements of the sciences relating to agriculture. This is the line of instruction, and every scholar, whether in city or country, should be taught those essentials which have to do with our very existence. The work is to popularize this movement, and, therefore, it is one in which the Board can well take definite action and make its influence felt.

Member from Penobscot. Our standards of education are constantly changing. We cannot measure the future by the past. Hence it is folly to charge that any future change cannot be made. We can do what we will. Our work is to represent the farmers of Maine. We need to measure standards by the needs of to-day. It is our duty to interest ourselves, and take an advanced position, thus leading in the work we recognize as necessary to be done. A complete, well rounded education is to-day necessary for success anywhere; and while we may regret our non-advantages, we should be the more active in securing these for others who are to come after us. This subject, properly urged and carried forward, will meet the approval of the general public.

Mr. STETSON. The children need to be taught these principles, and to know how to judge what are friends and what are enemies in insect life and in plant life as well.

Dr. Twitchell, Lecturer of the State Grange was called upon and expressed his great pleasure at the intensely practical turn given to the discussion of the two great questions of taxation and education, and pledged the Board the hearty support of the State Grange and the Patrons of Husbandry in all efforts to promote the welfare and increase the prosperity of the farmers of Maine.

The member from Franklin presented the following resolution:

Resolved, That it is the belief of the State Board of Agriculture that the principles of agriculture should be introduced and taught in our common schools as soon as may be practicable.

On motion of the member from Oxford, the resolution was given a passage.

On motion of the member from Androscoggin it was

Voted, That the executive committee of the Board, in connection with the secretary, be a committee to act with the committee appointed by the State Grange, to further the interest of introducing the principles of agricultural education into the public schools.

The member from Oxford then called up the matter of enlarging the work of the Board and increasing the duties of its secretary, advocating increased appropriations by the State for this purpose. He said that agriculture is not receiving the assistance and encouragement from the State that many other of our interests are, and it is the duty of the Board to keep the question prominently before the public till its just claims are recognized.

The institute work, so effective, is hampered because of insufficient appropriations. We should double the number of institutes held in the State. The secretary should be constantly employed in the duties of the office, and for this we must have increased appropriations. Other departments are securing something adequate

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to the work necessary to be done. The agricultural interests of Maine demand something more than has been necessary in the earlier days, and we are not faithful to duty if we do not recognize the situation, and act accordingly.

Hon. R. W. Ellis, the retiring member from Waldo. I want to heartily and emphatically endorse the position taken by Mr. McKeene. When we consider results possible by doubling our institute work, the outlay called for is too trivial to be worthy of notice. Results are what we should look after. Let us go to work like business men. Let us ask the legislature to invest a little in agricultural work, because of the great returns possible. Keep the question alive and before the public, till the necessities of agriculture are reached.

MEMBER FROM CUMBERLAND. When we select one branch of agriculture, and measure the advance of the past ten years, we are surprised at what has been accomplished. Take dairying, for instance. The benefit to the State to-day in this one department, is more than the whole outlay for the Board, and its advances are chiefly due to the work of this Board. Let us make our claim, and keep it before the public mind until we get what we need.

MEMBER FROM SAGADAHOC. Let us keep asking until we get what are our just rights. The Labor Commissioner receives a salary sufficient to command his entire time. Are his duties of greater importance than should be given into the hands of the secretary of the Board of Agriculture? Bring this question before every agricultural society in the State, and keep it prominent until something is accomplished.

Pres. FERNALD. In order to do a work commensurate to the importance of the question, greater appropriations must be secured. If we keep up the agitation, I believe another legislature will grant the reasonable petition of the agricultural interests. If we can increase any industry five per cent, it will more than compensate for any appropriations which may be asked for.

Adjourned to 2 o'clock.

AFTERNOON.

The subject matter of the forenoon being still before the Board, President Fernald of the State College presented the following preambles and resolutions, and they received a passage by a unanimous vote:

WHEREAS, The institutes in the different counties of the State, under the auspices of the Board of Agriculture, have largely promoted our agricultural interest, and

WHEREAS, A small percentage of improvement in our varied agricultural industries, insures large aggregate returns to the farmers of Maine, therefore

Be it resolved, That the scope and educational work of the Board through Farmers' Institutes can be largely increased with manifest advantage to the agriculture of the State; and

Be it further resolved, That the Executive Committee of this Board be a committee, with discretionary powers, to present the importance of this subject to the people of the State, and to arrange for such legislation as they shall deem necessary to give effect to the foregoing resolves.

The secretary called the attention of the members of the Board to some features of the work of agricultural societies, more particularly to the large amount of money, proportionately, paid out in trotting purses by many of the societies, and raised the question whether in some cases the racing was not being made the principal part of the show. He would not in any sense be understood as raising an objection to this feature of the exhibition, but claimed a society should not appropriate the principal part of its money and its efforts to its encouragement. As an accompaniment to a general exhibition the races were acknowledged as legitimate and recognized as important. While some enthusiastic horsemen claim that the races are the chief drawing card a careful observation shows conclusively that it takes an exhibition full in all its departments to draw a crowd and swell receipts. Experience has fully proven that a horse race alone will not do it.

The practice of some societies, where the exhibition is run through three days time, of holding the show of cattle proper on the first day and that only, and before the other departments are set up and open to visitors, results in a small attendance and an apparent indifference on the part of the public to the show of this class of stock. The trouble is believed to be with the arrangement rather than with the people. The visitors to a fair do not generally attend on all three of the days, so if any day is to be left out it is that on which there is the least in readiness to see, and this is the first day, and the only one in which the cattle are shown. So this part of the show is skipped, not because there is no interest in it, but it is believed because there is little else with it. The Oxford county society makes the first day a preparation day only all around and show their cattle on the second day when the whole exhibition is ready for visitors and the people are there to see it. There is no apparent indifference to or lack of interest in the cattle department under this arrangement.

Most of the members of the Board are officers of agricultural societies, and attention is called to these matters as suggestions for consideration in conducting their affairs. If it is a fact that people are deprived by the arrangement of the benefits which should be gained from a stock exhibition, all will agree that the order should be changed; if it is a growing indifference to stock matters on their part, then certainly the effort should be to correct the error by efforts to cultivate an interest in it.

The business of the session having been closed the Board adjourned without day.

Z. A. GILBERT, *Secretary.*

WORK OF THE BOARD.

The time covered by the record of the work of the Board given in this report began with June 1, 1889, and closes June 1, 1890. Its public work has been carried on in the usual manner and has met a creditable degree of interest on the part of the farming public and all others interested in agricultural affairs. It is a fact plainly demonstrated that through the efforts of the Board and other instrumentalities at work in a similar direction, there is more of study given to the problems of agriculture and more of consideration given to its business management from year to year as these instrumentalities keep up their work. But the necessity for studied attention on the part of the farmers is on the increase, so there is not likely to come a time when it can be said the work has been accomplished and the efforts can be discontinued. The age in which we live is one of advancement and agriculture cannot be left to trail its way along unaided. More and better work from the Board is called for each succeeding year. This can only be done through an increase of means and through the undivided attention to the work on the part of its chief executive officer. This is plainly seen by the members of the Board, hence the action at the annual meeting. They demand that this department shall be made more prominent and more effective; that the Secretary of the Board shall be required to give his entire time and energies to the duties of the position, and that in common with all the other departments of the State government the headquarters shall be permanently established at the Capitol. This is reasonable and just.

Institutes have been held as follows:

Aroostook,	at Caribou, October 22.
Washington,	at Cherryfield, October 25.
Piscataquis,	at Foxcroft, November 5.
Penobscot,	at Bradford, November 6.
	East Eddington, February 28.
Androscoggin,	at Poland, November 8.
Cumberland,	at Windham, November 9.
Lincoln,	at Bristol, November 19.
Waldo,	at Freedom, December 12.
Kennebec,	at Fayette, December 27.

Franklin,	at Farmington, January 10.
Somerset,	at Hartland, January 29.
	Fairfield, January 30.
Sagadahoc,	at Topsham, January 31.
Oxford,	at Norway, in connection with Pomological Society, February 5-7.
Knox,	at Union, February 18.
York,	at Saco, February 20.
	Springvale, February 21.
Hancock,	at Brooksville, February 26.

Nineteen institutes have been held during the time covered by this report with an expenditure of $1351.17, averaging $71.12 each. The work has been confined largely to the members of the Board. Experts from other States have been employed as follows: Prof. George H. Whitcher of the New Hampshire Agricultural College, Hon. Edmund Hersey, member of the Massachusetts Board of Agriculture, Prof. J. W. Sanborn, Director of Utah Experiment Station, Dr. T. H. Hoskins, Newport, Vermont, Prof. Levi Stockbridge, ex-President of the Massachusetts Agricultural College, and Mr. Abel F. Stevens, Wellesley, Massachusetts. Assistants within the State, but not members of the Board, have been employed to give lectures and papers as follows: Mr. A. I. Brown, Belfast, Joel Richardson, Esq., Newport, Dr. G. M. Twitchell, Fairfield, Hon. Rufus Prince, Turner, Mr. W. A. Allen, gardener to Insane Asylum farm, and Professors Jordan and Harvey of the Experiment Station.

The lectures and papers given in this report show the scope of the institute work.

REVIEW OF THE SEASON.

The season of 1889 was in the main crowned with a reasonable bounty to the diligent worker on the farm. The snow disappeared early in March and the frost left the ground in good time for operations on the farm. But little preparatory work had been done the previous autumn so that more than the usual work was crowded into the time for seeding. Farmers entered upon this work with vigor, and the weather favoring the usual area in the staple crops was seeded in good time.

Grass, the leading crop of the State, came through the winter without injury save that through the northern section it was thinned somewhat by winter-killing. Timely rains all through the season favored its growth and gave, probably, the heaviest crop of hay ever harvested in the State. Based on census statistics and estimates of former years the aggregate must reach a full one and a half million tons. The same conditions which gave the great hay crop were alike favorable to pasturage, and continuing through the autumn months, gave an unusual supply of feed for stock up to the season for housing. Thus the season was remarkable all through as *a great grass year*. While this striking feature of the year was especially favorable for the stock farmers in giving them an abundance of the cheapest and best stock food known to the farm it has been diametrically opposite for those who grow the crop for sale. The remarkable abundance of grass was not confined to our own State but extended throughout the great grass belt of the country. As a result the hay markets have been greatly overstocked and the prices correspondingly low, thus placing an almost complete embargo on the shipping to markets outside the State, and leaving a large bulk of the crop still on hand at the barns.

Oats and mixed grains take the lead in grain with barley taking the next position and wheat standing still lower. Since the advent of lower prices of Western flour, prevailing for several years past, wheat production has greatly fallen off in the State and appearances indicate will continue so to do unless a radical change of value should take place.

Grains of all kinds started out for a full crop, but heavy and frequent rains coming on at the time of its filling lodged it badly. Unfavorable weather prevailed during much of the harvest and added its effects to the previous damage. The final result was a light yield of damaged grain of all kinds.

Potatoes were planted in good season and in usual breadth. Aroostook county and other parts of the eastern part of the State still make this the leading cash crop of the farm. The crop grew admirably till up to the first of August, when a series of heavy rains accompanied by a succession of wet and foggy days started the "rust" or "blight" and in a week's time the crop was dead.

The first early planting were grown and ripe when the rust struck, and these gave a good yield and of good quality. With the great part of the field crop, however, the tubers were but about half grown, and the yield and the quality corresponded. Aroostook county, fortunately, was an exception to the sweeping destruction of the crop in other parts of the State. There the rust was later in its appearance and gave time for the potatoes to make a crop, though not fully ripe. The result was one of the heaviest yields and largest crops in the aggregate ever harvested in the county. On good land, well treated, the crops were surprising. Charles B. Coy, Presque Isle, took the grand eleven hundred dollar prize for largest crop, offered by the American Agriculturist and Bowker Fertilizer Company, with a yield of 738 bushels and 24 pounds on one acre. In competition for the same prize, Fred S. Wiggin, Maysville, grew a crop of 537 bushels and 38 pounds on an acre. Another crop of 523 bushels to the acre was grown by Delano Moore, Presque Isle, and still another of 402 bushels by George W. Moore of the same town. Other crops, but little under the last figures named, were harvested in many cases. The price for this great crop ruled from $1.50 to $2.00 per barrel at the stations and 25 cents per bushel for the starch potatoes at the factory. A large amount of money was left in the county in exchange for the crop.

The season was favorable for corn and a fine crop, well ripened, was harvested. The area in sweet corn for packing was less than in 1887 and 1888. Some of the factories did not pack on account of the unpromising condition of the market and some farmers would not plant on account of a reduction in the price paid. The corn crop is still increasing in favor among farmers as cheaper methods of culture are adopted and better methods of preservation of the fodder are introduced.

The business of orcharding is still increasing in the State notwithstanding the discouragements of the low prices of a year ago. The crop of apples was but a little less than the great crop of 1888. Prices ruled very favorable to the producer and the crop brought more money in the aggregate than any crop of apples ever before harvested in the State. A large measure of the crop was sold directly from the trees at $2.00 a barrel. The price gradually strengthened through the winter and in March and April reached $4.00 to $5.00 at the road for choice Baldwins, a price seldom before touched at that season of the year in the history of apple growing in the State.

Thus with a good crop of potatoes and good prices for them in the eastern part of the State, and a large crop of apples and high prices in the western, as cash crops, farmers have been favored with a goodly measure of ready money.

A review of the stock interests of the State is not wholly encouraging. The markets are still filled with Western beef and the low prices of last year continue. Six cents a pound has been the top price realized for the richest cattle at any time during the year, and but a small portion of the time that sales could be made at that figure. Steers and other young cattle have hardly had a selling value. The result of this shrinkage in value is that comparatively few calves have been raised and very much less attention is being given to the making of beef.

The dairy business of the State is on the increase in a small measure, and, in the main is meeting a good degree of favor where made a specialty. The factory system generally prevails. Thirty-three factories are in operation in the State.

Sheep are meeting increased favor, and though not increasing in numbers, yet the different practice to a large extent prevailing, brings more income to the head than was realized under the former course pursued, and probably brings in quite as much money as the larger flocks formerly kept. Mutton and lamb are now the leading object, with the wool a secondary, though by no means an unimportant matter. Where this change in the business has been inaugurated and the work conducted in a manner corresponding with it, sheep are in much favor.

The breeding of horses is receiving increased attention in the State from year to year and a large amount of capital is being invested in the business. The standard of the stock bred is also improving rapidly. While what is known as trotting stock monopolizes the chief attention, yet the heavier business and draft horses are now bred in considerable numbers and are rapidly gaining in favor.

The returns from the several agricultural societies of the State, given herewith, show active efforts among these organizations for the promotion of the agricultural interests among us. The receipts and expenditures of the several societies returned show the finances to be in good condition. Aside from the State Society there is now but very little of indebtedness standing against these societies, and most of them have grounds well equipped for exhibition purposes. The figures show a tendency to increase the proportion of money expended for trotting purses as compared with that offered in prizes for other stock. This is a questionable course and should be carefully considered by the officers. Certainly the State in aiding these societies contemplates a broader field of work than a trotting race. All of our stock interests should receive, as they deserve, encouragement proportionate to their importance among us.

OFFICERS OF AGRICULTURAL SOCIETIES, 1890.

Societies.	President.	Post Office.	Secretary.	Post Office.	Treasurer.	Post Office.
State Agricultural	Rufus Prince	South Turner	A. L. Dennison	Portland	E. G. Eveleth	Auburn.
Eastern Me. Fair Association,	J. P. Bass	Bangor	E. L Stearns	Bangor	E. B. Nealey	Bangor.
Maine State Pomological	Charles S Pope	Manchester	D. H. Knowlton	Farmington	A. S. Ricker	Turner.
Aroostook County	John Stewart, Jr	Houlton	G. H. Gilman	Houlton	A. H. Fogg	Houlton.
Androscoggin County	D. P. Field	Auburn	E. G. Woodside	Lewiston	J. G. Ham	Livermore Falls.
Aroostook, North	G. M. Park	Presque Isle	F. S. Wiggin	Maysville Centre,	James W. Bolton	Presque Isle.
Aroostook, Madawaska						
Aroostook, Van Buren	Ambrose Violette	Van Buren	Simeon Cyr	Van Buren	Simon Cyr	Van Buren.
Cumberland County	W. H. Vinton	Gray	D. F. Whittier		W. P. F. Robie	Gorham.
Franklin County	Rolo S. Sampson	Temple	E. A. Hall	Chesterville	P. P. Tufts	Farmington.
Franklin, North	T. B. Hunter	Strong	J. W. Butterfield	Phillips	D. D. Graffam	Phillips.
Kennebec County	George E Minot	Belgrade	H. O. Nickerson	Readfield	C H. Severy	Readfield.
Kennebec, North	S. C. Watson	Oakland	F. F. Graves	Waterville	C. G. Carleton	Waterville.
Kennebec, South	George Brown	Randolph	F. H. Moores	Pittston	Charles E. Coombs	Windsor.
Knox County						
Knox, North	E. H. Mero	Union	F. E. Burkett	Union	F. H. Pratt	Union.
Lincoln County	Thomas J. York		E. W. Dunbar	Damariscotta	George H. Weeks	Damariscotta.
Oxford County	A F. Andrews	Norway	A. C. T. King	South Paris	A. C. T. King	South Paris.
Oxford, West	C H Walker	Fryeburg	B. Walker McKeen	West Fryeburg	W. R. Tarbox	Fryeburg.
Oxford, Androscoggin Valley,	T. B. W. Stetson	Canton	H. T. Terrill	Canton	H. T. Terrill	Canton.
Oxford, Andover	Olcutt B Poor	Andover	John F. Talbot	Andover	George W. Abbott	Andover.
Penobscot County	H. M. Brown	Newburgh	G. N Holland	Hampden	G. N. Holland	Hampden.
Penobscot and Aroostook	Alfred Cushman	Sherman	L. B. Rogers	Patten	S W Robbins	Patten.
Penobscot, West	John Rogers	Stetson	T. P. Batchelder	Kenduskeag	T. B Batchelder	Kenduskeag.
Penobscot, North	E. A. Reed	Springfield	N. Averill	Lee	F. M. Johnson	Springfield.
Penobscot, Central						
Piscataquis, East	I. F Hobbs	Milo	W. H. Snow	Milo	W. N. Snow	Milo.
Piscataquis, Central	A. M. Ayer	Dover	D. E. Dinsmore	Dover	D E. Dinsmore	Dover.
Piscataquis, West	W. F. Towne	Monson	J. H. Thombs	Monson	J F. Thombs	Monson.

Sagadahoc County	G. M. Gowell	Bowdoinham	I. E. Mallett	Topsham	L. E. Smith	Brunswick.
Somerset, East	J. P. Longley	St Albans	J. M. Lancey	Hartland	S. L. Mayo	Hartland.
Somerset, Central	R. B. Shepherd	Skowhegan	A R. Smiley	Skowhegan	A. R. Smiley	Skowhegan.
Somerset, West						
Waldo County	Daniel A. Wadlin	Belfast	Mark A. Wadlin	Belfast	A S. Redman	Belfast.
Waldo and Penobscot	C. A. McKenney	Monroe	E. H Nealey	Monroe	F. S. Palmer	Monroe.
Waldo, North	E. Rand	Unity	J. H. Cook	Unity	H. B. Rice	Unity.
Waldo, West	R. S. Ayer	Liberty	F. Knowlton	Liberty	Stephen Bagley	Liberty.
Washington County	N. S. Allan	Dennysville	H. F. Porter	Pembroke	P. E. Vose	Dennysville.
Washington, West	J. L. Bucknam	Columbia Falls	Eben F Allen	Columbia Falls	F. L. Allen	Columbia Falls.
Washington, Central	J C. Talbot	East Machias	W. H Phinney	Machias	M. Jordan	Machias.
Washington, North	Oscar Pike	Princeton	W. R. Dresser	Princeton	S. G Spooner	Princeton.
York County	J. M. Deering	Saco	A. S. Ricker	Biddeford	G. H. Boothby	Saco.
York, Buxton and Hollis	Andrew L. Berry	Bar Mills	I M. Milliken	Hollis	J. W. Meserve	Bar Mills.
York Ossipee Valley	B. F. Pease.	Cornish	J. C. Ayer	Cornish	H. Brackett	Cornish.
York Ramshackle Park	A. G. Mitchell	West Newfield	Leroy O. Straw	West Newfield	C E. Pinkham	West Newfield.
York, Shapleigh and Acton	A. H. Brackett	Shapleigh	H. Bodwell	Acton	H. A. Stanley	Shapleigh.

FINANCIAL STATEMENT OF AGRICULTURAL SOCIETIES FOR THE YEAR 1889.

	Amount received from State.	Receipts from membership for the year (annual and life)	Receipts from annual exhibition.	Receipts from loans.	Total receipts for the year.	Amount awarded in trotting purses.	Total amount of premiums and gratuities awarded, including trotting purses.	Amount expended during the year on improvements on grounds and fixtures.	General expenses of Society during the year.	Total amount paid out during the year.	Value of property belonging to Society.	Amount of liabilities of Society.	Amount awarded for plowing.
	$	$	$	$	$	$	$	$	$	$	$	$	$
Maine State Pomological	500 00	100 00	500 00	-	1100 00	-	616 00	616 00	328 13	944 13	150 00	250 00	
Androscoggin	400 00	383 00	911 68	-	1694 00	822 87	1474 72	195 67	184 95	1948 95	1500 00		
Aroostook	167 00	45 00	595 15	-	807 15	245 00	469 66	16 64	140 97	743 02	379 55	125 00	
Aroostook, North...............	233 00	53 00	1443 91	-	1829 91	555 00	881 85	881 85	627 02	1633 72	1022 90		
Aroostook, Madawaska..........													
Aroostook, Van Buren..........													
Cumberland....................	400 00	40 00	2517 40	-	3042 42	1100 50	1757 15	1500 00	-	2926 90	4000 00	1316 02	
Franklin County........	131 00	142 40	1540 00	-	1813 40	400 00	850 00	300 00	325 00	-	5000 00	750 00	
Franklin, North	51 00	221 00	249 74	175 00	696 74	200 00	410 00	48 00	286 74	706 57	1200 00	532 61	
Kennebec County..............	310 18	-	1507 25	-	1817 43	343 00	1009 00	154 97	457 53	1817 43	1150 00	294 30	
Kennebec, North..............	159 00	-	-	-	-	-	-	-	45 00	-	3500 00	2000 00	
Knox County..........	176 00	-	478 20	150 00	804 20	75 00	337 50	187 89	-	825 39	-	171 19	
Knox, North...................	150 00	318 50	137 00	478 00	686 47	-	321 44	-	253 72	-	211 31		
Lincoln County................	248 00	26 00	1227 15		1475 15	367 00	630 98	200 00	272 20	1401 23	1500 00	590 00	
Oxford County.................	221 00	16 00	3958 26	67 20	4262 46	753 00	1181 25	215 40	2205 40	4312 74	7500 00	1132 00	
Oxford, West..................	105 00	40 00	1671 00	200 00	2016 00	625 00	1150 40	200 88	400 00	2217 00	6000 00	2700 00	
Oxford Androscoggin Valley.....	-	121 00	809 32	-	930 32	453 25	806 12	1883 56	221 96	1028 01	1883 56	1981 25	
Oxford, Andover	-	2 00	504 75	10 80	517 55	250 00	376 60	-	153 52	153 52	650 00		
Penobscot County	40 00	-	103 70	-	143 70	-	154 90	-	97 20	252 10			
Penobscot and Aroostook........	100 00	383 00	10 00	-	493 00	16 00	144 00	147 50	37 00	328 50			
Penobscot, West...............	288 00	62 00	1547 42	-	1897 42	520 00	908 50	449 60	328 90	2347 46	2000 00	385 50	
Penobscot, North.............	42 00	30 00	120 00	-	192 00	130 00	207 60	-	25 00	235 00			
Penobscot, Central.............													

Piscataquis, East................	20 00	37 00	16 00	-	73 00	8 00	49 10	-	22 30	71 40	15 00	
Piscataquis, Central.............	116 00	104 00	364 00	-	468 00	300 00	515 75	16 55	52 25	584 55	300 00	262 00
Piscataquis, West	13 00	-	108 83	-	121 83	-	80 06	-	31 49	111 55		
Sagadahoc.......................	264 00	50 00	2477 10	25 00	2816 10	681 00	1632 87	738 00	657 00	3027 87	5500 00	200 00
Somerset, East..................	143 00	163 16	708 59	1825 00	2884 76	475 75	789 95	2125 88	177 52	3094 45	4700 00	2226 58
Somerset, Central	180 00	69 50	921 25	-	990 75	350 00	857 00	200 00	566 63	1623 63	3000 00	632 88
Somerset, West												
Waldo County..................	167 00	-	837 75	-	1004 75	405 00	943 00	2000 00	25 00	862 75	3500 00	
Waldo and Penobscot...........	130 00	180 00	1830 25	57 00	2197 25	550 00	1135 05	651 63	367 00	2153 88	3000 00	
Waldo, North....................	57 00	112 00	305 00	-	474 00	-	447 00	60 00	32 16	92 16		
Washington County............	77 00	3 00	1221 14	-	1301 14	550 00	1001 54	-	372 58	1307 02	1500 00	70 70
Washington, West..............	123 00	1 00	2162 93	-	2286 93	510 00	1420 70	-	852 24	2272 94	1056 00	
Washington, Central...........	91 00	16 00	778 06	-	885 06	515 00	906 15	-	352 00	1120 10	-	425 00
Washington, North.............	109 00	7 00	792 71	-	908 71	316 00	676 50	100 00	132 21	908 71	2500 00	1225 00
York County....................	218 00	10 00	2126 48	-	2344 48	1272 50	1715 56	-	719 17	2434 73	2000 00	500 00
York, Buxton and Hollis........	137 00	-	1570 64	925 00	2632 64	702 00	889 50	1125 00	498 59	2513 09	3000 00	1750 00
York, Shapleigh and Acton......	45 00	140 00	189 75	83 35	458 10	95 00	385 75	20 00	30 00	415 75	4500 00	
York Ossipee Valley Association.	200 00	-	1841 90	1100 00	3141 90	749 00	1166 35	672 75	294 03	2133 13	5500 00	2300 00
York Ramshackle Park.........	--	125 00	599 95	-	724 95	264 00	512 00	100 00	75 00	687 00	2000 00	125 00

Financial Statement of Agricultural Societies for the Year 1889—*Continued.*

	For bulls and bull calves	Working oxen, 4 years old and over.	Steers under 4 years old.	Am't awarded for cows.	For heifers and heifer calves.	Amount awarded for fat cattle.	Amount awarded for stallions.	Amount awarded for breeding mares.	For other horses and colts.	For swine.	For sheep.	For poultry.	Total amount awarded for live stock.	Total amount awarded for horses—not purses.	Amount awarded for Indian corn.	For wheat.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Maine State Pomological																
Androscoggin	30 00	12 00	7 00	18 00	67 00	10 00	35 00	15 00	44 00	3 00	22 00	5 00	319 54	73 00	1 50	1 00
Aroostook	24 00	5 00	3 50	14 75	24 25	-	20 00	7 50	32 00	11 50	9 30	7 65	99 95	59 50	1 75	50
Aroostook, North	27 75	11 50	12 00	31 00	23 25	-	9 00	11 00	35 00	3 50	13 50	3 50	126 00	55 00	4 00	75
Aroostook, Madawaska																
Aroostook, Van Buren																
Cumberland	81 00	97 00	15 00	57 00	16 00	10 00	34 00	5 00	46 00	8 00	30 00	39 50	304 00	85 00	2 00	
Franklin County	42 00	51 50	46 00	20 25	27 50	10 00	14 00	6 00	18 50	5 00	58 75	14 00	275 00	46 50	2 75	
Franklin, North	8 00	35 50	20 00	11 00	10 00	4 50	4 50	4 50	22 50	5 25	13 50	4 40	100 00	33 65	45	3 00
Kennebec County	23 50	59 00	29 00	29 00	29 80	17 50	35 00	6 00	393 00	12 00	20 00	15 00	229 80	100 00	24 25	4 00
Kennebec, North																
Knox County	5 00	14 00	2 00	14 00	5 50	5 00	6 00	5 00	20 00	5 00	4 00	7 00	45 50	31 00	6 00	
Knox, North	8 00	26 50	25 00	10 50	9 50	8 50	8 00	4 00	36 00	6 50	12 50	8 50	173 50	48 00	2 15	50
Lincoln County	9 00	6 00	7 00	15 00	3 00	6 00	22 00	5 00	5 00	5 00	11 00	3 00	65 00	32 00	15 00	
Oxford County	1 28	1 01	78 00	97 00	116 00	12 00	67 00	27 00	46 00	26 00	48 00	19 50	653 50	140 00	3 75	75
Oxford, West	35 00	9 00	24 00	14 00	23 00	9 00	18 00	6 00	29 50	11 00	6 00	12 00	191 00	53 50	15 75	2 75
Oxford, Androscoggin Valley	22 00	40 00	58 00	43 00	25 00	8 00	30 00	14 00	22 00	5 00	9 00	-	210 00	66 00	2 05	
Oxford, Andover	3 50	18 00	12 00	7 50	4 80	5 00	3 00	5 40	-	3 00	6 50	2 50	-	3 75		
Penobscot County	2 00	-	-	9 00	1 00	-	3 00	3 00	10 00	-	-	16 50	28 00	16 00	75	75
Penobscot and Aroostook	4 00	6 00	5 25	9 00	6 50	-	6 00	3 00	37 75	-	12 00	-	42 75	30 75	50	
Penobscot, West	32 00	33 00	23 00	23 00	20 50	-	17 00	6 00	32 00	4 00	23 75	11 90	159 25	55 00	5 75	
Penobscot, North	3 25	8 50	1 50	2 00	1 00	2 50	3 00	2 50	7 75	1 00	4 00	1 75	21 50	13 25	4 10	2 00
Penobscot, Central																

Piscataquis, East	2 25	4 00	-	2 50	-	-	5 00	3 00	21 25	2 00	1 50	50	20 75	13 25	75	
Piscataquis, Central	27 00	28 00	10 00	20 00	8 00	7 00	16 00	12 00	41 00	3 00	11 50	4 00	118 50	69 00	75	
Piscataquis, West	3 50	12 25	1 75	1 50	1 00	-	2 00	2 25	5 25	1 25	3 50	50	25 25	9 50	36	
Sagadahoc	33 00	119 00	36 00	65 00	23 00	11 00	42 00	18 00	39 00	8 00	16 00	62 00	373 50	99 00	3 75	1 00
Somerset, East	18 75	23 50	20 75	28 25	13 75	2 00	21 25	8 75	28 25	2 00	20 00	-	129 00	58 75		
Somerset, Central	37 00	68 00	30 00	37 00	50 50	9 00	54 50	32 00	46 00	-	29 00	17 50	278 00	132 50	2 50	
Somerset, West																
Waldo County	20 00	25 00	12 00	35 00	23 00	12 50	15 00	10 00	30 00	10 00	4 00	5 00	101 50	55 00		
Waldo and Penobscot	35 00	58 00	29 00	28 00	17 00	25 00	50 00	11 00	89 00	7 00	-	21 00	220 00	150 00	7 50	2 00
Waldo, North	21 00	17 00	9 50	10 00	7 25	11 00	24 50	7 00	14 25	-	2 00	2 25	88 00	266 75	4 25	2 00
Washington County	5 50	9 00	17 00	45 00	24 50	9 00	18 00	24 00	46 00	17 00	16 50	14 00	157 50	88 00	4 75	1 75
Washington, West	39 00	19 00	36 00	18 00	36 00	-	79 00	24 00	46 00	10 00	-	20 50	142 50	149 00	6 25	5 00
Washington, Central	23 00	8 00	11 00	36 00	29 00	-	31 00	16 00	34 00	18 00	8 00	18 50	151 50	81 00	3 00	14 00
Washington, North	32 00	12 00	12 00	18 00	29 00	-	9 00	6 00	40 00	18 00	12 00	12 00	145 00	55 00	3 00	2 50
York County	28 50	121 00	8 00	42 00	21 00	6 00	-	8 00	33 00	7 00	8 00	37 00	278 50	41 00	1 50	
York, Buxton and Hollis	7 00	29 00	14 00	22 00	12 00	3 00	8 00	5 00	11 00	1 00	4 00	5 00	97 00	24 00	1 50	
York, Shapleigh and Acton	8 25	54 00	8 00	8 00	5 00	12 00	-	3 50	115 00	12 00	5 25	4 50	54 75	21 00	5 50	2 50
York Ossipee Valley Association	24	58	45 00	73 00	41 00	5 00	12 00	9 00	28 00	10 00	20 00	2 00	278 00	49 00	3 00	
York Ramshackle Park	15 00	27 00	25 00	24 00	18 00	6 00	8 00	10 00	35 00	6 00	11 00	3 00	135 00	53 00	2 25	

Financial Statement of Agricultural Societies for the Year 1889—*Continued.*

	For rye.	For barley.	For oats	For buckwheat.	For beans.	For peas.	For potatoes.	For carrots.	For beets.	For onions.	For turnips	For herds.	For cabbage.	For squashes.	Total amount awarded for grain and beet crops.	Am'nt awarded for any other cultivated crops.	For fruits and flowers.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Maine State Pomological																	
Androscoggin	1 00	1 00	1 00	1 00	1 00	1 00	1 50	1 00	2 00	1 50	2 50	-	1 50	3 50	34 00	12 00	86 20
Aroostook	-	-	-	25	75	-	5 00	75	1 50	50	75	-	55	75	13 05	1 91	14 30
Aroostook, North	75	75	1 50	25	2 00	-	9 25	1 50	1 50	1 50	1 25	-	1 50	2 25	-	8 00	24 25
Aroostook, Madawaska																	
Aroostook, Van Buren																	
Cumberland	-	-	-	-	1 00	3 00	-	-	-	-	-	-	-	-	75 00	-	15 00
Franklin County	-	-	-	40	-	-	25	20	55	40	60	-	35	75	6 25	5 00	35 00
Franklin, North	-	-	-	-	1 50	-	2 95	45	45	45	45	-	45	45	10 05	-	11 20
Kennebec County	-	3 00	-	-	-	-	75	-	-	-	75	-	-	75	40 25	-	51 50
Kennebec, North																	
Knox County	-	50	50	-	1 75	1 00	1 00	50	2 00	1 00	1 25	-	2 50	1 50	22 50	14 00	33 75
Knox, North	-	50	50	-	75	50	3 00	75	2 00	75	75	-	75	2 65	21 00	5 50	28 50
Lincoln County	2 00	-	6 00	-	3 50	1 50	2 25	50	1 00	1 00	50	-	1 25	50	35 00	3 00	28 35
Oxford County	-	-	-	-	75	-	1 50	75	75	75	75	-	75	4 50	12 00	-	48 90
Oxford, West	3 00	-	-	-	-	-	2 70	3 40	4 60	75	2 25	-	2 35	3 40	40 95	11 40	17 90
Oxford Androscoggin Valley	-	-	-	-	-	-	1 25	25	70	25	35	-	25	1 30	6 40	10 55	14 20
Oxford, Andover	-	-	-	-	60	60	75	40	40	40	80	-	-	-	7 70	-	5 90
Penobscot County	-	-	75	-	75	75	4 90	2 25	2 25	2 25	2 00	-	2 00	8 25	27 65	10 50	
Penobscot and Aroostook	-	-	-	50	-	-	50	-	50	-	-	-	50	50	-	-	8 00
Penobscot, West	-	-	1 20	-	2 25	-	4 50	90	1 10	2 25	1 20	-	25	45	20 85	-	21 75
Penobscot, North	1 10	2 00	-	-	30	-	-	-	-	-	-	-	-	-	9 50	-	2 75
Penobscot, Central																	

Piscataquis, East	-	-	-	-	-	-	75	-	75	75	75	-	75	75	5 25	-	1 25
Piscataquis, Central	-	-	-	-	-	-	50	25	25	25	25	-	25	50	3 00	-	9 50
Piscataquis, West	-	-	-	-	-	-	15	20	20	10	30	-	30	1 40	3 01	80	1 75
Sagadahoc	-	2 25	5 50	1 75	6 25	1 00	1 50	2 75	1 50	4 00	3 00	-	2 25	3 25	39 75	75 00	51 75
Somerset, East	-	-	..	-	-	-	-	-	-	-	-	-	-	-	-	14 00	4 05
Somerset, Central	-	-	75	75	2 00	75	3 00	75	75	1 75	75	-	1 50	1 75	17 00	6 00	14 25
Somerset, West																	
Waldo County	-	-	-	-	-	-	-	-	-		-	-	-	-	56 25	11 00	12 00
Waldo and Penobscot	-	1 00	1 50	-	1 50	1 50	6 75	1 50	3 00	3 00	3 25	-	1 50	6 00	39 50	2 25	23 00
Waldo, North	1 00	1 75	2 25	-	3 00	-	3 00	1 25	1 25	1 25	1 25	-	1 25	1 25	-	2 00	10 00
Washington County	50	2 25	2 25	2 25	11 25	4 00	22 25	2 25	2 25	3 50	2 25	-	2 25	13 50	63 75	27 50	20 30
Washington, West	-	5 00	5 00	-	17 10	6 05	27 75	3 75	5 50	3 75	3 75	-	2 25	7 20	77 35	11 25	28 75
Washington, Central	-	1 50	4 00	-	5 00	1 50	10 50	75	1 25	3 25	75		1 50	3 50	51 75	-	21 25
Washington, North	-	2 50	1 50	1 50	1 50	1 50	3 75	1 50	3 00	1 00	3 00	-	1 50	2 50	30 25	6 00	7 50
York County	-	-	-	-	-	-	1 50	-	25	1 50	-	-	1 00	1 25	-	6 75	3 50
York, Buxton and Hollis	-	-	-	-	1 50	-	2 00	-	50	25	-	-	-	50	-	-	7 60
York, Shapleigh and Acton	2 50	2 50	2 50	-	7 50	2 50	1 50	1 50	1 50	1 50	3 00	-	1 50	3 00	39 00	10 25	7 50
York Ossipee Valley Association	-	-	-	-	-	-	2 00	-	-	-	-	-	-	3 00	8 00	-	10 95
York Ramshackle Park	-	-	1 00	-	1 50	50	1 50	50	50	1 00	50	-	1 00	1 50	11 75	-	3 50

FINANCIAL STATEMENT OF AGRICULTURAL SOCIETIES FOR THE YEAR 1889—*Concluded.*

	Bread honey, sugar and syrup.	For butter and cheese.	For agricultural implements.	Household manufactures and needle-work.	Manufactures of wood, iron and leather.	For mechanical products.	For all objects enumerated above.	No. of bulls and bull calves.	No. of cows.	No. of heifers.	No. of heifer calves.	No of working oxen (pairs.)	No. of steers (pairs.)	No fat cattle.	Total No. of cattle exhibited.	No. of horses and colts.	No. of sheep.	No. of swine.	No. of poultry (coops.)
Maine State Pomological																			
Androscoggin	$11 25	$23 00	$13 00	$26 50		-	-	15	22	32	19	28	9	11	173	67	27	20	5
Aroostook	1 50	7 50	-	26 95	-	-	-	8	19	12	8	3	1	-	51	81	29	9	23
Aroostook, North........................	4 00	6 75	-	17 85	$2 00	-	$53 75	25	39	17	10	4	6	-	111	90	27	2	7
Aroostook, Madawaska																			
Aroostook, Van Buren																			
Cumberland	5 00	10 00	-	14 00	4 00	-	-	14	27	17	10	30	20	6	124	35	20	10	18
Franklin County	10 50	10 00	15 00	33 50	2 00	3 25	12 00	22	16	27	8	45	26	10	215	72	48	15	18
Franklin, North	2 50	5 40	1 00	20 00	.	1 00	7 00	13	20	21	9	39	16	20	168	75	60	23	6
Kennebec County..................	5 00	52 50	10 00	58 10	-	-	-	20	31	27	8	56	27	30	199	142	99	66	35
Kennebec, North																			
Knox County	6 25	15 00	-	49 50	6 50	-	123 50	3	23	7	1	19	1	3	57	34	11	21	7
Knox, North..........................	11 24	15 00	50	40 75	-	-	25 54	8	15	9	6	23	25	17	126	58	34	24	13
Lincoln County........................	4 50	2 50	1 50	32 25	-	-	62 85	8	15	7	3	3	5	5	74	36	18	39	7
Oxford County	16 25	26 50	7 00	31 50	23 00	28 55	187 60	22	38	52	22	50	30	8	325	60	90	32	46
Oxford, West..........................	16 50	18 00	5 75	59 20	10 50	-	59 75	13	5	11	5	37	12	6	138	46	7	24	7
Oxford Androscoggin Valley.............	50 00	12 00	5 00	11 70	5 10	5 10	6 50	10	49	18	12	35	20	6	150	40	25	2	
Oxford, Andover..	1 30	2 75	-	13 70	-	-	-	3	8	13	-	5	7	-	36	22	9	2	4
Penobscot County	12 50	1 00	-	6 75	-	-	52 00	3	17	2	-	-	-	-	22	25	-	-	21
Penobscot and Aroostook................	1 50	3 00	-	21 57	4 50	-	3 00	5	18	8	3	3	6	-	43	42	32	4	
Penobscot, West	6 80	21 25	-	77 70	1 00	10 00	-	16	25	27	6	21	19	-	154	134	102	8	16
Penobscot, North......................	5 25	1 00	-	13 00	-	-	-	12	2	1	-	10	8	3	32	35	35	1	10
Penobscot, Central.....................																			

Piscataquis, East	-	-	-	50	-	-	70	2	5	-	-	2	-	-	11	33	2	1	1
Piscataquis, Central	1 50	6 00	-	8 25	-		-	11	20	10	5	26	5	7	115	65	25	1	5
Piscataquis, West	15	2 00	-	2 25	-	-	25 35	4	12	11	1	11	3	-	54	46	45	4	2
Sagadahoc	8 00	29 00	5 50	50 95	-	68 00	151 42	9	25	29	7	33	23	8	275	74	28	23	92
Somerset, East	4 25	15 25	-	51 05	-		39 05	10	24	24	8	11	8	3	110	77	43	6	
Somerset, Central	5 50	13 50	-	18 25	9 00	13 00	-	11	23	23	7	43	32	10	224	102	29	-	22
Somerset, West																			
Waldo County	4 00	5 00	10 00	30 00	-	3 00	50 00	5	24	10	5	8	5	6	63	50	10	12	3
Waldo and Penobscot	1 50	6 25	-	112 30	-	-	30 25	16	14	9	7	16	13	10	100	75	45	28	225
Waldo, North	3 00	3 00	-	13 75	-	-	6 50	9	8	8	2	20	8	8	93	60	8	.	2
Washington County	4 25	12 25	-	64 09	7 50		5 75	4	27	18	5	4	15	7	102	59	50	2	20
Washington, West	3 25	25 00	-	98 78	13 00	24 75	847 78	6	5	12	2	14	16	-	85	39	-	7	21
Washington, Central	1 75	6 00	-	52 90	10 00	15 00		7	17	18	6	2	8	-	68	57	9	17	35
Washington, North	2 25	4 50	-	35 00	-	-	75 00	12	18	13	10	4	5	-	70	41	30	40	12
York County	1 25	5 00	-	83 06	-	-	12 12	14	45	8	4	49	5	4	129	100	23	20	25
York, Buxton and Hollis	3 50	1 50	-	47 65	-	-	-	11	65	22	8	17	9	2	162	22	17	3	5
York, Shapleigh and Acton	3 00	7 50	-	55 00	1 00	-	-	7	15	7	4	30	11	10	115	23	6	10	20
York Ossipee Valley Association	6 75	2 75	-	48 90	3 00	-	-	19	67	53	9	64	59	23	398	117	45	13	6
York Ramshackle Park	2 50	3 25	-	27 90	-	9 00	-	22	35	12	7	46	26	10	280	47	25	12	7

PAPERS AND LECTURES.

IMPRESSIONS RECEIVED FROM RAMBLES IN THE WEST.

By Prof. LEVI STOCKBRIDGE, Amherst, Massachusetts.

[Prepared expressly for the Massachusetts Board of Agricultural. Given at the joint meeting of the Maine Pomological Society and Board of Agricultural at Norway, February 6.]

What, and where *The West* is located, is a matter of great uncertainty to-day. In the public mind, it has been constantly changing during the last forty years, and very rapidly during the last twenty. In my boyhood days, the West,—the far-away and almost unknown West, was in the Genesee and Black river valleys of New York, and then, passing over the region in the southwest part of that State, it was located along the valleys of the Ohio river and its northern tributaries, and the shores of Lake Erie. At that time the "Great Northwest" was the territory of Michigan, respecting which as fabulous stories were told of the opportunities for getting rich quickly and by head-work alone, as have since been rehearsed of more distant regions. Soon the West was described to us as the boundless prairie-land of Indiana, Illinois and Wisconsin, with a soil so fertile that the only implements of tillage needed to secure the most marvelous crops, were a plough to turn the sod, and an axe to cut a hole in it, to insert the seed corn; and all centering at a mud-sunken shanty town at the south end of Lake Michigan, called Chicago. Then the Rock river country was the West, and its location gradually receded until it reached and crossed the Mississippi, and spread out in eastern Iowa. Here it lingered within reach of navigable waters for several years, for it was found that when the land carriage of farm crops was so extended, and the roads so bad, that it took two days' time and a pair of horses to convey enough of the crop to a place of sale to procure a pound of tea and a year's supply of family salt, the West had lost its immense attractions. Then Texas, with its measureless area and uncertain and disputed boundaries, was annexed to our southwestern limits; and soon after, by force or fraud,—or both, New Mexico and California were gathered in, and our West halted by the waters of the Pacific Ocean. The precious metals were soon discovered in the rocks and sands of the latter State, followed by a gold fever, rising higher and higher, until it reached the point of a frenzied craze, and men lost their heads. At this juncture our settled Western limits did not advance by pressure of population or effort to secure homes; but, ignoring all ordinary motives, one wild, mad rush was made, without regard to distance, dangers or difficulties, for the place where it was said the shining ore could be gathered in handfuls. To reach the diggings, some risked a sea voyage of 11,000 miles; others dared disease and death in the fetid swamps of the Isthmus; and many others took their lives in their hands, defying all the horrors of the little-known continental desert, the barriers of untrod snow-capped mountains and wild cañons, the trackless alkaline plains, the animosity of lurking savages, and laid their way directly westward from the waters of the great river to those of the Pacific Ocean. Obstacles before unheard of or encountered hedged up their way. Many perished of weariness, of cold and starvation, and others fell by savage hands. Some, after indescribable sufferings, worn and exhausted, reached the goal sought, to find all ability to labor gone, and that the adage was true, that all is not gold which glistens. They all suffered; a few received a recompense, most did not; but they marked out trails and passes westward, of immense value in the subsequent development of our domain. By their hardihood and pluck a great State was established in the region of the setting sun; but it was not the West, it was only California.

Then came that to the North, sudden convulsion, to the South, the long and deliberately planned War of the Rebellion, for the dismemberment of the nation and the extension and perpetuation of slavery. For a time the Union of the fathers appeared to be rent in twain from East to West, and there were mutterings in the air, that the Western and Northwestern States had so little direct connection with the parent States bordering on the Atlantic, that they would set up for themselves; that California, disconnected from all the others by 2,000 miles of roadless deserts and impassable mountains swarming with implacable foes, was beyond the reach of the forces of freedom, and would fall into the hands of those of slavery. The masses trembled in fear of the impending calamity, but soon rallied under the leadership of far seeing, sagacious and courageous men. These, while marshalling forces for the field and providing materials of war, devised plans and instituted measures in the way of quick and easy communication to connect these scattered peoples, and to make their varied interests one, in the protection of, and benefits to be received from the central government. At that time the railroad systems of the Eastern States were developed westward to and beyond the Mississippi. Our engineers had become expert and fertile in resources for overcoming, so far as then encountered, the obstacles presented by nature to railroad construction; and capital had been encouraged by success to make great expenditures for grand achievements. Impelled by these three forces—the necessity, the skill, and the courage—the great continental railway system developed. The arid plains, the broad rivers with treacherous quicksands and shifting channels, the towering mountains with their perpendicularly walled gorges and cañons were passed, and a continuous track extended from the Atlantic to the Pacific, binding the Union together with a cable of steel. Other similar efforts and successes followed, which with their laterals have given easy access to more territory than can be fully and wisely utilized during a century to come, and made *our* West to be almost any and every spot between the "great father of waters" and the Pacific, and between Canada and the republic of Mexico. In the manifold obstacles to be encountered and overcome, the countless expense to be incurred, the grandeur and magnitude of the whole conception, the rapidity of its execution—the world's history furnishes no parallel.

But there is one phase of this matter which should be here noted, because of its influence on the West and its people. Notwithstanding the fact that the conception and plan of a Pacific railroad was by private individuals, acting in a private capacity, it was of national importance; essential to the government for the proper administration of the affairs of its vast area, and the expense of construction would be national in magnitude. In its own interest it should aid this most important of public enterprises. But it was burdened with the responsibility and cost of carrying on a gigantic war, and had no ready money; it could guarantee bonds and was the owner of millions of acres of land along the proposed lines of construction. The land had then no money value, but certainly would have by the development of the enterprise. The scheme of

"Land Grants" to aid railroad construction through our public domain was therefore inaugurated, and eventually extended, for purposes honest and dishonest, to all points where a road could be constructed, and whether it was or ever would be needed. The first road built received 25,000,000 acres of land, and other roads a much larger grant in proportion to their importance. This land was in alternate sections, with surveyed government land on each side of and contiguous to the railroad track, which made it more valuable than government land farther back. In most instances the avails of its sale were sorely needed to pay construction debts, and the most extraordinary efforts were made for this purpose. The railroad corporations were actually transformed into great land trading and speculating companies. The East, both country and city, was flooded with flaming handbills, circulars and advertising cars, decked out with Western products, setting forth the quality and desirableness of their lands in the most preposterous terms. Their desert lands were represented as the best stock-breeding sections of the world, and the government lands of the same kind were free to all comers. A few dollars invested in a band of calves would increase so rapidly that in a very few years they would be countless, and a mine of wealth to their owners. The corn and wheat lands of their prairies and river bottoms were more fertile than the garden of Eden, would yield eighty bushels per acre of the former and forty of the latter, and were absolutely exhaustless. Their mountains were rich with mines of gold and silver, and the sands of their mountain streams yellow with the golden grains. From the Rio Grande to Manitoba the climate was delightful; the dry, pure air of their high plateaus made them a perfect sanitarium; and, the nearer you went to the polar circle, the more agreeable it became. Copious streams flowed from all the mountain gorges, which could be so utilized for irrigation as to make the husbandman independent of the fickleness of the weather. They expatiated upon the generosity of the government; there was a homestead and a tree-planting law; and they rang all possible changes on "free homes in the West," "land for the landless," "Uncle Sam is rich enough to give us all a farm." It was not only in the Eastern States that these representations were made, but they had their agents in every country and city of Europe. Free transportation tickets were offered to land buyers and settlers; and soon the boom was on, and on hard. There was a rush westward, not only of the landless and those seeking homes, but of the titled nabobs of Europe, ready to take up whole counties, and of speculators and sharpers from everywhere; and the last were first in the field. Semi-officials of the railroads, and their friends who were in the railroad ring, took the lead. They knew or could determine where the railroad centers were to be and secured all adjacent lands within the five-mile limit. By the time the first construction trains reached those points, a town was begun. Stakes tipped with red flannel are set in squares in the grass indicating the line of proposed streets. Abutting lots are marked on these, and at once tents or brush booths are going up, and these signs adorn their fronts: "Building lots for sale," "Land Office," "Real Estate Agency," "Money to loan," "Hobbie & Co., Brokers, money exchanged," "Saloon, all kinds of the best of liquors," "Guns, rifles and ammunition," and, looking in at the open door of one or a half-dozen of them, you would see a couple of barrels covered with rough boards, and on these a dice box, a pack of cards, a faro bank and a black bottle.

Visit this locality a month or six months afterwards, and all is still, and the ground is littered with all kinds of trash, but empty bottles and old tin cans do most abound. It was found that a mistake was made; the projectors did not understand "the tip," or were purposely deceived; and therefore the "town" has moved on. Or else, at your second visit, you find frame houses on the streets, decorated with the same signs; stone and brick foundations going in for banks, churches, school-houses and quite likely a theatre. Money is plenty, everybody (but the lambs) is getting rich; but yet not a sod has been turned on the adjacent land, and the whole country is in its native wildness. Between these attractive railroad points and fancy "Town Sites" the scene changes; but the bottom motive power and the controlling actors are the same. The railroad in the form of friends is abroad in the land. All the *desirable* railroad lands are taken at a nominal price (to be re-sold of course for a consideration,) and all the desirable government sections between have been secured "in ways that are very peculiar," under the homestead and tree-planting acts; and they can always find as many names to be used as there are desirable sections to be covered in, but which in due time turn back to the projectors of the scheme, who become the owners of domains of from ten to fifty thousand acres, but all for sale at a speculator's profit. These parties are not here to stay, except with an "if;" and, with an "if," they unload and "lite out."

But now comes the great army of honest, guileless settlers, hundreds of thousands of them seeking homes. Many of them are from fairly comfortable homes in the Middle States; other many are from New England, with New England loves, and New England a part of their very being. They have believed the story of "land for the landless, free homes for the emigrant;" they come to make homes of broad acres and to leave them to their children, surrounded by all the blessings of Eastern life, but which Western conditions cannot produce, and money cannot buy. Along the great trunk lines they crowd, accompanied by wife and children, and bearing a few household goods and gods. Mingled with foreigners babbling in an unknown tongue, and jostled by land sharks and sharpers, they swarm around the land offices, to obtain the first title to that magnificent farm of which they have heard so much, and which in their mind's eye they have so often seen. But they find that somebody has been there before them; land is not so free or so near at hand as they supposed. Their Uncle Samuel is not at home to walk out along the railroad and stake off the alternate sections for their occupancy. But they are told that there is such land as they want at a distance,—"no better land in the world than that up around Devil's Lake or out in the north part of Burleigh county." "The best stock ranges are out in the bad lands of Montana." "Gold is abundant in Nevada, and the claims are not half taken." The great crowd looks downcast; but it scatters from the offices of the loaners and exchangers of money, from the land offices and real estate dealers, from the rambling toad-stool villages, and disappears in the vast expanse of prairie, plain, mountain range and sequestered gulch, to find, if possible by searching, the home which they supposed was ready to receive them.

This country, thus opened, thus advertised, and thus settled, is *the West*, over which we are to ramble, and we had better be off before another like invasion arrives. Now we are at Castleton, in the great valley of the Red river of the North. It is one boundless expanse of dark, friable soil; and here and there to the farthest horizon we see the smoke of steam threshers on the wheat fields, and the teams moving wheat in the straw to the machines, grain to the elevators and water for the boiler. The scene is new, it is enchanting and expanding. Roving free, we find we are on the great wheat farm of Mr. D., and soon at the central office. To the Yankees questions come these answers: "Seventy thousand acres in the ranch, twenty-nine thousand acres in wheat this year, the rest unbroken sod." "The average yield is forty bushels per acre; the machines thresh on the average fifteen hundred bushels a day each; it costs from a cent to a cent and a half a bushel to thresh it." "The expense of growing it, from the plough to the elevator, is about twelve or fifteen cents a bushel; this land is all soil, and of the best down as far as you can dig." "It has been waiting here for the plough, and growing richer and richer for thousands of years, and it will produce wheat for a thousand to come without exhaustion." "The air is so pure and dry we don't feel any cold, and the winters are agreeable."

Thanking the gentleman for his politeness, and still rambling free, in due time we find ourselves far away on the wheat fields, and among the men, the teams, and threshing machines. The latter are all steamers, and burning straw for fuel which is a Western phase of economy, and a novelty to New England eyes. The rush of steam, the roar of the thresher, the flying dust and smoke obscure everything; and for a short time you are confused, but soon discover that there is order and a controlling head behind the dusty screen. And you run up against a live Yankee from Connecticut, the boss of four sections (about twenty-six hundred acres) of this land, its teams, implements and crops. He is glad to greet anything in the way of a fresh Yankee or tenderfoot, ready to talk, and knows his business. With some banter and giving news from the East, questions for information are put, but for brevity's sake only the answers are given: "Have been out here four years, summer and winter, but came as an emigrant, not after this job." "In some respects I like it better than old Connecticut; get fifty dollars a month the year round, but all don't get that." "Don't have anything to do in the winter but take care of the stock (the teams); there is no field work that men or teams can do." "Well, now, the crops do fall off some; don't average more than fifteen bushels to the acre; but we shall take up some new land next year, and fallow some of the stubble, taking a crop once in two or three years." There is not so much capital in this establishment as you might think; preferred stock of the railroad was bought at seven dollars a share, and swapped to the company, at a hundred dollars a share, for this land at a twisted two dollars an acre." "Don't know how much money they make or lose." "Know that bankruptcy is common around here, but they are all right; these great Western arable farms will be cut up and sold out when the times are right and prices high enough." "You expect to get a slice then, do you not?" "I shouldn't wonder." "Those fellows up on Goose Creek brag well; they may get twenty-two bushels an acre this year, but last year they didn't get ten; I guess 'twill average about like ours." "That ditch is for a pipe to bring water from the wind-mill at the creek to the elevator; it is two miles long." Ten feet seems deep to you for a water-pipe, but in August we dug out junks of frost down nine feet." "Summers are short, but we can begin early; are sowing when two or three inches are thawed out on the surface; what frost is below that can thaw when it gets ready—the wheat will grow." "I don't find any fault with the climate; its good if you like it, and when you fellows down East are shivering around in your winter fogs, you can come out here and get warm, however low the thermometer is." "Yes, shall finish threshing to-morrow, and the next day the men will go to burning the straw, and the teams, four mules and driver and a two plough gang will commence ploughing at that line, and go straight away yonder four miles across the four sections and back; and they will alternate, traveling sixteen miles one day and twenty-four the next, and will keep it up until the ground freezes." We thanked the man for his time and information, and turned away with the impression that we had seen only the best side, the outside, the glossed side of the affair. As we did so, he called after us, "Say, you, if you ever go round old Connecticut way, salute it for me; for I call it home, and the old folks are there yet."

Now we find ourselves well up the Little Missouri river, in the Bad Lands of Western Dakota. Winding and twisting our way along for many a weary mile among the clay buttes, the scene constantly wilder and more forbidding, a sudden turn of the trail brings us face to a typical cow-boy. He is mounted on a thin-necked, sharp-eared, bright-eyed, restless broncho. Hanging in a case at the horn of his saddle is a Winchester rifle; on his right hip a heavy revolver, and a large hunting knife in its case on the left; around his person two leather belts filled with cartridges, one for the rifle, one for the revolver; moccasins on his feet; leather leggins; a brown corduroy coat, and a brown felt hat large enough for an umbrella; his face is bearded and browned; he looks the bandit, (and here is where such roam uncaught,) and you almost expect to hear the order, "Stand and hold up!" To the inquiry, "Does this trail lead to Mr. C's ranch?" came the answer in a bright, cheery voice, as his countenance lighted up with a smile, "No, here you are, and yonder is the shack." "Are you Mr. C.?" "I am, and am glad to see you." "Well, you look like a galloping arsenal. What do you load yourself down with all that artillery for?" "It is sometimes mighty handy to have it around; a man ought always to have it on here, and its presence may prevent the necessity for its use." In a few moments we are at the shack, which we notice as we approach, is about fifteen feet square, seven feet high, made of poles about five inches through, sides and top, interspaces filled with clay and daubed over top and sides with the same materials. All around the eaves, antlered heads were fastened, on which were hanging the carcass of a deer, saddles, harness, yokes, lariats, etc.; and through the open door could be seen an earth floor, bunks, blankets, skins, a sheet-iron stove, and a few cooking utensils. We alight, and stand at the home and headquarters, cattle ranch, of a college graduate born and reared in Philadelphia, and now three years a cow-boy. He was evidently pleased with the visit, as evinced by the hearty exclamation, "Gentlemen, I am glad to see you here; it does a fellow good to see somebody from God's country once more. How is all the world, the men, but especially the girls down East?" He seems glad to see a new face, and to talk to somebody besides the two stolid helpers he has in his employ; and so we will let him talk, and see what we can learn of him, his business, the country in which he lives, and its people.

"After college graduation, and casting about awhile for something to do, I concluded the professions were so crowded I should have hard work to squeeze in anywhere; in fact, people were getting pretty thick in Philadelphia. There was a good deal said about the chances to make money in the stock business out here; and, having a little capital with which to start, I thought I would come and grow up with the country, as Greeley advised. Could not have gone much farther if I had tried. Could not have found a place where I could have a cleaner sweep and swing; have pure, free air, free water, free land; free of all law and law officers but those shooting irons; free of all the dissipations of civilization; free of all human kind, except an occasional fellow to whom we point our rifles, and the section gang ten miles away down at the railroad. Business don't amount to much yet; think I have about eight hundred head of stock, old and young, and shall begin to sell next year. Cannot show them to you; don't know where they all are, but shall have them all back on the range within a month, but may have to go a hundred miles after some of them down to the reservation. This is the worst-looking country, and the hardest to find anything in, that man or pony ever trod; but there is feed enough, and it is the best to *winter* stock in there is in the whole realm. They huddle into these gulches and ravines, and do not drift before the blizzards; and when the storms are over they nose their way out of the snow, rustle around and fill themselves with willow and cottonwood browse. I don't lose more than about fifteen per cent. of them in a year, from cold, snow, wolves, bears, cats and accidents, all combined; but away south on the plains, drifting before storms, freezing and starvation is liable to clean out from fifty to ninety per cent.; and if it don't take cow-boys too, they are lucky. We don't do much in the winter, and would not do anything but eat, sleep, and keep a fire, if the cattle did not rove; but they do sometimes, when we have to rustle around and keep them on the range, regardless of snow, wind or weather. Game? Yes, game is plenty, and we get it without much trouble when looking after cattle.

"We get letters occasionally, and papers; and I know that a month ago Philadelphia still stood on the banks of the Delaware; but can't say that I know much of the prevailing fashions there, and care less, for I know we are in the full swim of fashion out here. The mail comes every day down at the station; but that is ten miles away, and in winter that is farther than a hundred miles anywhere in the East. In the summer we get down there once a week sometimes; then again we are away on the range, and don't bring around once a month. We don't have the advantage of lectures, conventions, balls and circuses; but we don't care much about that, for our business is about equal to a perpetual circus. Oh, we shan't starve, with eight hundred head of stock around us, and deer's heads sticking out of every other bunch of scrub. We get some canned goods, coffee, tea, salt, etc.; should like fresh vegetables and apples. We have deer skins in abundance, and that supplies most of our want of dry goods. Our establishment is rather primitive, in fact not quite up in style to that of Abraham the great ranchman of the East; but you know, 'man wants but little here below, nor wants that little long.' But you give me a call in July next year, and you will find me in style. I am going to have my mother and sister here then. Before they come I shall tear this shack down and build a new one—a nice one with two rooms; am bound it shall have every modern convenience, if it costs me fifty dollars. I am bound that they shall have a good time here and see the West as it is, and its people as they are. We will have all the people of the county here, and we will have a *social* time."

"Mr. C , how large is this county?" "I don't know exactly, but I think about as large as the State of Vermont." "How many inhabitants in it?" "I don't know of any *fixed inhabitants* but the section gang at the railroad, but there are some scattered around; a squad of cavalry comes along occasionally, and there may be one then." "I doubt not, Mr. C., your mother will be delighted to meet your friends and neighbors, and to see the country in which her son has pitched his tent." "I don't know about that, but I know she will be delighted to see me, and I shall to see her; and the beaux won't be so thick but that I can have that sister of mine to myself for a time, and for the rest I don't care."

Mr. C. entertained us on the fat of the land, and apparently regretted our departure, and we left with the impression that the next time we rambled that way, not a track of the scholar and ranchman would be found in the Bad Lands, but we should learn that he and what capital he had saved from that which he brought from the East had gone back there, and the country left to grow up without him.

But now the scene changes; we are running west on the Northwestern Railroad in the southwestern part of Minnesota, and near the Dakota and the Iowa line. We are in a region famous for its wide-spreading prairies and good quality of soil. The horizon is far, far away in all directions, and the view unobstructed. Along the track side are occasional reaches of turned sod or stubble. From the moving train it is difficult to clearly distinguish human habitations away from the little villages, but at intervals smoke is seen to rise, and there are stacks of grain or hay. We run to the end of the road, and find ourselves in a little village three years old. A conspicuous object is a grain elevator; there are several shanty stores, a half hotel, half boarding-house, a land office, a real estate agency, a broker's office, and two or three saloons. A school-house was under way, "as an advertisement;" but they were "not so advanced as to think of churches." There was a dealer in all kinds of agricultural implements, machinery and vehicles, which were scattered around promiscuously in the prairie grass over an acre of land. We are hardly domiciled for the night before most of the villagers know we are not there to sell patents, lend money or buy land, but rather to see the land which is sold, the men who have bought it, how they like it and its surroundings, what they propose to do with it, and how they live. This information given, we have ceased to be an object of special attraction. We inquire for other settlements or villages in the region and are told there are none; for roads out of this metropolis into the out country, and receive for reply, "Roads! it is all road; go where you please, there is nothing to hinder.

As the next morning's sun lighted up the scene, that remark was fully appreciated. Grass—brown, dry grass under foot in every direction, and not an object to obstruct the view or attract attention. But how far does this expanse extend, who owns this land, and what is beyond it, are curiosity-provoking thoughts; and we start out due southwest by compass for a long tramp of discovery. As we advance, the horizon recedes. The prairie, which appeared so absolutely level, is found to gently undulate in long, smooth swells. These swells come plainer and plainer to view as we move on, and behind fall away to the horizon. For miles the scene is the same; and it would be very monotonous but for an occasional whirr of a prairie chick out of the grass, whose flight is hastened rather than retarded by the gun we bear.

After miles of tramping, the field-glass brings to view a something at the horizon which is unusual and artificial rather than natural, and the course is laid in that direction; as we advance, it comes plainly into view, and after a walk of two miles we find we are approaching the dwelling of a home-steader. As we draw near, we note it and its surroundings. It stands on the summit of a prairie roll; is a board shanty about twenty feet square, with a stove-pipe chimney. There is a small glass window on the side of approach, where it seems there should also be a door; but, as there is none, we conclude the front door is on the back side. We notice there is a pole barn, covered, roof and sides, heavily with straw, which is black by a year's exposure; off to the left is a stubblefield, and beyond, a dozen head of cows and young cattle feeding. Near the barn are two stacks of wheat and four or five of hay, and scattered around the premises sundry farm implements and a good two-horse wagon, but no other vehicle.

But we are now too near to be longer unnoticed, and our approach is announced by the sharp bark of a fine collie dog. By the time we are within speaking distance, a man is seen coming from the barn, a boy of about seven years of age and a girl of five, from the direction of the hay stacks, and a woman appears at the door. A glance showed that all were comfortably and neatly dressed, had an intelligent but a sort of scared, quizzical look, as much as to say, "Who are you? where did you come from? what brings you here? but we are glad to see *even you.*" Salutations were exchanged without much embarrassment on either side. They were told that we had fallen in with their place while roving out from C., but that we were from the East. "Are you?" said the woman, with animation; "We are from the East." "From what State, Madam?" "From Ohio." "Then we were neighbors; Massachusetts is my home." That was enough; all embarrassment was removed, and conversation flowed freely respecting the East and the West. With occasional leading questions to draw it out, the homesteader's story was practically as follows, told sometimes by the husband and sometimes by the wife:

"We had a good little farm in Ohio in a thickly settled neighborhood, with school, church, store and post-office close by. But there was a mortgage on the farm which we could pay off only slowly everything we had to sell was so low. A good opportunity occurred to sell out, and we concluded to do it, get out of debt, and take what we had left, come West, get a larger farm for nothing, fit it up and begin anew. Good recommendations led us to this locality, of which, however, we had no actual knowledge until we reached here. We did not find it just as we expected. We supposed we could get a location near the railroad and convenient to town privileges, but nothing could be homesteaded there. Then there was no wood for fuel or timber or fences. We wanted to both keep stock and make crops, and a good barn shelter for them and a house for ourselves. The timber to do this must be brought from the far North through Chicago or St. Paul, and it would all cost more than we could afford. We could not go farther, and disliked to go back, and finally concluded to make the best of the situation as a trial.

We got here in July, year before last, and you can see what we have done. We brought a few household goods with us, and soon after getting here we bought a pair of horses, a wagon and all the rig, some tools and two cows. That season we built the house, a part of the barn, set over a piece of sod for spring wheat, and cut and stacked a lot of hay, some for the stock and more to burn. I have now grown two fair crops of wheat of two hundred bushels each, a little corn, and all the prime roots and vegetables we wanted. The cattle have increased, and we are better off than when we lived on this spot in a two-horse wagon. We havn't got everything we want yet,—water, for one thing. You see that pile of dirt out there? that is where we are digging a well. We are down now forty feet, but five or six feet more will bring it. To this time we have brought all we have had a mile and a half, in barrels from the sink down yonder. This soil is good, and no mistake,—better, I think than it was in Ohio.

"The climate,—well, you should live in it a year or two to appreciate it. If it is good, it is good; but when it gets on a tantrum you had better stand from under. A blizzard struck us last year in May, and we had a terrible one the eighteenth of the following October. Describe a blizzard? No; I don't know any words which meet the case. The wind sweeps across this open country, roaring, howling and shrieking in a way nobody can describe; the little ice needles are driven by the wind into and through everything. Then the cold is awful, and nothing but hay to burn; and quite likely you will be caught without enough in the house to last through the storm. If you want to appreciate a blizzard, come, see and feel it, but be caught in it at your peril. If one had come in October, the first fall we were here, none of us would have been here to tell the story.

"Prairie fires? You would think so; and the grass is about dry enough to burn now. When the fire gets going, and a high wind gets behind it, it seems as if the whole world and all in it was going to burn up. The smoke and heat go ahead of the fire, and it is dark as night, and you are almost suffocated. Hardly know which to choose, a prairie fire or a blizzard. On some account we have the most dread of the fire, and keep the grass mown and fed back a hundred rods from the place, and then plough a fire-guard inside and outside of that line; so that we have escaped thus far. But fires have swept over whole counties here, and cleaned out everything, villages and all.

"As yet, there is practically nothing that farmers can raise to sell in this region but wheat, and that might about as well be burned as sold.

It is hard to find a man here who raises more than about two hundred bushels, and he cannot take or send that much to the Chicago market. Either way the freights and commissions will take the whole crop.

"On the way out, you probably noticed elevators once in twenty or thirty miles all along the railroad. The railroad ring own them all, whatever may be the name painted on their brown sides. Oh, yes; they are ready to buy wheat; 'but the crop is not a desirable one, and the market is glutted; but if you cannot hold it, draw it in,—we will give what the market will afford.' They have a sure thing, and can wait; the farmer generally cannot; so the crop goes to the elevator, and of course in the worst possible time. 'There never was such a glut;' it is hard, but the best they can do is forty-five cents a bushel. That won't do for the farmer at all; but it is thirty miles to the next elevator, which is two days' journey from home, and when he gets there he is in the power of the same ring; and so the wheat raiser surrenders, and the weighing commences. A bag or two is emptied, when the buyer discovers the wheat is not up to standard, is not well cleaned; he won't have it; the farmer may take it back, or throw off ten per cent. for refanning. The farmer yields again from necessity, thinking it is but one load, and it is soon in the machinery; but, 'Cash is short to-day, and we cannot pay now possibly, but will be ready and cash it when the whole crop is delivered.' The farmer goes home a wiser but not a happier man; but the buyer gets his whole crop, and nearly all others that are in the vicinity, in kindred ways. That is how and where we get our money.

"We are comfortable, as comfort goes out here, but yet we have as you see, no roads; a month in the fall, six weeks in the spring, and after every great rain, we are mud-bound, however great our necessities. We could not get land nearer the village and depot; it is ten miles there, and somebody owns the land all the way, and is holding it for a rise. We have no schools, no society, no meetings, no doctor; yet people die out here."

During this conversation we were sitting on a wagon-seat placed on the ground; thinking it was taking a gloomy turn we rose as if to go, but were cordially invited to walk into the house and take a cup of tea, to "strengthen us" for a ten-mile tramp to the village. The little boy ran to the hay stack from which he came on our arrival, and immediately returned bringing some loose hay and a handful of twists. We then discovered that he and his sister had been engaged in twisting and piling hay for use during winter blizzards. Entering the house, we noticed it had really but one room with two small windows; there was a bed in one corner, from beneath which peeped a trundle-bed; there was a large sheet-iron stove, a small table, a chest; shelves around the walls, on which were pans of milk and an assortment of crockery and tinware; in a closet near the stove sundry cooking utensils, four chairs about the room, and all neat and tidy. In a wonderfully short time the burning hay made the steam whistle from the spout of the tea kettle, and soon "a humming cup of tea" was presented us. That sipped, we thanked them for their hospitality, bade them good-bye, and took our compass course northeast for town. As we turned away, the woman said, pleasantly, "If you meet anyone who wants to buy an improved claim, send them this way;" and I received the impression that she meant all she said, and a good deal more.

During the two following days we are riding in different directions over this much-boomed section of country, and find farmers long distances apart, in out-of-the-way places; some in side-hill "dugouts," some in turf shanties with a single window and earth for a floor, and some establishments of the kind abandoned and claim given up. Occasionally we found a settler and his wife who appeared bright and cheerful; but most of them, especially the wives, bore a sorrowful countenance, as if the light of their lives had gone out. We have not time to particularize and make comparisons here, and only stop to say, we left the section with the impression, that the family interviewed during our first day's ramble, were country nabobs in the land; and if they did not sell out, have probably finished their well, and have an abundance of water

But now we are away across the continent to the southwest; have passed through the cañons and gorges of the Rockies; have looked with awe at the snow-covered Spanish Peaks; have succeeded in the struggle up Pike's Peak trail to the summit; and have reached a dry, thirsty and barren, though boomed. land, and stop to take breath at Las Vegas, New Mexico. We cannot stop to describe its wonderful hot soda and sulphur springs, or their boasted curative properties; but hasten to tell of a *discovery* we thought we made here, but afterwards found to be as common all over the Western country as hay-seed It was what might be called a professional emigrant. We saw a sturdy man with a pair of good mules grading around the railroad hotel (the Montezuma). He looked and talked like a Yankee, but not quite that; but certainly he was not a foreigner. At noon, when roving on the outskirts of the village, we noticed the same man with the team put out, and feeding from the rear end of the wagon. Himself, a woman and three children were seated on the ground near by, eating their dinner from tin plates held in their laps, the food reservoir being an iron spider, and their drinking cup an old fruit can. There was a fire smouldering a few feet away, between three flat stones set edgewise. Near by on the ground was the canvas-covered top of the wagon, which for the time being was evidently serving the purpose of a tent, and in which were a few household goods—boxes, bundles, and what looked like bedding. At a little distance, browsing in the sage brush, were two Indian ponies for riding when the party was on the move. The man and his wife appeared to be about forty-five years of age, the children, two boys and a girl—about twelve, ten and seven. Salutations were given and received, and, as there was no bashfulness on their part, a rattling conversation was soon on the flow. The story, told with little interruption or prompting, was as follows:

"We are of Massachusetts origin, but were born and reared in central New York, and commenced married life there on an inherited farm about twenty years ago. The farm was a good one, we think now; but we caught the Western and the lumber fever, and sold out and went to Northern Michigan and bought in the woods. Stayed there most three years, but didn't like it; didn't like logging, didn't like the woods, didn't like the stumps, couldn't stand the cold in winter nor the mosquitoes in summer, and so sold and went to Wisconsin. Did not buy there, but rented a place for one year, but found it to be Michigan over again, so concluded to try the prairie country, and went out to Nebraska and bought an improved claim with a good turf house and some tools on it, but no barn."

"The first year was a good one, so far as crops were concerned; but neighbors were few and far between, and they were Dutch or something of the kind, we couldn't understand their lingo. We had to burn up most of our corn for want of wood, for there was none in that country. There was little market for what we had to sell, and what there was was so far away that it didn't pay to go for it."

"The second year was a bad one. There was a great drought. The crops and grass all dried up, and we sat up nights to watch, fearing the prairies would burn over in July. That winter we had blizzard after blizzard, and it seemed as if we should freeze solid and blow away; and I believe we should, if we had not been completely snowed under; as it was, we froze our ears lying in bed."

"The third year was good enough, but, with the cost of building a pole barn, we did not get ahead any, but rather fell behind."

"The fourth year promised splendidly. Corn, wheat and grass grew as we never saw them in York State. But one day, just as wheat was beginning to turn, we noticed a sort of cloud coming up from the southeast and coming directly towards us, growing darker as it came; and then it began to roar like Niagara at a distance, or near by, for that matter; the sunlight went out, and almost before we knew what the matter was, the locusts came down upon us. They flew into our faces and caught in our hair, and filled the house before we could shut the door and window; they completely covered the ground and all the plants there was on it; and the gnawing, grating, whirring roar was awful. It did not take them long to eat every particle of a plant there was on the farm and all the surrounding country, and to scratch up their roots; and the last that came starved for want of fodder, making a smell about as bad as a slaughter house. There was nothing left for us, and we 'lit out' and went down to Kansas, where I got a job on the railroad. I made up my mind that locusts were too much for us, and the first man who wanted that farm and try his hand with them could have it, and he did; and we took a year to look around and find a place where a man could live and have a decent show."

"The next spring we went off southwest a hundred miles in the State, and bought out a fellow and went to work. Times were lively there so far as settling up the country was concerned; but the emigrants were a mongrel crowd from every part of the world. They were late in coming in, and it rained all the time until the middle of June, and the land could not be worked. Half of them could not get cover, and when hot weather came on they took the shakes, and kept it up all summer. What crops they got in didn't do any too well, and were not grown when a stinging frost came in September and killed everything. That was a tough winter; it seemed as if those foreigners would starve, and we were not much better off. Some of them went off, and loads of provision were bought by somebody to feed those who stayed."

"After that the look ahead wasn't bright; there wasn't grain enough in the country for spring planting; so, as soon as we could travel, we put our claim into the hands of an agent to sell, and, rigging up a prairie schooner, headed for Colorado, thinking as hard luck followed all trials at farming, we would try mining for a change. It was a long journey and a rough one, but we struck Pike's Peak after a while, and went on up to Denver. There was people enough, and hurrah enough, and mining talk enough there, but no mines. So we kept on West into a crack of the mountain so narrow and so deep that sunlight didn't reach the bottom, and it was crookeder than a meadow brook; but it led at last to a mining town that was hanging around promiscuously in the sides of the ledges, and called Blackhawk. It didn't take more than two days for me to find out that we were out of place. I could not find any leads, veins or color of gold on the surface, I wouldn't work in a dark hole a thousand feet deep down in the bowels of the mountain, and I couldn't make salt shovelling and washing gravel down in clear creek with a gang of Chinamen. But I had my team, and could get good wages hauling rocks to the smelter; so we concluded to stop a while, and we did for eighteen months, but all the time trying to get information so that the next move should be a good one, and a final one. Our plans were finally laid, and we are so far on our way to carry them out, and have only stopped here for a few weeks to rest and refit. We have started for southern California to go into fruit raising; for, from all we can learn, that is the coming thing. But of all the countries man or beast ever traveled over, this along here caps the whole; it is all in hummocks tipped up or tipped down, there is no rain, no water, unless it smells of brimstone, nothing grows on it but sage brush, and this journey I reckon is like going through purgatory to paradise."

"We did not dispute him, but bid the family good-bye, impressed by the sad, weary, hopeless look stamped on the face of that wife and mother; and also that men of a certain mental mould are like plants, indigenous, and it is unnatural that they should take root and thrive as exotics. But we will take the train and hie away across the deserts to California, and see what our chronic emigrant will see when he reaches the end of his long journey, and gets into the full swim of his "coming thing." We are now in the vicinity of Los Angeles, and it is the beautiful month of June, when the hills and valleys of New England are in all their glory of verdure and bloom, the air loaded with sweet perfume and vocal with the music of singing birds; but here the great range of view is brown and sere. The wild oats, the only native herbage on the hill-sides, are seeded and dead. Here and there are green spots of grove or vineyard, but they only serve to make the great sweep of country look more forbidding. The traveled roads are inches deep with a fine, almost impalpable dust, the color of yellow snuff, and about as pungent to eyes and nostrils. As teams or equestrians pass along, it rises and settles upon and in everything, leaving its dirty hue. Far away in the line of the road you are pursuing you notice a dense cloud rising and you remark to the driver of your vehicle, "A rain is coming up yonder; we thought you did not have rain here at this season of the year." He gave us a quizzical look, as much as to say, "You *are* a green one;" and replied, "I reckon it will be a dry one, but wait and see." We did not have long to wait before we found the cloud was dust raised by a flock of two thousand sheep, who, as they moved along nipping here and there a tuft of dry herbage, raised so thick a cloud of dust that only the outer edge of the flock could be distinctly seen. Sheep, dog and shepherd were coughing and sneezing; all were of dark snuff color, all looked haggard and dejected, and the last demented, at any rate he was uncommunicative. We remarked to our driver, "This is a hard looking country now, but I suppose you have rain in the winter, and the country looks fine." His reply was, "Yes, perhaps so; the country is fine enough, but it rains all the time, the roads become a perfect porridge, the bottom drops out, tourists don't come, you can't get around, business is dead, and we den up. Give me the dry season, dust and all."

As we passed along the road in another section, at many a spot men were cutting down orange groves, trees from six to ten inches in diameter. An inquiry of one of the bosses brought the information that the scale had got the better of them; that as they grew larger they needed more water, which could not be had; and they must go into some other business, he hardly knew what, on account of the water question. We retired from the scene with the impression that the country had been boomed to death, and that when our chronic emigrator reached it from New Mexico, he would be impressed in the same way, and find swarms of sympathizers, if, their "grin and bear it" would let them talk. But we are away and pass on to the north, to a section famous for the rugged grandeur of its scenery, and find ourselves near the south fork of the American river in the Sierras, where gold mines in all forms and conditions of deposit and development are said to abound, and to have yielded untold millions. We find nothing inviting here but the wild sublimity of the mountains, and the reputation that they contain gold, which by searching may be found. A little exploration discloses the fact that simple placer mining, hydraulic mining and stamp mining are being practiced; and in due time we find ourselves at a mining camp consisting of one small shanty, one man, and one dark hole down into the mountain rock, at the surface of which is a rough windlass with a crank to be turned by hand. Our approach was discovered, and hailed by a hearty "How are you? Are you lost, or only looking for something?" We replied, "Both." "Well," said the man, "come inside and tell all about the country you came from, and its people, and how you came to be here." The invitation was accepted, and we stood in the mining home of two graduates of a Massachusetts college, whom we knew to be good geologists, mineralogists and chemists. News from the East was eagerly sought, and from friends near and far. The conversation gradually drifted to personal experiences among mines and mining camps during the three years then passed; and this is the story told in few words:—

"C. is half owner of all there is here, but got discouraged, and about eight months ago went off to Nevada City and got a superintendent's job there; but I have stuck to this mine off and on, thinking we could not be mistaken, and if indications were good for anything, we should get something worth having if we could contrive to live until we got the shaft deep enough. When we first came out here we thought we knew about rocks and metals, but went into the employment of Sargent, down at Georgetown, to get a practical knowledge of mining as a business. After eight months there we took a month to visit mines in all directions to see the character of the rocks in which the metal was found, and the different methods of approach and reduction. We then started out independently on an extended prospecting tour. We found several places that miners would call a good prospect, but in our opinion the best show was here. Therefore, we secured a patent, got suitable tools, and began work sinking a shaft. Near the surface we struck a quartz vein, and got some beautiful specimens of free gold, and thought our fortune was made; but it was so thin it yielded but little, and soon pinched out. The shaft is now seventy feet deep; at intervals, as we went down, we found a little color, but did not strike it rich, and more than once we were dead broke. It is pretty difficult in such a place to tell what the show may be a day or a week ahead."

"Soon after C. went away, just for a change, a friend of mine went with me over into Placer county, to a place that C. and I had spotted, and secured a right and went to work sinking a shaft in decomposing talcose slate rock, in which veins of soft, gold-bearing quartz frequently occur. We worked hard for several months, and as the rock was not hard, we got down about forty feet, but did not find a trace of anything; and I got discouraged and thought I had rather put work into our old mine. So one morning, just after I reached the bottom of the shaft, I said to A. 'What will you give me for all my right, title and interest in this hole?' His reply was, 'I had rather sell than to buy; but I will run for luck, and give you fifty dollars; but you shall wait for your pay until I take it out of the mine.' 'It is yours,' said I, and did not strike another blow, but got up top of the ground and tramped back here. Then something happened, the like of which has happened before in this country. A. got into the hole which I left, took up my pick and went to work; and before night of that day, he uncovered a pocket of soft, clayey material, about the size of a barrel, out of which he took $25,000 worth of gold. The news was not long in getting over here, and it made me and this whole mountain so blue that it fairly smelt of sulphur. That find had one good effect on me,—I got my fifty dollars, and a little more as a present, otherwise I should not have received, as really I did not expect, a single cent. But A. was affected in a different way; he thought he saw himself a millionnaire in the near future, and hired gangs of men, and put up costly machinery; but to this time he has not found a trace of color, and quite likely will not, and will exhaust his whole find. That is the way it goes here. A knowledge of rocks and minerals, and even practical experience, are all at fault in this business. Before C. and I began for ourselves, we visited all kinds of mines, saw all sorts of mining operations, ran against all classes of miners, from the old forty-niners down to the tender-footed; and we have found but two classes, who, in the long run, have made more than a fair living, and they are: first, those who by accident have made a rich find like A., and had sense enough to leave the business at once; and second, those who dug shafts or tunnels into the mountains, 'salted' them well, told stories of their fabulous richness, stocked them, increasing the number of shares as long as they could find fools to buy, and then disappeared with their pile; or still others, who owned fairly good paying mines, but stocked them at a thousand times their real value, sold the stock, and retired millionnaires. The rank and file of the immense army of gold seekers have been roving helter-skelter through all the wild mountain gorges of the West and California. You will find their abandoned pits and tunnels where you would not have believed the foot of man had ever trod; and each tells of great and bright hopes blasted."

"I know this region well; it has the reputation of being the best mining section in the whole country; and, if you will pay the expenses of the trip, I will take you around, let you see for yourself and invest if you wish, for you will find the chances are plenty." We accepted his very reasonable proposition, and tramped and climbed and rode for a week among mountains and mines; saw gold taken from the stamp mills in the form of quick-silver amalgam, saw it washed from the "putty" lanks and caught on the sluice ripples, saw it cradled out of the creek sands and pounded out of crumbling quartz in an iron mortar; interviewed mine superintendents and day workmen, and was confirmed in the impression that our guide and friend knew what he had previously told me, and that practical mining in the mountains was quite unlike that which is done in the stock markets of New York and San Francisco. Those two young men are now in New England, and successful in important and responsible positions.

But, you may ask, are there no contented, happy households, no towns and cities of solid growth; nothing that is bright and encouraging in a business line in the West? Yes, we answer, many and much every way; but that side of the story has been told a thousand times in a thousand ways by all the known methods of creating public opinion. Our path has been behind the scenes, as it were, among the producing classes, who alone create the necessity for towns and cities, and who sustain them; whose voice the great public rarely hears, and whose struggles and deprivations are not known or appreciated. Land as a gift on a wide prairie in the West costs more when the comforts and conveniences of Eastern homes are placed upon and around it, than the same does here. The rich may emigrate to such a locality; but the poor man or the one in moderate circumstances with a family never should. Within the last few months, a great crowd of emigrants have been making a wild rush for Oklahoma, as if pursued by a devastating prairie fire, or a horde of bloodthirsty screeching savages. That rush was not made because those people were in search of land for homes and there was none to be had except in Oklahoma, for there were millions of unoccupied acres behind as good as those before. Neither has this vast emigration from the East to the West been caused by pressure of population on food supply. Excluding the areas of water, we have 540,204,160 acres of land on the east side of the Mississippi river. Allowing that one-third of this is mountain range and unimprovable land we have left to produce food, six acres for every man, woman and child of our sixty millions of people, and it is agreed that an acre and a fourth of well cultivated land will annually produce the food of an adult human being. The provoking cause of this rush of emigrants from the East to the West during the last twenty years has not been a natural one—the necessity of food, or the scarcity of good land which could be profitably cultivated. But it has been the innate propensity of the Aryan race to rove and wander, which, by fraud and falsehood has been artificially excited by speculators for their personal profit. My *impression* of this whole matter after extended practical observation, has become a decided *conviction*, that if a tithe of the effort was made and assistance given to induce these people to emigrate back to the Eastern and New England States, that was put forth to seduce them away, they would return by the hundreds of thousands, and we should have no occasion to complain of abandoned farms, or to invite emigrants from foreign countries, the desirable homogeneous character of our population would be maintained, and the sum of national thrift, human comfort and happiness be increased.

INDIAN CORN.

By Professor J. W. SANBORN.

[Embracing the substance of a lecture given at Poland, November 8, 1889.]

Indian corn is indigenous to the western hemisphere. The Americas have the honor of giving to the world this grandest of the forage crops. Botanists for a long while maintained its Asiatic origin. It was said by them that it was the only plant of the species found on this side of the ocean while there were allied plants in Asia.

Absurd arguments were drawn from the scripture to sustain this view of its origin, such for instance as the case where our Saviour plucked the ears and rubbed them in his hands, an operation and designation that it was maintained could only apply to Indian corn. Rubbing is precisely what we in fact do when we desire to obtain the kernels of wheat from the head. An Indian corn plant was drawn in China fifteen years after the discovery of this continent. From this fact, considering that oceanic communication did not commercially exist with that country, has been drawn the conclusion that the seed did not find its way overland to this remote nation. But communication existed with China overland, and had existed as far back as Roman times, when silk was drawn from it. We know that the early Spaniards took back with them to Spain all objects of promise in the plant world that were readily accessible. It was first seen in 1498 on the mainland, in 1498 on the shores of the Gulf of Paria. In 1492 in November, Columbus himself saw it in Cuba. Indeed the Icelandic explorers, the remains of whose works are now seen in Massachusetts, are said to have mentioned its existence. Those are as early as the very beginning of the eleventh century.

Dr. E. L. Sturtevant, who has collected very much historical data regarding this crop and who has presented it to the public in the form of a pamphlet, says that in 1636 the English found in their attack on Block Island, that the Indians had 200 acres under cultivation. The Marquis de Nouville in the French invasion of the Senecas is said to have destroyed over 1,200,000 bushels.

The Spaniards in their invasion of Mexico came very near being surprised by native foes screened within a cornfield and were embarrassed by it in the battle. Its presence all over the American Continent in the hands of the natives, who had very much developed it, wherever the European penetrated, and in advance of him is conclusive. Indeed the Chinese ascribe its origin to the Western world.

The native population had *very* diverse varieties; whether its variations were due to their skill or environing conditions and natural crossings we do not know. The probabilities all favor the latter view, as the Indian character and accomplishments will not readily admit of a belief in the application of the necessary creative skill to produce the results seen. They have the just credit of producing various foods and drinks from it. On the hard soils of New England, their industry and skill had broadened out to the point of catching the alewife and placing one in the bottom of each hill of corn. Fish even now is used, but as a regular source of the nitrogen and some of the phosphoric acid of the chemical manures used for corn.

ITS NATURAL HISTORY.

Corn belongs to the gramminæ or grass family, having the round pointed stem, the leaf development, the root development and the general characteristics of the grasses. The most casual observer will perceive that clover has none of the marked traits of the grasses. Its reproductive organs are carried upon distinct parts of the plants,—the tassel or stamens (the male element of fertilization) being at the summit of the plant, while the pistils, or silks—the female organ of the plant is borne near the centre of the plant on the ear. Sometimes we find both organs of reproduction at one point, as when the tassel bears an ear or the ear is found at the end of the sucker. Sometimes the staminate flowers are found at the end of the pistilate spike or cob. These facts suggest the possibilities of variation in the past. Building upon this possibility some have suggested that in the original form of corn the ear was borne upon the tassel. The wild form of corn is unknown. The various views presented seem but idle speculations, and the solution of its history remote. If it has developed from a wild form that form has long since entered historic oblivion. If its parentage exists the links that unite the tame to the native forms are too obscure to be traced. It is true that the husk corn, or a variety having around each kernel an enveloping covering enclosing it closely, while the ear as a whole is still surrounded by husks, each husk rolled up in a loose way, has been regarded as the possible parent-type. I have grown it and observed it. This guess may be as good as any that has been made or is likely to be made.

In height it varies from two feet to over twenty-five feet. Sturtevant tells us that the number of seeds required to make a pound varies from three hundred and thirty of the busco, or husk corn, to three thousand six hundred in the smallest sort. Its period of ripening varies from less than two to about six months. Its rows vary from two (Prof. Brewer says a botanist told him that he had seen a wild form in Mexico with only two rows) to thirty rows. In color it runs through white, yellow, red, blue and various intermediate or blended colors. The stalks increase in size from north to south; likewise the height of the ear from the ground and the distance that the corn must be planted apart. The Dent varieties grow their ears very high up on the stalk. In Missouri they may be found as high as the tenth to the twelfth node above the ground. On the bottom lands of this State it is often difficult to reach the ear, while the Flint sorts of Maine grow their ears near the ground.

This species, Zea Mays, seems to stand out distinct and alone. The differences between what is known to us as varieties are based upon distinctions so trivial that botanists have not attempted to separate the varieties of corn into species. They readily cross and vary quickly under change of climate and soil. Dr. Sturtevant has proposed the following classification into species: *Zea everta* (pop corn); *Z. indurata* (Flints); *Z. indentata* (Dents); *Z. Amglacea* (soft kinds); *Z. saccharata* (sweet corn); and *Z. Amgleas acchorata*—the starchy sweet corns. These he sub-divides into their varieties. Doubtless the varieties all have one source, and characteristics too indistinct to result in an agreement to erect them into several species.

Prof. Leazenby proposes a classification for convenience, and suggests the following:

$$\text{Race}\begin{cases}\text{Flint, Yellow,}\\ \text{Dent, White,}\end{cases}\qquad \text{Type}\begin{cases}\text{Large, Medi-}\\ \text{um, Small.}\end{cases}$$

I have carried out one side only, for illustration of his method. Our farmers seem to be too familiar with the varieties and their outward distinctions to be hampered by set formulas. Classification may serve some interests. Its botanical name is Zea Mays; the former is Greek and signifies, to live. How admirably named a life supporter. Mays is Latin. The French call it Maiz. We add an e and have our Maize.

The word corn itself has quite a different meaning with the various nations and has been applied to the cereal that fills or has filled a most important place in the agriculture of each people. In England it means the various grain crops. They do not raise maize there. In Scotland it is oats; in other countries it is wheat; here it means Indian corn alone.

I shall not now attempt to speak of the kinds that Dr. Sturtevant regards as species. Each has its own distinctive field which the other cannot successfully invade. Pop corn has no competitor for popping purposes. Sweet corn for consumption when green has the field to itself. The Dents do not succeed far north, while the Flints do not succeed in the remote south as well as do the Dents. Upon the common ground where they touch and come into competition occasion will arise for the presentation of their relative merits.

Before turning from this very brief review of one phase of the corn question, I remark that Gerard's Herbal, printed some three centuries ago, a copy of which I was so fortunate as to procure for the library of the Missouri Agricultural College, has cuts of several varieties of corn carrying many colors and characteristics that we recognize as of a high order. The blue is there, which with the above data, shows that very soon after the discovery of this continent corn was so far perfected that Prof. Brewer declares in a letter to Dr. Sturtevant that he could not determine that it has undergone any material improvement to the present.

The colors, it has been said, depend upon the physical structure of the seed in a very large measure. I quote the following expressed opinion. Red, blue and black varieties have an opaque epidermis or thick outer coating. The yellow and white sorts have a transparent epidermis. In the former the oil is said to show through, and in the latter it is the starch which shows which part will be seen on opening any of the starchy varieties. I have consulted eminent authorities on the color question and find that the matter is not understood. The above views, though from a fair authority, do not seem to be correct. I give them in hopes that some one will investigate the color question The Flint varieties are said to carry their oil more on the exterior than the Dent sorts, while the pop corn has the oil unusually well distributed throughout the mass. However that may be, in the latter sort the starch has more to do with that quality of pop corn we all so admire.

The Flint varieties show the hard or corneous matters surrounding the starch and which appear clearly to the eye when the seed is split open. The Dent varieties show this hard surrounding matter only on the sides extending to the ends of the seed. Dr. Sturtevant says that one ripens from the outside in, and the other from the inside out. Of the bearing of this I shall speak under ripening off of the the two sorts. Soft corn shows no corneous or hard matter, while pop corn contains, some the germ only, wholly this hard matter. These physical differences are important and have their bearing. The Western feeder does not like the Flint varieties as well to feed because they are harder to chew than the Dents and are more wearing on the teeth. The Eastern farmer will find them more kindly to harvest at a date when the full value of the fodder can be secured. The sweet varieties, on account of yield, are mainly confined in their use to the household table, yet in some trials I made it appeared that the fodder plant of sweet corn is more valuable for milk production than that of Dent corn. One trial nearly always needs corroboration. The relative yield for forage is not yet clearly enough defined to give it its final place in use for domestic animals. Its analysis is good and it is very palatable.

ISOTHEMAL LIMITS.

Corn is a subtropical plant in its general characteristics and held to be such in its origin. It thrives best near the northern limits of its possible northern growth on any commercial scale. This is seen in the yield of this country. The last annual report of the National Department of Agriculture shows that Maine, New Hampshire and Vermont averaged in round numbers thirty-five bushels per acre; New Jersey, New York and Pennsylvania but thirty-two bushels; Virginia, Maryland and Kentucky but twenty-one bushels, while South Carolina, Georgia and Alabama averaged less than twelve bushels per acre. Indeed, more corn is grown where the temperature of the year is below 40° than where it is above 70°. Prof. Brewer in the tenth census finds that 87.3 per cent of our corn crop is grown in sections where the mean temperature is between 45° and 60° Farenheit. So narrow is the limit of its best development that 40.8 per cent of our entire corn crop is grown where the temperature averages from 45° to 50°. Where the temperature ranges in July from 70° to 80° nearly all of our corn crop is grown, or 87 per cent of it.

The six great states falling within a narrow range of latitude, Ohio, Iowa, Indiana, Illinois, Missouri and Kansas, in 1880 raised fifty-seven per cent of the national crop.

The bulk of the corn crop of the United States will be grown south of 44° and north of 38°. This will be modified by large bodies of water, as in Maine through the ocean's influence. The inadequate rainfall west of the 100th meridiau will forbid its passing of this point, save in isolated spots where irrigation will make small areas available.

If, now, we turn to statistics, we find that the six great corn states mentioned, including a seventh, Nebraska, which has risen to importance as a corn growing State since 1880, raised in 1888, (the last annual report out at the time of writing) of corn, wheat, oats, rye, barley, buckwheat, tobacco, potatoes and hay 1,317,174,-371 acres. These states had for the same year 780,505,000 acres in corn, or over fifty-nine per cent of the entire arable land devoted to the great staple crops, including hay. This is by far too great an area for any one crop unless it be hay and grass. This large area of corn is utterly incompatible with high agriculture. This all means that the great area in the corn crop in these states should not expand but contract. It also means, when taken in connection with the facts presented in relation to the area of most successful corn growing, that population in the future is likely to increase faster than corn production.

Hon. J. R. Dodge has shown that the per cent of our corn crop that is exported varies from three per cent to five per cent, and averages but a little over three per cent of the production of the nation. This margin of exportation can easily be overtaken. When overtaken and past, then the factor necessary to increased prices has begun its work. An increase of price will be slow, as any enhancement of value would extend its area of production in other States.

This field of discussion is so wide that I shall have to avoid being entangled in it. I have introduced it as an element of interest and hope to the Maine farmer. In passing, I may observe that consumption of farm products in this country is now gradually overtaking production, as shown by statistics, and hence the factor is not without its value.

Dr. Sturtevant estimates that during the four to five months of its growth, corn requires 4,300 to 5,000 degrees of heat for its successful maturity. The amount of heat required will vary with the variety and the moisture of the atmosphere and possibly with the vitality of the seed, but for the latter within narrow limits. The difference in varieties in the above respects is seen in the observations of the above authority.

	Vegetated.	Bloomed.	Sum of mean daily temperature.
1883, Flint corn,	May 28,	56 days,	3,727°
1884, "	" 26,	56 "	3,629°
1885, "	" 28,	60 "	4,103°
1883, Chester Co. mammoth corn,	" 28,	74 "	5,117°
1884, " "	" 26,	80 "	5,268°
1885, " "	June 1,	70 "	4,850°

The heat limits required varied with the year. Very singularly the year that the Flint variety required the most heat the other required the least heat to flowering. The yield will follow the temperature fluctuations of the seasons. We shall have to learn more of the matter and adjust our varieties to the average season.

THE VALUE OF THE CORN CROP.

It is the world's royal forage crop and is the matchless source of animal food, save the grasses proper, which must remain for awhile king of the stock foods on account of their mat of green from spring to winter again, that the animals may themselves harvest without tax upon man. Whittier rightly measured the value of corn in his verses:

"Heap high the farmer's winter hoard,
Heap high the golden corn
For no richer gift has Autumn poured
From out her lavish horn."

I shall endeavor to maintain the high position accorded to "Golden corn" by a presentation of its several important merits.

A. ITS YIELD.

I would encourage every farmer to grow seventy to eighty bushels per acre, but would have him grow no less than fifty to sixty bushels. At the latter amount, sixty bushels per acre, we get in corn, assuming 14 pounds of cobs per bushel and 90 pounds of fodder, 3,360 pounds corn, 840 pounds cobs and 5,400 pounds of stover, or a grand total of 9,400 pounds per acre or enough to keep a cow yearly.

If we regard the corn and cobs as carrying 10 per cent of water and the stover 20 per cent, we should have 8,100 pounds of dry matter.

It would require four and one-half tons of hay per acre to give the same yield, and nearly fifty tons of mangold wurtzels.

Corn is not only a crop that yields heavily, but it is a food that has rare qualities. It is a very palatable food. This quality in a food I regard as one of the most important factors in foods. It is that quality that induces an animal to consume it in liberal amounts. If eighteen pounds of food constitute the maintenance ration of a cow or of a steer, it will be found that the amount eaten over and above this sum will be gauged by its palatableness; and the excess amount eaten will gauge the production of the animal, and through it, of the ratio of the whole ration that goes to growth and thereby of its economy.

Corn is one of the very best fattening foods. It is unexcelled as a butter food when quantity and quality of butter are considered, coupled with that of the sustenance of the cow. It is an exceedingly digestible crop. Three American digestion trials show that 83.3 per cent of the dry matter of corn is digestible. Prof. Jordan finds that Timothy is but 57.1 per cent digestible, while Prof. Armsby finds 62 per cent of stover digestible in the only trial made. Cobs have a digestibility of 45 per cent, as I judge from some facts at command. If so, and if stover constitutes 56.35 per cent, corn 35 per cent and cobs 8.75 per cent of the weight of the whole plant, then the whole corn plant is 68 per cent digestible, or nearly twelve pounds more so than Timothy, or over 26 per cent more digestible. If this is correct, as it is so far as our data yet show, it would require instead of four and one-half tons of Timothy, five and two-thirds tons to equal to the yield of digestible matter estimated in sixty bushels of corn per acre. But as we do not know as yet the ratio of dry matter in the fodder of corn to the corn, the estimate is not wholly a safe one and probably errs in favor of corn against hay, owing to the fact that stover may carry more water than data show. This is probably true, yet it will leave corn, after all corrections are made, more digestible as a whole plant than Timothy is by a very material degree, and the yield of hay to equal it not far below that given.

B. OUR CHEAPEST TILLAGE CROP.

Corn gives the maximum yield for the minimum amount of tillage cost. It is the crop involving the largest substitution of machinery for muscle of any stock food filling such a mission as corn. I hope, hereafter, to show that this crop is chiefly a machine crop and thus in step with the age, which demands machine products. The price of American labor and the tastes of the American people forbid such crops as the root crops from taking a strong hold in our practice. We find in corn a productive crop that is cheaply tilled and one that fills the purposes of a clearing and tillage crop, for which the English use the root crops.

I have praised it as a cheap tillage crop, (I shall show this later on). This may not demonstrate more than a relative value to the Maine farmer. I mean more than the heading implies—beyond doubt high agriculture under normal conditions, demands tillage crops in its rotations. In a series of experiments covering several years, I demonstrated that crop rotations upon a philosophic basis actually gave fifty per cent larger yields than when a given crop succeeded itself. There can be no good rotation without a tillage crop combining the functions of soil areation and weed extermination.

Tillage is manuring. Job considered good tillage a religious merit, and exclaims in his agonizing search for the cause of his punishment, "If my land cry out against me or the furrows thereof likewise complain." Virgil said, "vex the ground with continual harrowings." Cato considered extra good tillage more important than "laying on of manure." The fable, according to which a Grecian willed a bag of gold to each of his sons within the first foot of the soil, was realized by the sons in the good crops that their digging produced. Jethro Tull, the first philosophical farm-thinker that agriculture produced, succeeded in raising large crops by tillage which he believed alone would furnish ample plant food. "Plow it, harrow it, grind the earth to powder" said he. Liebig tells us that the influence of tillage "often borders on the marvelous." Joseph Harris claimed a gain of fifteen bushels of wheat per acre on a hard piece of ground, as the extra gain of good over bad tillage.

Tillage opens the soil to the air and admits of its more free access to it In a careful trial of harrows covering days of work in weighing and measuring the soil, I found that between two types of harrows one had made the soil fifty per cent more open than the other, or it contained that ratio more of air. Air contains oxygen, carbonic acid, ammonia, etc., etc. Those are all agents of soil decomposition. They have been the main agents by which it has been decomposed from the original rock which covered the earth's surface. Air, made up of various gasses, is the poets "tooth of time" that rends asunder everything, even eating up iron as seen in its rust that rots off. The open and the closed soil is the difference between food in the silo, where air cannot get at it and the same food out in the air loosely piled where it soon rots; the difference between muck in its bed sealed up by water from air where leaves and twigs have slept for ages closed to the burning, rotting influence of air, and the same thrown out on a dry knoll where all vestige of leaf and twig disappear before this all-devouring "tooth of time."

The grass farm holds quiet air between its stems, while its close mat shuts off its free movement in the soil. Do we know this? Most assuredly. Dr. Sturtevant found that his lysimeter covered with grass had leached from it but 0.3 of a pound of solids in a season, while the one cultivated, in which the air was sent coursing through it with its devouring breath, had leached from it 218 pounds.

Sir John B. Laws found that nitrogen and carbonic acid had decreased in some twenty odd years of tillage, over one-half when compared with adjoining soil which was covered with grass during the entire period. Indeed he found that nitrogen actually increased under sod. This was largely through the increase of its own roots, which in a close soil would not readily decay and thereby furnish locked-up food. Stockhardt aerated a soil by pipes and spaded it 20 inches deep and got 2,772 pounds grain. A piece by its side spaded 20 inches deep but unaerated yielded but 2,072 pounds. I need not dwell. Tillage is manuring and we must till, and tilling we must turn to corn and welcome it as our one best tillage crop for the high, northern, coarse, slow decomposing soil of New England.

C. CORN A RENOVATING CROP.

I do not mean that corn actually enriches the soil, but speak of it in a relative sense. It is a broad leaved crop, and, like all of its class, is successful in wresting from nature a high ratio of food without the full supply of applied plant food that many other crops require. Its life is through the summer, when the heat of the sun and long summer days conspire to make soil disintegration most rapid. In the same field in Missouri for seven successive years, I found that this disintegration of the organic matter of the soil was almost rapid enough to furnish this gross feeder all of the nitrogen it needed without my aid, while the wheat growing as winter wheat does in the fall and in the early spring, doubled and sometimes quadrupled its yield by the addition of costly nitrogen. The broad leaves of corn pump up from the soil and throw off upon the moving breezes an enormous amount of water. One writer has estimated its amount to be 1,500,000 pounds per acre. Doubtless this carries with it more of the salts of the unfed soil than would be carried by a plant that moves but little water through its leaves.

Corn is a gross feeder. Its roots soon fill the soil as the arteries do the human system. It seems to have through its root system, a power of soil disintegration not possessed by all crops. This power resides in the acids secreted by the roots which attack the soil. Further discussion of its feeding power will be deferred until I reach the feeding of corn.

D. A HOME CONSUMPTION CROP.

Home made manures are the cheapest manures, and corn, second to grass, is the best crop for home consumption. In a series of feeding experiments with shotes, I found that 100 pounds of corn and cob meal made as much growth as 100 pounds of clear meal. I leave the fact undiscussed, as this paper does not enter the field of animal nutrition. Suffice it to say that 100 pounds of corn and cob meal will make twenty-six pounds of pig pork, which pays, when shotes are four cents a pound live weight, seventy-one cents a bushel for corn and cobs of the corn. The stalks have more pounds of digestible matter than Timothy hay has, and in a recent review of some over forty periods of personal feeding trials I have shown that they have practically as high a feeding value as this honored hay. If I were to turn aside to advise Maine farmers touching crop rotations it would involve the counsel to place in it some sale crop for cash, nevertheless such a rotation would include corn for home consumption.

I have briefly set forth some of the virtues of the corn crop. It is a magnificent crop and a grand source of national wealth. While I have been prosaic in the discussion of its merits and have confined such discussion to its relation to the lower animals, I am not insensible of its value to the higher animal, man, and fully agree in the sentiment poetically expressed in the following lines:

"Let vapid idlers loll in silk
Around their costly board,
Give me the bowl of samp and milk
By home-spun beauty poured."

But once more we find that it is

E. A FLEXIBLE CROP.

It has already been shown that corn varies wonderfully in the weight of its kernels, in its number of rows to the ear, in the height of the stalk and in other particulars. Dr. Sturtevant succeeded in marvelously calling out one of its possibilities and of showing to the world the reserve opportunities for man that is wrapped up in the fact that at most of the nodes or joints of corn, there is developed a miniature ear. If we examine a field of corn at the time that the leaves that encircle the corn put out from the joints, we shall find on unfolding them that a tiny ear with its visible rows for corn has been formed. Dr. Sturtevant started twenty-three of these ears on one stalk, and developed seven of them to maturity and many nubbins. What are the capacities of such a plant? Has it an equal in possibilities? What a field for man to unfold himself in his endeavor to gauge the capacities of a plant! Here we behold a field worthy of our skill. Agriculture was ordained to put us to the test to furnish a standard in nature to measure ourselves up to.

I omitted to name in its fitting place some of the recorded yields of corn. I do not suppose that the returns below are those of critical conditions on the part of those securing them. Nevertheless they demonstrate the fact that practice has reached a standard, when compared with our average results, that is marvelous.

H. Norton of Ohio	raised	per acre	165	bushels.
J. Barnard of New Hampshire	"	"	160	"
D. W. Dickey of Pennsylvania	"	"	169	"
Dr. Parker of South Carolina	"	"	200	"
W. F. Young of Alabama	"	"	217	"
D Petit of New Jersey	"	"	263	"

Grangers of Saline county, Missouri, for 10 acres, and 11 out of 17 trials, over 100 bushels.

Mr. Howard, Saline county, Missouri, for 5 acres raised under the most critical conditions, fixed by the writer of this, in a phenominally poor year, 96 bushels per acre without doubt.

The prize given for the best acre raised in this country offered for the year 1888, was won on a yield of 255 bushels per acre, or as finally air dried or calculated on a fully fair dry basis 239 bushels per acre under somewhat stringent limitations, save that the growers were allowed to plant up to the line of the acre and thus really to grow the corn on over an acre of ground. All hail corn as the king of the tillage crops!

CORN FOR MAINE AND FOR NEW ENGLAND FARMS.

Corn is held to be in the region of doubt, even worse, in discouragement, on New England farms. Level prairies, rich from the accumulations of ages, machinery with almost positive intelligence, and railroad freights but half of a cent a ton a mile, have largely driven wheat production out of the East. We are asked to give up the royal tillage crop, the corn crop, to those new forces. Shall we? No! a most emphatic no! I have shown why corn is a good crop to raise upon general principles, but can I show good cause for its growth in New England under what are regarded as specially unfavorable conditions? The reasons given hold especially for New England. Why? I invite attention to the fair logic of the case.

Nature has not favored New England as a farming section. Man is the measure of the productions of agriculture and not necessarily the soil. Our agriculture must depend upon the man engaged in it or upon the application of brains, energy and capital in its prosecution. Have we high farming? We apply about the minimum of labor, capital and tillage to our soil that it is possible to use. Only 16 per cent of Maine's arable soil is under the plow, or out of 1,580,451 acres in the great crops of Maine, namely: Corn, wheat, rye, oats, barley, potatoes, buckwheat and hay, all but 267,-840 acres of it is hay. If the grazing land is reckoned in to the total, but the merest fraction of Maine soil is tilled. Missouri has 88 per cent of her area under the plow and only 12 per cent under grass. England, France, Germany and other European countries, even including the grazing land, have about one-half of their area under the plow. This system of Maine requires but little labor or capital and uses very little skill. It results in a ton of hay per acre —in as near nothing as it is possible to bring farming in grass returns and keep up a pretence of farming. It is not farming in its legitimate sense, and in the light of what we now know to be possible in farming. The supremacy and even the success of New England agriculture demands its capitalization, it requires energizing. Man must rise supreme over natural obstacles (which are not as great as supposed) and apply not his muscular but his intellectual fibre to wresting from the soil its full producing capacity. The statistics of every country and of the states of the Union show that the intelligence of the people is a measure of their crop returns. What has this fact to do with corn? This high farming requires at least one-half of our area under the plow and the application of twice to thrice the capital and labor now used. For this purpose corn will be a prominent crop in the new order. Corn is peculiarly adapted to high farming because of all the virtues named, and holds out an especial promise to the critically intelligent farmer because its great flexibility will yield great returns to his skill. The New England farmer has the time to farm for the greatest products because he tills less area. He can till with greater safety than his western brother, for in New England soils leach less and surface wash far less, as the results of tillage. But as pronounced a reason for more tillage as any that I am aware of, exists in the fact that tillage, as shown, is manuring. Excessive tillage is a destructive process in the West on account of the leaching and surface washing of its fine soils. The soils of northern New England are frost locked for nearly one-half of the year and so are not subject to the wastage from tillage that is met with in many sections of the world, where the seasons are short. In the coarseness of our soils is found an emphatic reason for more tillage. Our soils often analyze as rich as Western soils that will give, without artificial aid, far better crops. Our coarse granite whose hard face is set against nature's destructive agencies like flint, weather very slowly, while the finer and softer limestone soils of the West disintegrate much more rapidly. It is safe, nay more desirable, to keep these granite soils breathing or loosely thrown up to the air, in order to intensify the disintegration of the soil than those of the West. Looking into the first foot of each acre of the soil, we find from six to eight thousand pounds of potash, nearly as much nitrogen, and four to six thousand pounds of phosphoric acid. This immense amount of plant food it has to act upon. Yet so little of it is available in its natural condition that I, by the use of sixty-seven pounds of plant food nutrients have averaged to gain eighty-five bushels of increase of potatoes per acre over the amount that the soil would have grown without the chemicals. Let New England reflect on this mass of material in the soil, on the effect of tillage upon it. Let her remember that no civilized people of the world till so little as she does; that no other crop opens such a field for genius to develop; that unlike wheat its low price will not bear transportation so long a distance without consuming its value, and that in her smaller fields the corn fodder, which is worth as much as the corn grown upon it, can be all gained, while in the West this half is mainly wasted.

We may fairly do by corn what the English do by roots, charge part of the expense of production to the next crop because of its tillage effects. I firmly believe that a good rotation with greater amount of tillage judiciously introduced will result in the increase of our crops by fifty per cent.

COST OF CORN.

The reader mentally avers, as he reads the plea for corn, that he must farm by mathematics, an exact science; and that farming by faith up among the clouds of speculation will not answer to the condition of his exchequer. I ask the reader's attention while I make a balance sheet in advance of the supporting evidence. Be assured of my own faith in it and of a considerable experience with this crop in New Hampshire and in Missouri. You will pardon a New Englander for the assertion that New England farmers have fallen behind their boys and brothers in the West in many respects. Attention in the East has been distracted from the farm by other and greater movements. New England talent has not asserted itself on the farm as it has elsewhere in New England. At least such is the observation of the writer.

I propose the Western method in its application to corn growing in Maine. The horse is to take the place of the ox, the sulky plow of the walking plow, the checkrower of the old method, and cultivation as it is applied in the West whereby one man cares alone for forty acres of corn. I shall ask the Maine farmer to do one-half as much, only, although I believe he ought to do nearly as much as the westerner. I would not husk the corn. I shall content myself with the balance sheet now and leave the reader to pick out my reasons from the general after-discussion. I believe that the Maine farmer can defy any competition in his own market and that he can afford to grow corn for the direct profit, nay more, that he cannot afford the failure not to grow it.

Plowing, man and three horses one-half day....	$1 50
Harrowing	75
Planting, with two horse checkrower............	35
Cultivating both ways, three times each, man and pair horses	2 50
Cutting up and drawing to barn..........	6 00
Total cost per acre............................	$11 10
Chemicals or manure...........................	12 00
Total...	$23 10

CR.

By sixty bushels corn and cobs at 60 cents	$36 00
By two and seven-tenths tons fodder three-fourths value of Timothy, or $7.50 a ton	20 25
Total credit	$56 25

In estimating the yield I have assumed that rotation of crops is pursued—that farming has begun in earnest for profit and not simply for a living, and that the system has been carried on a few years, that is: that the crop is not the first one in a departure from the old system; I may add that I have used the sulky plow in New Hampshire.

I now turn to corn growing, to methods. It is high time that the approaches were passed over. I need not speak in detail of the soil for corn. A good loamy soil without a subsoil so compact as to hold water and so turn the roots and yellow the corn in its uncongenial areas. A fair amount of organic matter is desirable and it should be retentive enough of moisture to furnish the large amount that the broad corn leaves demand for evaporation under the hot summer's sun.

PLOWING AND FITTING THE SOIL.

There is no authoritative knowledge touching the proper depth of plowing. It must vary with the character of the soil and of the season. The latter we cannot foretell. I would not plow a sandy soil deep, as plowing sand deeply turns the organic matter, so deficient in sands, down too far and brings a poorer soil to the surface. Sandy soils are already open enough when turned over without extra trouble to let in the air, to still further reduce their organic matter, so valuable in holding moisture and in gaining plant-food from the air. Wet, sour subsoils should never be brought to the surface except it be in very small amounts. Experience is conclusive on this point. Subsoiling has been tried by the writer and specially investigated. In wet seasons on close subsoils, it reduces the yield of corn, while in dry seasons it increases the yield. The balance of many trials is about even. The labor is lost. Others have found the same fact. I plow six to seven inches deep on good loams and find no trials that warrant deeper plowing. Prof. Lazenby of the Indiana Experiment Station tried eight inches deep on a rather loose soil against four inches deep. For the three years tried the result favored the deeper plowing by 2.4 bushels, 1.1 bushels, and 0.1 bushels respectively. The leaving is in favor of eight inches against four inches, but as against six to seven inches we have no answer.

Corn is shallow rooted or not deep rooted, and in ordinary soils its roots will not fail to go down if they desire to, as deep as we can till, and deeper so far as compactness of soil is concerned. The frosts of New England lift and move the particles every year deeper than the plow can run. We must await trials for solid ground to stand on in this matter, as the question involves several factors.

I tried the narrow cut furrow last year against the broad furrow for corn. The soil was rather a heavy one. The former furrow gave one hundred and sixty pounds less of fodder per acre and also one hundred and thirty pounds less of corn. Further trials will be required. But it has this significance—the broad furrows cost less to make per acre. Again the narrow furrows (nine inches) did the best in the early part of the season, when it was quite wet, but later, when a drought came on, the result was reversed.

FALL OR SPRING PLOWING.

Facts are not abundant enough to solve the problem. Some assume that a fresh sod for corn is the true soil for it. I do not propose to reason upon a question where facts are needed and where I firmly believe only a long series of trials alone can give a satisfactory answer.

Spring plowed corn gave me one hundred and ten pounds more of corn and four hundred and fifty pounds more of fodder, per acre. This was the answer of two sets of plants, each set giving one answer. The relatively greater ratio of fodder is doubtless no accident in favor of spring plowing The soil was the fine soil of Missouri and liable to run together by the fall and spring rains. In this case, the fall, winter and spring were unusually favorable for fall plowing, so far as running together of the soil was involved. The tendency of thought among farmers now is rather adverse to fall plowing except as a matter of convenience. The running of the fine soil between the coarse particles by rains, surface washing and the blowing winds antagonize some of the well known benefits of fall plowing. Sands should not, in all probability, be plowed before they are needed for use. Their physical structure does not demand it.

The after cultivation of the soil is a matter equally in the dark with the proper time and manner of plowing. In a long trial with tillage implements, I found that each class had its own peculiar influence on fineness, porosity, depth of culture, &c., of the soil. I favor the class of harrows like the Albion and square toothed harrows or such as tend to compress the soil for use on light soils, while for heavy soils I would use harrows with a lifting and loosening action, like those that lift the dirt to the rear, such as the roller cutters and others having similar movements. We wish to let the air into these soils and thereby aid in their disintegration or decomposition. We have no fear that in New England this action will become too rapid or that close, compact soils will have their organic matter cut out too fast, so as to reduce its gas and water absorbing capacity too fast and too far.

I can illustrate this point and the need of more aeration of our New England soils by the fact that my father has observed, as I have, on the New Hampshire homestead, an upland clay loam, the effects of manure for twenty years. In Missouri, the clay loam farm tilled by me, far more rapidly in their longer seasons used up the applied manure. Incidentally I may remark that, so far as I can learn, no soils of the world finally give up a larger ratio of the manure applied to them than do our soils of northern New England. Furthermore it may be said that inasmuch as high agriculture, and in the future all profitable agriculture in this country, depends upon manuring, we are on the eve of the period when this economy of manures by the New England soils will place her in a far more favorable position with reference to the rest of the country.

The fact is (returning again to tillage) we do not know the A, B, C's of tillage. What does the plowing and surface harrowing of corn accomplish? The winter frosts pulverize the lumps, but if we plow at the wrong time we lump the soil again. Plowing turns the grass under, when it dies and leaves the supremacy of the plants we desire. But if it is not a grass soil, then what? It is said that we lighten and aerate the soil. This I have claimed to be desirable for our heavy soils. But the how and the when are other questions. Plowing is usually done in the cold season while the after tillage comes later when it is warmer. Many questions are involved that we do not as yet penetrate. I shall not discuss the points that rise up before me. The truth is we are ignorant, and very ignorant upon this topic.

Last year I planted corn on old ground without plowing it and received 2,650 lbs. of fodder, and 3,040 lbs. of corn, while the plowed ground by its side gave but 2,660 lbs. of fodder and 2,890 lbs. of corn. Throughout the drier portions of the West corn is listed. The lister consists of a plow with a double wing. Behind the wing on the same implement is a corn planter which drops corn. Scrapers attached draw the dirt over it and a roller smooths it down. This implement is used upon unplowed ground and puts the corn in rows at any distance apart that is desired. The practice is extending into the older parts of the West and is quite popular. The after cultivation between the rows is all of the plowing that the land gets. Trials have shown good results from the practice, although its place is not definitely known. It strikes us all as all wrong, yet it is growing in popularity. If successful we shall have to look deeper into our philosophy of corn tillage. Success with it means much, as it very greatly reduces the cost of corn growing. I have used it and it seems, would have had a decided success with me save for the fact that in getting my education with it, I paid the usual cost. The rows were run up hill and down. A heavy rain washed the corn out very materially after it was well up. The rows should have crossed the line of descent. On very wet and close soils the trenches would be likely to hold water.

I have less faith than formerly in tilling to allow the roots opportunity to push out. Most of the roots are in the the surface of the soil. The surface gets moved and loosened by frosts, while the decaying roots of previous plants keeps it light and loose. We only know that we should in northern climes, till for soil aeration and for weed destruction and at the right time. The rest we must learn and come to the problem divested of set views. My remarks apply to tillage before planting.

I should add that it is sheer folly to plow or to harrow when the soil is not in the right condition. I should literally prefer not to plow (unless for a sod) or harrow, than to do it when the soil is in bad order. The kaolin in clay loams is a sticky principle that when wet swells and holds the particles of soil together. Plowing such soils when moist glazes them, which when dried form up into lumps. This latter fact occurs through the shrinking and binding influence of the kaolin when dried. It binds in this condition like glue. Pulverization is then practically impossible. A clod a cubic inch in size has tens of thousands of soil particles in it. When the soil is neither wet nor dry this kaolin does not manifest the qualities mentioned, and the soil falls apart into its finer subdivisions. Sands do not give us the same trouble that clays do, for they are deficient in kaolin. By boiling a very rich clay, any one of the readers will find, after twenty-four hours of active boiling, and after the coarser particles have settled, a milk white fluid. The material that gives the color is the kaolin.

MANURING.

Under tillage we have concluded to plow for economy's sake a broad, quick furrow. This should be done when the soil is neither wet nor dry and in the spring, unless convenience determines the fall to be the better time. On a heavy soil we should use a harrow that lifts the soil much after the manner of a rolling cutter or the Acme harrow, although the latter runs shallow and draws hard for square inch of soil turned.

Rotations and right tillage will half feed the crop and give us a poor living. Big crops and fine profits come by getting the crops to consume a large ration, just as the best results from the steers are the product of liberal feeding. The good feeder finds yard manure the cheapest source of plant food, as yet. The cheapest manure obtained by him is that which he has saved from wastage as lost by the average practice. Hence I advise chemicals only after this source has been exhausted. Yard manure should be applied in the spring and harrowed well in. Several years of weighing trials by the writer resulted in as great a crop of corn where the manure was plowed under as when it was applied on top, but the stalks were more and the corn less: that is, manure applied on top gave the greatest yield in ears, but less of stalks—the total being about equal by either practice. This I found to be a law with other crops.

Shall we ferment it? Raw manure has done the best with me for the first crop. Where the application has been yearly to the same ground, the fermented manure has ultimately yielded the best. On the whole, in rotations for corn, for reasons that I will not elaborate, I should not ferment the manure. I believe it to be better to apply the manure in small quantities and in frequent years in preference to the reverse plan, so far as corn is involved, and in fact, as a rule.

CHEMICALS.

I am an unqualified friend of chemicals in the hands of a man who has mastered the art of buying and of using them, and as unqualifiedly opposed to the unstudied use of them, as happens in the majority of cases. By them we come into an unlimited control of plant food and can determine the size and acreage of crops that we will grow in a term of years. I find that their use with yard manure—halving the quantity of each that would be applied alone, and joining them to double the area that could otherwise be produced, results in not only a larger area but a larger crop per acre.

After further experience I am still of the opinion given years ago that Maine farmers should before the use of chemicals, test the soil by plat work and ascertain the needs of the farm for plant food. A former report of the Board of Agriculture, gives the details of the method proposed. In the absence of that definite knowledge of the needs of his farm that alone can lead to the most economic use of chemicals, I would advise the following chemicals to be used with twelve to fifteen loads of yard manure, or even ten to twelve loads if the manure is of fine quality. Muriate of potash 80–100 lbs. and dissolved bone black 200 lbs. This would not cost over $5.00 per acre. Nature and the yard manure will furnish the nitrogen as my own, Atwater's and others' trials have shown. If chemicals are used alone, 100 lbs. of nitrate of soda and twice the minerals named should be used.

Chemicals have been used on the old homestead in New Hampshire, an upland farm, for fourteen years experimentally. They have been used on one piece of run-out field for nine years consecutively with no other manure. The crops are on the increase, and the land is richer than it was at the beginning. I have used chemicals broadcast and in the drill in experimental inquiry and with little difference in the result. Chemicals are destined to play a great part in the renovation of New England, after a readjustment of rates and a more intelligent use of them is acquired. This presentation of so vital a question as the feeding of the corn crop will seem to many a very brief one. I wish it understood that a large mass of experimental data is at my command, and that I have given the best advice that I can sift out of it and gather from my own experience in the growth of corn on a commercial scale. It will also be understood that in my own farming, I expect to manure no less often than once in three years, and really oftener in the use of chemicals, they should be applied to nearly every crop. The increased fertility of the general use of chemicals, tillage, rotations, etc., soon gives more manure on the farm, when the manure question is resolved not into a question of inability to get it, but into one of its method of applying and the supplemental chemicals that should be used. This advice I alone gave. It is demonstrated that corn needs but a little nitrogen and that New England soils need for corn more potash than is used. Ashes will furnish it to corn. They are limited. Other forms of phosphoric acid may be used. The use of Charleston rock, fine ground, is a matter of local test, and hence I advised experimentation, etc.

CORN PLANTING—THE SEED.

The plant is the source of all animal life on the farm and its cost is the measure of the cost of the animal. The seed is the parent of the plant and its inherited capacity is one of the measure of the yield of the plant. Probably no other factor in plant growth costs so little to acquire as seeds of high productive powers, therefore good seed becomes one of the guages of the economy of plant growth. No other plant is so easily bred to a type and great unlimited powers so easily acquired in, as the corn crop.

Dr. Sturtevant has shown that two corn plants in the same hill, having seemingly equal chance, do not yield within one hundred per cent. of each other. Why? Gregory esteems good seed as of more consequence than manuring. I recall trials by others of corn, manured and unmanured, in the West that showed no gain for manuring, although the yield of the manured plats was but 58.4 bushels per acre. Cannot manure produce over fifty-eight bushels of corn per acre? Look at the recorded yields in this paper. Yet on the soil that gave but 58.4 bushels of corn without manure, manure did not raise the yield. It would seem that the soil was fertile enough to raise all the corn that the seed had a capacity to yield. What would be the use to feed a man with food enough to give another man, with equal amount of food, power to lift 300 pounds, expecting the first man to lift this weight, while he had the constitutional capacity to lift but 200 pounds? The power of development is limited in a seed as it is in an animal, and it is as useless to feed one beyond its capacity as it is the other.

The laws of seed breeding are analogous to those of animal breeding, and give analogous results. We can breed seed for quality or for quantity, and for any peculiar development of type with the same success that we can an animal. As the seed is the parent of all life on the farm, what folly to neglect seed breeding for animal breeding, when the former includes the latter or is the measure of the number and cost of the products of the latter. I shall omit further general discussion of this phase of the subject further than to say that corn can be modified in all of its qualities to the same extent that animals can.

The silk in corn is the female organ. No seed can grow at the base of each silk unless it be first fertilized by the pollen or yellow dust which falls from the tassel upon the silk connected with it. The tassel is the male organ of the plant. This is called botanically the stamens and the silk the pistil. If any one silk is pulled out, a kernel of corn will part at that point. If they are all covered up by a paper bag before the pollen is ripe and shed upon them they all fail to be fertilized, with the result that no corn appears on the ear. These organs of reproduction are so large and so placed that we can easily determine the character of the seed by applying the pollen of other sorts to the silk, removing the tassel of the plant to be treated.

Director Speer of the Iowa Agricultural College has been investigating the fertilization of corn. He says, that the tassels and the silk of the upper ear of the stalk are ripe for fertilization at about the same time; that the upper central spike sheds its pollen first and the laterals shed theirs last. Malloy who assisted Mr. Speer suggests that the pollen of the central spike is more vigorous than that of the laterals. This is not unlikely and p ossibly in trial plats or mere plats for seed that these laterals might be removed advantageously. Director Speer also says that in good weather the silk grows two inches daily; that the silk throws out little barbs which on their part exude a sticky liquid. This holds the pollen that is shed, save in wet weather when no pollen is shed nor liquid exuded from the barbs. He has counted twenty-five pollen grains thus caught at a time, although one would have been enough for fertilization. Nature is bounteous in her provisions to secure reproduction. The lower silks are fertilized first, and corn grows there first. He says, that the reason that corn does not fill out well on the end of the ear is due to a deficiency of plant food or to defective nutrition. In demonstration of this, it was found that the pulling out of the lower silks of an ear resulted in the filling out of the tip of the ear of corn. The upper ears on the stalk are the oldest and get the first nutrition. On the end of the husks of corn there is developed a blade or extended leaf. It is believed from some examinations that this has a material influence on the development of the ear. If this be so, those ears in which this development is large should be selected for growth. This can be but a suggestion.

BREEDING AND SELECTION OF CORN.

Believing that high productive powers are inherited, I recommend that the choicest seed be planted on a piece of ground set apart for seed alone, that the best possible attention may be bestowed upon it. This ground should be very fertile in order to produce a great crop. Seed thus grown would inherit, I believe, greater producing powers than seed from ground yielding only one-half as much. I hold that changing seed from good to poor ground gives a seed on poor ground that will yield more than that grown upon such ground. On the other hand seed changed from poor to good ground will yield less than seed grown on the rich ground. Its inherited vigor differs. On this seed producing area shall we remove suckers and barren stalks? Popularly it is supposed to be desirable.

The opinion is current that removing the suckers from the bearing corn will increase the yield of sound corn. By so doing shade is removed and the tax for subsistence of the barren corn on the soil is withdrawn. This turns this current of food from stalks to corn. Thus we reason. Dr. Sturtevant, Prof. Shelton and others have tried the experiment only to ascertain that no gain is secured while a loss of corn is liable to be involved. Possibly the bleeding of the injured part may have a bearing The reason is not so clear as the fact that no advantage is secured by the process.

But another question arises with reference to seed selection, suckers and barren plants. Barren plants develop pollen. Will not this pollen from the barren plants fertilize the productive plants? It seems so. A barren plant is not the plant to breed from. The characteristics of a plant are inherited. A plant that develops no ear nor silk is liable to impress its trait on the productive plants. For this reason an area for seed growth by itself, should be planted from which all barren plants and suckers should be removed in order to secure only productive plants.

CROSSING OF CORN.

Inbreeding impairs the vitality of most plants and invigorates none. Very few men approve of inbreeding cattle or domestic animals and none endorse it for the human family. Nature seems to desire dissimilarity and by a natural law in the vegetable as in the animal kingdom (the provision is more obscure in the animal kingdom than in the vegetable world) provides against close breeding. Darwin did a wonderful work in testing this law for us in the vegetable kingdom and aimed at results that appear conclusive for plants. In a large number of trials wherein he inbred plants by pollinating the female organ (the pistil) from the male organ (the stamens) of the same plant, he found that in no single case did the inbred plant produce more than the outcrossed plant (that is the plant having the pollen from another plant dusted over its pistil) while in most cases or nearly all of them the outbred plants produced much the larger crop. It is the plan of nature in plants to outcross.

Darwin found a climbing plant that was outcrossed grew 6 to 7 feet, as the average of six plants, while the inbred plants grew to but 5⅓ feet. The second generation of the above gave 121 seed capsules (pods) while the self-fertilized gave but 84. He found that *Minulus lecteus* grew 4½ feet when cross-bred, 3 feet when inbred. The most conclusive trial of his, containing a world of reflective material, was in the results of planting cross-bred and inbred plants under practically perfect conditions, in two boxes, where water and food abounded. One in this case did as well as the other. When the outbred and inbred plants were put into the same box and plenty did not abound for both, then the outcrossed plant shot right away from the inbred plant. It was truly the "survival of the fittest." Constitutional vigor resided in the outbred plant.

How is it with corn? The same law prevails. Prof. Beal found that outcrossed corn, as the average of two years of trial, gave as 131 is to 100 for inbred corn. I found the same result or as 252 is to 179 and for fodder as 490 is to 350. The facts have a deep significance to our farmers.

How shall we cross our corn? Plant every other row on the seed producing area which I have already advocated, of one sort of corn and the other row with another sort. Let these kinds be similar on the same principle that violent or wide crosses are not made in the animal kingdom. Just before the row that is to receive the pollen from the other sort is ready to ripen its pollen, go through with a corn knife and cut off the tassels. The result will be that this row will have to receive its fertilization from the other row. In this case, the corn will be a pure cross—a half bred sort, just as the cross of a Hereford with a Short Horn will give a product half Hereford and half Short Horn.

It is this outcrossed seed that will give the great crops for the next year. It will be noticed that I gained twelve bushels per acre by using crossbred seed. The operation is simple and almost costless and will pay one hundred-fold for the cost involved. This cross must be made every year, using new seed, the product of the outcross of two pure sorts.

SELECTING THE SEED.

The seed area should be planted to only the best, the very best, seed to be procured. How shall that seed be procured? There is but one best way and that way is to make the selection in the field where the growing plant can be looked in the face. The stalk is a part of the plant, and a vital part, and is a gauge of the type and powers of the whole plant—the measure of the producing capacity of an acre of plants. It is folly to expect the best results from corn selected in the barn for here only a mere factor of the plant is seen, while many interesting points are unobserved. We do not know of the diseases of the plant, of its vigor, its leaf development, its relative size, whether it stands up well, time of ripening and other factors.

Truth is best enforced by examples. I will give some facts that will illustrate important points involved. On taking charge of the Missouri college farm I found the southwestern practice of planting corn in use, namely: Planting it in checks four feet square, and only two stalks in the hill. This would give 5,445 plants per acre. In the above section 100 ears are regarded as a bushel of corn. This means that if every stalk lived and bore one ear of corn, that the yield would be 54.45 bushels per acre, and the limit of yield under the conditions named. This great distance of planting grows out of the rank character of the stalks or plants grown in that climate and upon that soil. On investigation I found that some plants run to vegetation, or to stalk and leaf, giving no greater and often not as great an ear of corn. I selected corn from stalks that averaged thirteen feet, and nine feet tall. This I did for three years, with one result. I will give one trial. Corn from short stalks yielded 2,118 pounds corn and the stover 2,450 pounds. The corn from tall stalks gave 1,710 pounds corn and 3,130 pounds of stover.

It is simple and straight heredity, nothing more, nothing less, and will always occur. A plant that runs to stalk will produce a plant that runs to stalk. The reader will understand that the above crops were derived from the seed selected as stated. By selecting from the right plants we may breed lower or shorter stalks and so place more plants per acre and receive more corn and less fodder. To do this our seed must be selected in the field. The seed should come from a stalk that stands up well and has a vigorous character and good leaf development, as the leaves take in one-half of the food of the plant, and elaborate all of the food of the plant. I would select twin ears. Prolificacy is hereditary as well as other traits. But twin ears mean good feeding of the soil. Without this, better not raise corn. For the purpose of seed I am now convinced that corn had better ripen on the stalk Investigations with other plants and the results of early selections and early cutting up of the whole plant by me, have convinced me that it is an error to take the seed of corn from the stock or to cut up the stalk before maturity. The seeds thus taken, I find, as do others with other seeds, germinate well but it is my observation that vitality is sacrificed. Under the process my corn suffered without my being able to ascribe it to other causes, for great care was taken with it. I understand the general result of Sturtevant's trials with immature seeds at the New York Experiment Station look the same way.

EARLY RIPENING.

Shall we select the seed earliest ripe? Logic and much experience says clearly, no. Our earliest ripening peas, beans and vegetables of all sorts are small and small yielders. This is true of corn. This is to be expected Gain of time is naturally at the expense of quantity. This being true it is a mistake to hunt out the ears that ripen before it is necessary to have them ripen. I would lay down this rule for Northern New England: Grow those larger sorts that fall within the necessary period to escape frosts.

Fortunately we are not wanting corroborating data. Prof. Lazenby of the Ohio Experiment Station, found that 26 varieties, ripening before September 12, gave 81 bushels per acre, while 18 varieties, ripening after this date gave 100.8 bushels. This is too great a gain to lightly ignore.

THE EAR.

I need not describe minutely the desirable points in the ear in its shape. They are generally known. It should be straight with straight rows. The cob should be as nearly uniform in diameter throughout its length as is consistent with other desired qualities The cob should not swell out large at the butt as it breaks hard in husking, neither should it be bred so small that it will break off from the weight of the ear in the field. It should tip out well at the end; a great failing in Western practice. The kernels should be deep, giving them something of a wedge shape, and should square out well against each other as far up to their outer edge as possible, as this gives more weight than low round kernels. The ear should be long up to the point that other qualities begin to be sacrificed. This will require skill and watchfulness. Length of ear may be at the expense of diameter. This gives rise to the question of the size of the cob. The increase of the size of the cob up to the point that the depth of the kernel begins to decrease, is desirable. Plenty of food in the soil will have something to do with this and with the other questions involved. I would push out the size of the cob so long as I could hold the other qualities, depth of kernel and fair length.

This naturally brings us to the number of rows on the cob, as it is connected with size of cob. Reason calls for the greatest number of rows, and art is required to keep those rows deep by selection. On this point Prof. Lazenby gives data from trials. Twenty-four varieties under fourteen rows gave eighty-six bushels per acre, while twenty varieties over fourteen rows gave 91.3 bushels. This is a fine profit, as a net gain for the mere cost of choice. Dents were mainly under trial.

On this general question of size of cob, number of rows, Prof. Lazenby made a great number of measurements one year. From his table I gather the following facts: The varieties, as a rule, with a small number of rows were largest in the ear. This was more particularly true of the Flint than of the Dent sorts. Those of the most rows, carried, as would be expected, the greatest number of kernels. Dents having sixteen to twenty rows carried twice the number than the Flints of eight rows did. The diameter of the cobs increased with the number of the rows, and likewise the diameter of the ear with the kernels on. The total weight of the kernels usually followed the diameter of the cobs.

There are discovered breed variations of interest that illustrate the value of close study of sorts. Thus, if two sorts have the same diameter of cob and a greater diameter of ear, then it has greater depth of kernel. If the ears remain of the same length then the choice is easy. The variation in the weight of the ears was greater than that of the cob.

This again speaks in favor of the many rowed sorts. It required 159 ears of the Flint sorts to make a bushel of corn; 90 of the 16 to 20 rowed Dents for a bushel. It took 102 of the 14 rowed sorts for a bushel, and 103 of the 12 to 14 rowed ears for a bushel. Of the miscellaneous sorts 95 ears were required of the 16 rowed kinds for a bushel, while of the 16 to 20 rowed varieties but 90 ears were necessary. Of the 16 to 18 rowed white sorts but 86 ears were taken, showing the white Dents to be very promising. These general facts will be of valuable service to those handling the Flint varieties, for, doubtless, one general law covers these varieties. I may say that the western farmer feeds his horses and much of his stock, not by weight or measurement, but by the count of ears. The facts given, and those before us for further consideration, will show a splendid field for the time and talent of the New England farmer with his small areas of corn (which should be doubled) to enter and to work up yields which will enable him to defy competition on the part of outsiders, whose cost of shipping to Maine is equal to the cost of manuring. The western fields are yielding less and less, while Maine farms are on the ascending scale. These facts statistics before us show.

POSITION OF SEED.

The position of the seed on the head, ear or in the pod, &c., has long been one of speculation and of investigation. Major Hallet of England made himself famous in his investigation of wheat. My recollection is that he was disappointed in not finding any marked difference in the results from seeds selected from various positions on the head—wheat being used. He did derive an advantage from selections in other directions and issued what he termed pedigree wheat.

The question of the place on the ear of the corn is an old controversy. Some have advanced the unique idea that the tip kernels should be used as they aid in securing a well tipped out ear and that failure to use such kernels results in barren tips. Each seed growing upon a given ear carries the same heredity as every other kernel and the only question that could arise would be one of vigor due to its advantageous or disadvantageous position with reference to nourishment. Mr. Speer found as stated that the butt seeds were first fertilized and grew first.

Dr Sturtevant called down criticisms upon himself by publishing results of actual trials showing that tip seed did as well as any other seeds of the ear. (How absurd to criticise a man who honestly relates the answer that nature gave him ; but such is the bigotry of man.)

Tip seeds and inbred seeds from the butts of corn are rejected by most if not by all farmers. Those of the butt are abnormal in shape and those of the tip small. Indeed in dry years and on poor soils the end of the cob does not carry seed which seems to justify Director Spear's assertion that lack of nourishment is the cause. Small seeds and illy nourished seeds are popularly supposed to be and in other directions have been shown to be less productive. This places the tip seeds of corn under suspicion.

Prof. Carter of the Pennsylvania college farm received 7.022 pounds for butt seed and 7.192 pounds for tip seed. The tip gave the best yield six times out of 13 trials.

Prof. Daniels of the Wisconsin college found no difference in the yields in his trials.

Prof. Roberts of Cornell University got for butt seed, 23 bushels, for middle seed, 23 bushels, and for tip seed, 31 bushels yield. In a second trial the butt seed gave 40 bushels and the tip seed 38 bushels.

The Massachusetts college farm received from butt seed 815 pounds, from middle seed 827 pounds, and for tip seed 800 pounds. Flint quotes a Massachusetts farmer, who, for seven years out of ten years, received more from the tip seed than from other parts of the plant.

Sturtevant's average for four years was for butt seed 56.6 bushels, for middle seed 57.6 bushels, and for tip seed 58.6 bushels. I received $122\frac{1}{2}$ pounds from tip seed, $96\frac{1}{2}$ pounds from middle seed and 126 pounds from butt seed.

These figures are very significant and about conclusive so far as corn is concerned. For three years the tip seed with Sturtevant gave 15 per cent of unsound corn and the central seed the same.

The tip seed by Sturtevant had rather the stronger germinating power.

The same authority has investigated the influence of color on seed vitality. It is well known that color of many vegetables influence flavor such as onions, apples, currants and raspberries. This influence extends into other fields probably. I had a variety of corn called Evans, of yellow and red sorts intermixed. The yellow corn had red cobs and the red corn had white cobs. The red ears gave the heaviest yield of corn. Dr. Sturtevant found that 14 varieties of seed of the darker sorts averaged to weigh 4.92 grains, while the lighter colored sorts weighed but 3.77 grains. Six kinds average to germinate at the rate of 80 per cent while the lighter sorts gave but 75.9 per cent of germination. Prof. Beal repeated Sturtevant's trials. He received less marked results yet a balance in favor of the darker seeds. I do not necessarily mean that darker colored seeds should be used, but that it seems to be true that of a given variety of corn, that those kernels or ears having the deepest hue have the greatest vitality. I suppose those that are specially vigorous individuals deepen a little in their natural color. But the field is a new or unsettled one.

PRESFRVATION OF SEED.

Corn is a seed that is very easily damaged. Whatever reduces its vitality reduces its yield through the reduction of the vigor of the first start of the plant. This is the same fact observed in young animals that have become once stinted in food. I had an illustration with some traced corn placed in an old empty barn. It was supposed to be a fine place. But through the cracks between the boards the fog drifted in at night to be followed by drying out the next day. A companion lot was placed in an empty room over the dining-room. This seed germinated better than the lot from the barn by fifteen per cent. In the field it germinated still relatively better, and in growth was stronger and more vigorous in every way. Incidentally I was taught that in testing seed corn in the spring, as all seed corn must be tested in good farming, that in the house in boxes where conditions are favorable seed corn of low vitality may start better than in the field where cold nights succeed warm days. We must have good vigorous germination in the house in order to secure satisfactory seed. Poor seed is also in the ground subject in its slow germination to insects and fungus growth, as good seed is not for it has no rallying powers.

Dr. Sturtevant's trials of kiln dried corn, and since his trials those of others, have gone the rounds of the press. He found kiln dried corn gave the best germination in the soil for two years. One of those years the germination in the house was alike, but in the field crib corn gave 20 per cent germination, instead of 94 per cent in the house, while the kiln dried corn gave 80 per cent. This shows that more vitality resided in one than the other, inasmuch as under similar and very favorable conditions germination was alike, but under unfavorable conditions the weaker went to "the wall" We desire to eliminate every element of chance that it is possible to eliminate in our business. Herein lies the hope of our farming.

Crib seed corn is out of the question. It is in a mass of corn subject to heating and to fluctuations of moisture. The trouble is not one of temperature but of moisture and warmth. Dry it well at the start where moisture is not variable and then place it in a dry place. This we can not afford to neglect for the cost of care in seed per acre may be five cents, while the loss may be five dollars. In drying it, it must not be massed. Each one will dry his seed corn according to his conveniences, but dry it he should and leave it in a dry room he must.

POSITION OF CORN ON THE STALK

It is a long time and favorite view that the position of an ear or of any seed growing along the line of the stem, has the value of its seed measured by or influenced in some particular by its position. Such, for illustration, as the first melon on the vine, the lower pods on pole beans, etc. The upper ear obtains, it is said, the lion's share of the food of a stalk of corn and it would seem should be the most vigorous seed corn Pickering of Rhode Island claims that he could breed the stalk down by selecting the lower ears. I have carried out for one year only, experiments in the general question involved, coupled with allied and more important points. I found that ears selected from low down on the stalk when grown against those selected high up reproduced their kind with wonderfully interesting certainty. Standing by the two plats and looking down the rows a difference unmistakable and marked was observed. This lowering of the stalk on the ear seems desirable in husking tall sorts, as in the West, and particularly in the South the ears are very high up. But more is involved. The upper ear seems more vigorous than one that grows low down for reasons that I do not understand in full. From the high up ears I received 4,560 pounds and from those lower down but 3,900 pounds per acre.

This matter was tested with twin ears, using the upper ear for the seed of one plat and the lower ear for the seed of another plat. The result was 4,760 pounds for the upper ear and 6,060 pounds for the lower ears. These figures do not necessarily conflict for the problems are distinct although they seem to have points of contact. The matter is of great importance. I do not regard my data as sufficient to rely upon for practice but enough to warrant each corn grower to look into the matter for himself.

I spoke favorably of twin ears in a previous part of this talk. The test was made against single ears with the result that the twin ears gave 5,410 pounds per acre, as the average of the high and low ears above selected, while the plat from single ears to the stalk gave 4,460 pounds. Such a great difference can scarcely be relied upon for the average year in practice. It is so marked as to make it probable that a law is involved of much moment.

Probably as interesting results as any received was from the selections from delicate stalks that bore average ears. These stalks were not strong and vigorous but rather under growth and not vigorous. From them was found good average ears (such stalks often bear fine ears as nature throws all of its forces into reproduction at the expense of the individual). From the seed of these poor plants a far less crop was derived, the exact amount of which I am unable to define through a loss of a small part of the data. But this trial was in keeping with another for the same season and field.

Corn was selected from ears that were quite defective especially in tipping out at the end. These yielded against good ears 2,325 lbs., the good ears giving 3,062 lbs. The difference was plainly noticeable when growing. The seed from defective ears gave corn that tipped out miserably and was far poorer. The husks run out picked and empty at the ends.

The inquiry was continued to other points of the development of the corn plant. All the results show corn to be marvelously flexible, as I asserted at the start and very responsive to good or ill treatment. Its characteristics are easily varied by selection, and therefore invite a far higher degree of skill in its management than has been devoted to it.

In concluding this matter of seed breeding I wish to say a word touching the influence of the first cross. Botanists have long discussed the oft repeated assertion that the influence of a cross or of the mixing of seeds of the gourd family, squashes and pumpkins as well as melons, etc., is observed the first year in the squash, etc. A long list of other plants are involved, including corn. The evidence sustains what reason avers, namely, that the influence of crosses of corn can be readily seen the first year.

The kernels of corn are the seed, while the flesh surrounding the seeds of squash is quite another thing. Corn will mix of course, as all agree with great readiness, and will show its results the first year, provided that the sorts ripen near enough in point of time together. This must be observed in crossing varieties for seed, that is near conjunction of the maturing time of the pollen of each sort. While corn does not naturally inbreed as found by inquiry, yet we wish to go further and not breed in together some of the same variety. Some have asserted that corn cannot self fertilize and Prof. Roberts at first thought he had proven this to be the fact. It is shown, and I think that Prof. Roberts has also since shown, that it is possible for corn to self fertilize. But it is known that a stalk of corn standing alone in the field where it has to self fertilize, does not produce as good an ear as where it has companions.

PLANTING CORN.

There is a conflict of opinion touching the point of the proper time to plant corn. Being a sub-tropical plant, it is stoutly maintained that corn should never be planted until after the ground is well warmed up in the late spring. The argument is emphasized by the asserted fact that corn roots nestle near the surface of the ground near the warm rays of the sun. To this argument has been added the result of German tests showing that corn will not germinate until the thermometer rises to 48°, while wheat and oats—northern clime crops—germinate at 42° to 44°. Corn will not grow at the low temperatures that wheat and oats will. Failure to take on quick growth is said to stunt it and to give the cellular development of the plant a slow pace that it will never fully overcome, from the fact that its type has become fixed. One danger of early planting is certain, aside from the well known danger of frost: that impaired or retarded growth at the start increases the length of time in which insects may injure the young sprout and possibly kill it, while the fungi plants obviously may overcome better the vitality of the young plant. But every debatable question presents two sides. When a young man, a neighbor strongly advocated to me the practice of quite early planting. He said the later planted corn, after the ground is well warmed up, will germinate quicker, grow more rapidly, and possibly seem to outstrip the early planted corn; but in the fall the early planted will have more ears or corn and less stalk. It is corn not stalk that we want, said he. I think that it is unquestionably true that later planted corn grows more rapidly and escapes more dangers than very early planted corn, and in stem and foliage carries more vigor if not a deeper green.

May it not be true that the check received by early planted corn is only a check to the vegetative functions? If so, may it not happen that, as in girdling a tree or in not pruning, the nutrition sets all the stronger to seed production—puts more of its force of the productive powers of the soil into seed and less into foliage? May it not be true that if such be the case that this influence compensates for the losses or risk of losses involved in early planting? On the credit side of early planting is to be set down the decreased risk from drouth and fall frosts. It seems that the early planted corn ripens first, although possibly not growing as rank. It is probable that the early planted corn is rooting strongly, although growth above ground is not rapid. Field tests alone can settle a question thus involving complex forces.

Prof. Lazenby of Ohio planted at three periods varying in time to meet the seasons of each year, hence the variation in time shown in the table covering his five years' trials. April 28 to May 6, yield, 51.5 bushels; May 5 to June 2, yield, 46.8 bushels; May 13 to June 9, yield, 50.3 bushels. Each period for five years average one week later than the previous period. One year was a very bad corn year. That year the yield of the last planting was lost and so gives it a more favorable showing. Again 1885 was a very favorable year and especially so for late planting. The yield stood at 62.4 for early, 55 for medium early, and 82.5 for late planting. This year taken out, and four out of the five years show a continuous gain for the earliest over the other plantings.

Prof. Latta of Indiana made the trial and got the most for May 21st, over May 11th, and May 1st. This year a frost in May cut down the first planting. The problem for the West looks like a very close one with the leanings to early planting. In Maine the problem would be varied, but I should judge only in its relation to early frost. I therefore in the absence of conclusive data, advocate as early planting as will be reasonably secure against frost.

I omitted to say that Prof. Lazenby received more fodder from the late planted corn. This indicates, or rather seems to, that those who plant for the silo should not hasten planting. I also should have said that Dr. Sturtevant finds that corn will germinate at 40° or possibly less. He also finds that when corn in germinating has been checked or even absolutely stopped in germination for several times it yet has vitality to start germination again. If checked germination in cold nights of spring does not result in insects killing the seed or in fungus attacks, it may renew growth readily so far as checked vegetation is involved.

DEPTH OF PLANTING.

Whichever way we turn in agriculture we find almost nothing settled in the popular mind. So we are in disputation as to depth of planting. Plant twice the depth of the largest diameter of the seed tersely say the horticulturists. But this rule must be modified. On the clay loam soils of New Hampshire, I was taught to cover the corn one-half to three-fourths of an inch deep. On the sandy soils, two inches became the custom. Prof. S. W. Johnson tells us that the Moqui Indians plant in the dry climate and dryer soil of Colorado eight inches deep. Many trials in depth of planting various seeds are now going forward and are generally showing that we may plant shallower than has been supposed with impunity.

The drainage, moisture and physical character of the soil and rainfall forbid a decisive answer. The depth must be adjusted to the necessities of the seed for water. This is a very variable factor. Less than an inch will do in a moist season on a retentive soil. Prof. Lazenby found for three years the following results:

Inches deep.	Yield corn.	Yield fodder.	Ohio results for five years, in corn.
1	63 3 bushels,	3,669 pounds,	57 7 bushels.
2	51.4 "	3,047 "	47.4 "
3	50 4 "	2,290 "	43. "
4	43.1 "	2,090 "	
5	42 9 "	2.331 "	
6	42 8 "		

The first three depths were for four years. At a later trial one-half inch was used and gave the best result.

Sturtevant for	¼	inch got	58	pounds,	7¼	ounces.
"	1	"	62	"	13	"
"	2	"	64	"	9	"
"	3	"	58	"	0	"

The Illinois Experiment Station by Profs. Morrow and Hunt

For 1	inch deep got	109.7	bushels	per acre.
2	inches deep got	88 4	bushels	per acre.
3	" "	100.8	"	"
4	" "	88 0	"	"
5	" "	73 1	"	"
6	" "	60 3	"	"

Last year on the clay soil and with moist spring and dry summer, I got the following results:

¾ inch deep,	25 pounds.		5 inches deep,	20	pounds.
1½ inches deep,	16½ pounds.		6 "	17	"
2 "	21½ "		7 "	18½	"
3 "	20 "		8 "	21¼	"
4 "	20 "				

The evidence leans to planting one inch or less on retentive soils. The New York soil used by Sturtevant was an open soil. Very shallow planting would subject it to too much fluctuation of temperature between day and night.

METHOD OF PLANTING.

Machine planting, exclaims everyone, is the true way. Machinery is the genius of our civilization. Metal supplants muscle and the mind has time for reading and cultivation. The motto is right, but its application needs to be very carefully considered.

Prof. Shelton of the Kansas College found that his machine, using corn that germinated 99 per cent and planted with usual accuracy, gave a stand of corn that was pronounced a fine stand by farmers, varied on count from 62 to 143 plants in rows 150 feet long, and the yield from 24.42 bushels per acre to 66.6 bushels per acre. The spaces varied between plants from 12 to 24 inches. Mechanism may not be wholly to blame for worms and fungi are open to charge of adding a destructive influence. But Prof. Shelton holds the machinery much at fault. Prof. Latta has received more direct testimony and most remarkable data in the course of the search for other data. Strangely he did not note the incidental truth brought out. The table will show it:

Distance Between Hills. Hand planted.	Machine planted.	Yield of hand planted.	Yield of machine planted.
12 inches.	12¼ inches.	68.8 bushels.	57.3 bushels.
16 "	16¼ "	57.1 "	47.2 "
14 "	13¾ "	59.9 "	56.7 "
Average,		61.9 "	53.7 "

Eight bushels of corn at sixty cents per bushel, will pay well for the extra cost of hand planting, which need not be over fifty cents above that of the corn planter. This alone in its gain over looser methods of the West would make a profit that would sustain corn growing in Maine. Probably greater attention to the machine will correct the major part of the trouble. Wherein does the trouble lie? Various reasons suggest themselves as involved, such as split or injured seed in passing the machine, clods that give irregularity to its motion, varying depths, failure to drop, &c., &c. It should receive more critical study or we must become conservative in the use of the planter.

DIRECTION OF ROWS AND DISTANCE OF PLANTS.

Some German trials with other plants indicate that the prejudice of our farmers touching the direction of the rows is not wholly without foundation. Kemer found that the maximum temperature of the soil follows the sun around to the south in its year's course. Beds running north and south are found more equitable in temperature. Wollney finds southern directions result in the largest formation of carbonic acid and the hottest temperatures; southeast being next best. In Italy the irrigating beds run north and south. Rows running south or southeast would favor best the sun's action, allowing it to slant its beams along the rows more. Southern slopes should be the best for corn.

Corn growers have long been in a state of uncertainty regarding the proper distance to plant corn and whether the drill or check row system should be used. The question is one of great importance to New England. In the West they use the check row system. By this method one man is enabled to take very good care of forty acres of ground and to keep it practically as clean, probably as clear of weeds as the eastern farmer does.

Does he sacrifice yield of corn by so doing? If he does it will bear hard against him in the long run, and will in the end force him to till less acres through the necessity of adopting drill planting and the hand hoe to a mild extent. The fact is that the West is now averaging from 26 to 30 bushels of corn only and selling it for from $6 to $9 an acre in ordinary years, a rate that affords only a miserable return. Corn now sells in Nebraska and Kansas for 12 cents a bushel and is being used as fuel. Against such a return I have not a particle of doubt that New England can make easy headway in corn growing when her farmers awake out of the sleep that they have fallen into.

On the other hand if check-rowing sacrifices nothing in yield then Maine wants to know it and to learn it quickly too. One man in Maine can till as many acres, approximately, as one man in Iowa, provided he uses the check-row system and Iowa tools. The problem is a vital one and I shall deal with as extended data as I have at hand.

Drill planting has been favored because it has been said that each plant gets more of sun, more even distribution of its roots in the ground—hilling radiating the roots from less centers and bunching them more. Cross-plowing, it is said, repeats the passage of the harrow over most of the area gone over and cuts the roots in ground already cultivated without any adequate compensation. On the other hand it may be said that plants standing together pollinate or fertilize better, as seen in the result of single plants by themselves. The sun will get full better access to the ground when the corn is planted in check-rows. The harrow does not pass over the ground twice as often in the check-row system and need not in fact go each way only one-half as often as it would if it went one way only. By this system more ground is touched and the weeds, which are thus crowded into a small square around the hill are fully subdued by throwing dirt up over them about the hill. The effect of this latter practice will have to be discussed under tillage. The factors are so complex that I at once turn from further discussion to the trials that bear on the point.

TRIALS AT CORNELL.

Rows 3 1-2 feet apart.	Yield first year.		Yield second year.	
1 stalk per foot,	54 bushels,	55 pounds.		
5 stalks per hill,	56 "	60 "	40 bushels.	
4 " "	68 "	60 "	38 "	41 pounds.
3 " "	61 "	15 "	37 "	30 "
2 " "	45 "		31 "	50 "

One stalk per foot gave three and one-half feet for each plant; five stalks per hill 2.45 feet per plant and four stalks per hill 3.05 feet per stalk. The drill system was used at a loss in this trial where only one plant stands alone, while it is shown that the best result is secured by 2.45 to 3.05 square feet per plant, as all wider distances gave less yield.

Prof. Latta of Indiana gives the average of three years of trials with machine planted corn. The machine was set to drop one kernel, but dropped two occasionally and 3.88 feet between rows.

Hills	$10\frac{3}{4}$ inches apart,	yield	56.9 bushels.
"	$12\frac{1}{8}$ "	"	57.3 "
"	$13\frac{3}{4}$ "	"	56.7 "
"	$16\frac{1}{4}$ "	"	52.1 "
"	$19\frac{1}{2}$ "	"	50.1 "

Twelve inches gave the best yield, or one plant occupied 3.90 square feet each.

Hand planted plats gave for

	For 1888.	Average of three years.
Two kernels every 24 inches,	64.1,	
One kernel " 12 "	65.8,	62.8
" " " 14 "	60.9,	59.9
" " " 16 "	59.2,	57.1
" " " 18 "	53.0,	
Two kernels " 24 "	65.8,	
Three " " 33 "	55.0,	
" " " 36 "	61.5,	65.8
" " " 39 "	61.0,	
" " " 42 "	54.9,	
Two " " 24 "	62.9,	

One kernel alone, but for only one plat did very slightly the best. Plants further part than twelve inches per plant gave a reduced yield in all of the series. The rows were $3\frac{3}{8}$ feet wide hence each plat occupied $3\frac{3}{8}$ feet.

Latta had another series.

	Yield for 1888.	Average of three years.
Two kernels every 24 inches,	62.4	
" " " 20 "	66.3	62.4
" " " 22 "	66.5	
" " " 26 "	65.6	
" " " 28 "	65.7	65.1
" " " 24 "	70.2	
" " " 30 "	61.4	
" " " 32 "	63.7	59
" " " 34 "	63.3	
" " " 36 "	60.3	
" " " 24 "	75.1	

The plats grow richer in this lot as we go down the list, as seen by the duplicate 24 inches plats. I assume that a plant every 11 inches does best, or 2 plants to every 22 inches.

In the previous plat the two kernel series did better than the three kernel series for square foot of space occupied. In this trial the plant occupied 3.4 feet that did the best.

The Illinois Station received the following results:

Kernels per hill.	Inches between hills.	Bushels shelled corn, per acre.	Pounds stover per acre.
1	3	73.0	13,584
1	6	88.5	10,368
1	9	84.4	9,720
1	12	81.7	10,176
1	15	71 9	9,960
1	24	56.4	8,760
2	6	87.4	11,976
2	12	87.3	10,080
2	18	76.0	8,424
2	24	79.5	8,712
2	30	61.7	8,520
2	48	50.3	7,032
3	9	81.7	9,984
3	18	75.2	7,896
3	27	75.6	7,728
3	36	76.0	8,208
3	45	57.9	7,008
4	12	76.5	11,036
4	24	81.3	9,768
4	36	81.7	9,480
4	48	70.4	7,488
5	15	76.0	12,336
5	30	85.5	8,736
5	45	66.8	8,832

One stalk to every six inches or the rows being $3\frac{2}{3}$ feet apart, a stalk every 1.83 feet gives the greatest yield. Fodder considered, a stalk every six inches does best. The more the number of plants the more the ratio of stover. The one stalk series consistently throughout, does the best.

The same year this station tried drill against hill planting. It has some misfortunes. The results were almost identical. In the first trial related by the Illinois Station the great yield from the close planting was of poorer corn and required the husking of more ears. Had there been a test for moisture it is not improbable that two or three other yields, where cultivating both ways could have been carried forward would have given practically the same yield and at decidedly less cost. Recent trials with ensilage is showing that the greater yield from close planting is of more water or mostly water. Stalks every 36 inches or five every 30 inches probably produced as much net value as one every six inches.

Prof. Shelton of Kansas in 1885 planted some corn a little over twice as thick as the common practice there and got an increase of fifteen bushels of corn and one-half ton of fodder. In a subsequent trial he found that one seed to every 14 to 16 inches as gauged by the planter gave the best yield. But these figures are the incidental result of another inquiry.

The Minnesota Station by Prof. Hays tried 4 plants to the hill and the same number in drills. The drilled corn gave 4 bushels most in yield. The rows were $3\frac{1}{4}$ feet square. Where 5 kernels were put in the hill the yield was the greatest.

I made a trial on a moderate plan in Missouri but worms and irregularity of corn planter disturbed it.

Distance.	Plants per hill intended.	Actual plants per acre.	Yield.
4x4	4	9890	31.1 Bushels.
4x2	4	14290	41.7 "
4x3	3	12545	41.5 "
4x2	2	8612	30.2 "

One plant to every 3 square feet did the best although one to every 3.45 did about as well.

The Pennsylvania Experiment Station also made the trial. I have not the original trial with me. The data were applied for but have not reached me.

The New York Geneva Station under Dr. Sturtevant investigated the question. In 1882, one plant per foot in drills 44 inches apart gave 53.1 bushels yield.

			No. of seed used.
In hills,	1x1 feet,	16.8 bushels,	43,560
"	2x2 "	18.6 "	43,560
"	3x3 "	61.5 "	19,360
"	4x4 "	38.4 "	10,890
"	5x5 "	21.9 "	6,969

The best yield here was with plants 2.25 feet space each, and in checks 3x3 feet.

In 1885 hills $3\frac{1}{2}$x$3\frac{2}{3}$ feet.

1 plant to hill gave	47 bushels.
2 plants "	60.9 "
3 " "	64.2 "
4 " "	73.7 "
5 " "	75.2 "
1 plant "	35.5 "

Here 2.74 square feet to a plant are best.

In 1884 it stood as follows:

Rows $3\frac{1}{2}$x$3\frac{2}{3}$	1 plant to hill	45.4 bushels.
	2 plants "	48.4 "
	3 "	60.7 "
	4 "	59.4 "

This time 3 to 4 feet are required. Dividing the figures we get 3 feet to a plant as the average of the above three trials.

In 1888 the hill and drill system was tried and slightly favored the hill system, so the report informs us, but does not give the figures.

The Ohio Experiment Station has made the fullest trials covering several years and therefore entitled to most weight. The following table is for four years. The rows were $3\frac{1}{2}$ feet apart.

Inches apart in row.	Plants in hill.	Yield in bushels.	Yield of stalks.	Per cent sound ears.
12	1	70.8	4,178	50.7
12	2	66.9	5,016	31
15	1	61.1	4,398	56.5
15	2	75.0	5,201	
18	1	65.4	3,490	70.5
18	2	65.7	5,118	34.4
18	3	59.8	4,907	27.8
21	1	60.9	3,657	76.0
21	2	61.1	4,083	
24	1	55.3	3,026	80.8
24	2	72.7	3,801	55.8
24	3	52.0	4,328	25.0
30	2	59.6	3,639	52.0
30	3	53.1	3,980	26.9

The best yield of corn and stalks comes from two in a hill and averaging one to every 7½ inches or to every 2 17 feet. This is thick, very thick.

For the fifth year which will not average with the above as the distances were dissimilar, Ohio again had the best yield from two stalks in the hill and about as good with three as with two. The distance was two kernels to every 36 inches although three kernels every 36 inches did nearly as well. Seasons vary the result. The trial was a most elaborate one. In this as in all other trials the stalks weighed most in close planting. Whether they would give more dry matter per acre we do not know, as near the close of this article it will be seen that the closer the plants the more the water in the fodder. As in all these trials of distance for yield of grain no test of water of fodder was made. I leave out the discussion of the fodder in this place.

Prof Cook of Vermont made a rough trial with the corn planter, which causes some uncertainty. I assume the distance of his rows to have been three and one-half feet.

Five kernels, 36 inches in row, 390 pounds; 3 kernels, 24 inches in row, 343 pounds; 2 kernels, twelve inches in row, 303 pounds; 1 kernel, 12 inches in row, 224 pounds.

The hill system did better than the drill system, and one kernel every 7 1-5 inches in row on average, gave the greatest result, or one plant to 2.1 feet. The fodder was less than when the plants were every 6 inches, but probably a little better.

Prof. S. W. Johnson of Connecticut Station planted 8, 4, 2, 1, ½, ¼ plant to every foot in the row, the rows being four feet apart. The yields in the order above will be seen in the table below, which gives the space occupied by each sort:

	Sq're feet to each plant.	Total yield.	Yield dry matter.	Per cent of water in plant.	Per cent of crop kernels.
8 stalks per foot	½	471.6	248.9	47.2	25.9
4 stalks per foot	1	521.0	291.7	44.0	51.6
2 stalks per foot	2	555.8	293.3	47.2	56.8
1 stalk per foot	4	609.0	344.9	43.3	47.8
½ stalk per foot	8	524.6	263.2	49.8	55.2
¼ stalk per foot	16	426.6	206.4	51.6	45.9

The largest yield was for a plant every four square feet, or one to each foot of the row and had the least water in the plant. Strangely in this case, the thinnest planting gave the most water, nor did the thin planting give the largest ratio of corn to the whole plant. The rows were too wide for Flint corn for best results. These facts agree with the Ohio results in showing that there may be a considerable variation of the number of plants per acre without varying very heavily or materially the ratio of corn to stalk. It does vary the ratio of sound corn.

Summing up the average of all of the trials reported and using the Ohio trials by single years, it is found that 2.9 square feet of land produce the most corn. For total weight of corn and stalks something less than this would be required. At the above rate 15,022 plants (more than stands on the average acre) would be required per acre. If rows three and a half feet apart are used then a plant every ten inches will be required, or at four feet between rows, one every 8 7 inches. This is about as thick as it is now advised to grow ensilage. It is highly probable that the Flint sorts may be planted a little closer in Northern New England, or five plants in a hill where 3½ x 3½ checks are used. This is closer than usual or closer than average. As less than this amount involves a loss in yield it will be seen that the point merits attention.

Touching the question of hilling versus drilling, it stands about a draw. When the Ohio trials of five years have been allowed their full weight, check-rowing or planting corn in hills proves the best. In any event they fail utterly to show that hilling is not as efficacious as drilling. They seem to show that moderate nearness of the hills is desirable and that 2 to 3 stalks per hill is better than more. This being assumed to be the case, if we acquire this rate, it will require check-rows to be 23 inches square for two plants to the hill, and for 3 plants 3 feet square or a bit less for Northern New England. I should adopt the latter system in Northern New England making the checks a bit less than 3 feet square, cultivating them both ways, and hoeing more, as will be seen under following headings. The method of square checks instead of wide rows is new as a means of increasing plants per acre. It is better than wide rows I believe, and massing many plants in a row. The reason is obvious.

TILLAGE OF CORN.

This question is one of great importance when considered by itself; but it takes on more importance when connected with the former question in its relation to check-rowing, cross cultivation and hilling to kill the weeds that the cultivator cannot reach. Behind it all still lies the unanswered and vital question, Can the cheap western system of handling corn take root in New England?

Why do we till corn? The pivotal purposes are the regulation and the conservation of moisture, the destruction of weeds, and where the soils bake in drying and form a hard crust, the prevention of this baneful process which shuts out in a measure, air circulation and disturbs the proper movement of water in the soil. A good corn crop should be worth fifty dollars per acre. No tillage should take place that is injurious to this crop, hence we do not till growing crops for manuring or for soil disintegration. Such tillage now becomes an incident of the growing crop and is not to be taken into consideration to any material degree. All will understand that tillage is necessary to keep a crust from forming and that tillage for this purpose need only be shallow if applied as it should be before the crust actually forms in order to prevent its formation. As scarcely two opinions can exist on this point and as the agreement is general that its formation is deleterious, I will not consider any further this reason for cultivation.

Secondly, we till to keep down the weeds. If there is any other way that they can be kept down we need not till to restrain them. It would be well if we could avoid this reason for tillage, as then we need till only for the relation to tillage on soil moisture or root pruning, or for the direct value of tillage. Sturtevant and Lazenby have both investigated the relation of the weeds to the question. Sturtevant, Lazenby and myself have found it desirable to get rid of the weeds. I will not go over the evidence. The fact is that the direct influence of the nutrients on soil fertility robbed from the corn by weeds is less than is generally supposed. The amount of dried weeds and of fertility found in them per acre is very small. Dr. Sturtevant, in a learned article, ascribes the chief damage from weeds to the evaporation of water by their leaves. This has importance from the fact that corn needs an excessive amount of water, and suffers more from this need in dry years than from any other cause. The horse cultivator is at present the cheapest method of destroying weeds. If, in the future, it is found that weeds are in the way and need to be eradicated when cultivation would injure the corn more than is gained by cultivation to kill weeds over other methods of eradicating them, it will follow that cultivation will be abridged for this purpose. The question will arise in this article whether cross tillage and ridging does not kill weeds by a pernicious system of tillage. If so, it will have to go out of use. If not, then we will all drop the hoe forever in New England agriculture and kill weeds by check-row ridging, as it has been found that the check-row system is not as yet shown to reduce the yield of corn over the drill system.

Shall we till to root prune? For a while it was strongly urged that the cutting of the roots of corn by the cultivator had the same effect on the corn that cutting the roots of trees, which tended too much to foliage, had on setting their fruit. A treatise, virtually, was written in advocacy of root pruning of corn. Corn is a quick, rank growing annual. I will not go over the philosophical side of the question, since trials by Dr. Sturtevant and Profs. Morrow, Hunt, Hays and others, have all and I believe invariably, found that root pruning cut down the yield of corn by amounts ranging from 2 to 5 bushels per acre. I regard the evidence as satisfactorily conclusive on this point. We then, do not want to till to root prune. I should say before leaving this subject that root pruning was done by running a knife down into the soil some three inches and upwards at about the distance from the plant that the cultivator runs.

RELATION OF TILLAGE OF CORN TO SOIL MOISTURE.

While tillage may have some effect on aeration of the soil and on soil decomposition, the cost of this form of tillage so far will out weigh the benefits derived, that I shall not be far wrong in assuming that the main function and benefit of tillage grows out of its saving of soil moisture. It will, of course, be remembered that I agree that it may break up forming crusts on some clay soils and kill weeds, still the main gain is in saving soil moisture in dry years. In wet years the destruction of weeds may be its best good.

The old notion that tillage gained moisture for the soil by opening its pores to freer a r circulation and then condensation of moisture within its pores from the air, is now fully and finally exploded. More air does enter the soil by stirring and thus loosening it. But this air is dryer than the soil usually, and is also cooler than the soil. This being the case it warms up to the temperature of the soil. As it warms up it expands in volume. As it expands in volume it takes on more moisture, as demonstration shows, and actually leaves the soil with more water than it brought with it.

But says some one, at night the soil is the coolest and then we gain dew. Profs. Stockbridge, Alvord and the writer have shown that the soil is warmer at night than the air, while the first and last have shown that the soil loses moisture at night, as theory would demand. For three years, under various systems, I found that soils lost moisture at night and this is at least a part of the source of dew. For months I found that earth surrounded by water tight coverings, save at the top weighed less in the morning than at night. Any one of a half dozen methods of testing the question gave the same answer. An occasional night when the atmospheric conditions were peculiar there would be a gain in weight. The month's average was a decided loss. See Bulletin 23 of the Missouri Agricultural College, where a loss of dew at night is recorded.

Tillage has little to gain from this source even if it were true that the soil condensed moisture from the air, as a cubic foot of air weighs only an ounce, of which less than one per cent is water. It would take 100 cubic feet of air to give one ounce of water. How much would a soil get in a day provided it got it all, as it cannot, but a mere fraction of it instead?

Tillage decreases the water in the area actually tilled by admitting air more freely to cut it out. This every one knows who dries hay by loosening it, or who has observed the stirred soil of the roads much traveled, or who has dug soil a foot deep and stirred that foot daily, or who harrows his garden early and deep in the spring to dry it out. I have stirred a soil three inches deep every day for thirty days and found that it had 25 per cent less water in it than soil by its side that had not been stirred, that is, this three inches was dryer than three inches of surface soil by its side.

Tillage saves moisture to the soil below the point stirred by throwing a mulch over the sections below this point. It is equivalent to a mulch above ground. A mulch of straw has increased the soil moisture, or saved from evaporation over 100,000 pounds per acre with me, by actual test, for potatoes and corn. Water moves up through the soil for evaporation by a law called capillary action. In this movement it forms for itself lines of movement freest from obstruction. Tillage readjusts the particles of soil and throws them over the line of ascent of water, just as an above ground mulch does. In the lot that I tilled for thirty days, and found the surface drier for it in the first three inches than where it was not tilled, I found that the next three inches below this had 11.71 per cent moisture, while the second three inches of the unhoed ground had 9.63 per cent, or about 100,000 pounds less per acre. What a gain by mere prevention of escape into the air, the difference between a good crop and a poor one. An inch of rain is but about 200,000 pounds of water, while there are millons of pounds in the soil to be held there if we can do so. Nessler, Stochbridge, Atwater, the writer, and Dr. Sturtevant have shown by accurate tests that tillage holds the water in the soil. Let us regard the point as one of the demonstrated problems in agriculture and pass it by without arraying the long line of data in proof.

DEPTH OF TILLAGE.

If tillage saves moisture, how deep shall it be for the best effect, and what is its relation to root cutting? It is a mixed and puzzling question. First, all trials show—Nessler's included—that soil to quite a depth is made drier by tillage. Second, that deep tillage holds the water better, or seems to do so. Third, it is shown that corn roots love to grow comparatively near the surface. Fourth, if we till deep, we cut them and force them to go lower. Fifth, it has been shown that root pruning cuts down the yield, therefore we do not want to go deep with the cultivator for this last reason. Again we till to save the most water. The point is at what depth is the gain of water by deep tillage overcome by the loss in cutting roots and by the dried surface tilled in which corn roots desire in part to grow. It must vary with soil and season. No mortal man can answer this question from pure reasoning. I turn to trials.

First, does tillage actually increase the crop? Sturtevant one year got, when conditions were favorable, on some plats actually more corn on untilled than on tilled sections. But whether the weeds are pulled or not, his years of trial, as a whole, mine and Lazenby's show non-tillage to be markedly disastrous in a series of years. One year, Lazenby received no corn on an untilled section; and but ten bushels as the average of five years. Tillage pays, then.

As tillage pays by holding the moisture, the question arises, will tillage, which injuriously cuts roots, pay if we can save the water without the tillage and its consequent root cutting. Two years, I tried a 6-inch mulch of straw. This kept the weeds down and the moisture in the soil, as repeated tests showed. But it kept the temperature of the soil down and set back the ripening of the corn and the yield. This I abandoned. Last year, I used a mulch of sand ¼ inch deep, reasoning that this would cover the capillary spaces of the soil. This small mulch checked evaporation heavily. The yield was 147 pounds where common cultivation gave 123 pounds. A quarter inch mulch of dirt gave 135 pounds, and cultivation 141 pounds. A mulch of ½ inch of wheat chaff gave 127 pounds, and cultivation 118 pounds. The scuffle hoe, which merely skimmed the surface and cut the weeds—moving the top particles of soil only—gave 172 pounds, 138 and 118 respectively.

The yield of each system in totals was for mulch, 409 pounds, cultivation, 382 pounds and scuffle hoe 428 pounds, or per acre 51.1 bushels, 47.7 bushels and 53.5 bushels. Cultivation was not an essential here. I know of no other trials from this point of view and believe they have matter worthy of consideration. Cutting roots at all is probably a bad practice and to be avoided if possible. If we must give water to the soil by tillage shall it be shallow or deep? The roots of corn are relatively shallow rooted. Profs. Morrow and Hunt in washing out roots of corn found some roots within ¾ of an inch of the surface. When the plant is 6 to 8 inches high some of the roots may be 2 feet long and quite a fraction of them 18 inches long. The bulk of these roots, after passing 6 to 8 inches from the plant, begin to go downwards in the soil and at the middle of the row are mainly found below 2½ inches deep Some few of the roots still remain near the surface at the center of the row. I found the same state of facts in digging up corn roots of young plants. Prof. Hays in a dry year on a dry soil found that after passing out horizontally for a short distance, or from 6 inches to a foot, the roots turned downwards and the bulk of them below ordinary cultivation. These trials and others that have come to my attention show that corn roots are not so exclusively found in the near surface as has been heretofore supposed. This fact only makes deep cultivation less destructive than heretofore supposed for Prof. Hays found a destruction of roots in tillage. Moreover, the richest soil, when manuring is surface manuring, is near the surface. It has been demonstrated again and again by putting manure in given spots that roots develop most, as reason affirms that they will, in the richest spots. We may expect many roots to develop near the surface, and to this end they should be encouraged in order to have all parts of the soil fed.

Our conclusions or demonstrations up to this point are that root pruning is a positive injury; that many roots grow near the surface; that some of the roots are cut; that from my trial it is probable that if we could save the water without cultivation it would be better. Until my trials are verified and made of practical application we must till. Trial has shown less roots near the surface than supposed and that deep tillage saves more water. Again I ask, at what depth does the cutting of roots overbalance the water saved? What is deep tillage? My trials with the Acme harrow weighted and set for deep tillage showed that its average depth of culture was but 1.65 inches; the Randall 2.54 inches; spring toothed harrow 1.79 inches; smoothing harrow 1.08 inches. The shallow toothed cultivators for corn did not average two inches deep. I did not try the deep running corn cultivators, as the trial was fitting corn for planting. This I know, that our implements do not run as deep as they are popularly supposed to. This bears on the question, for practically the bulk of the corn roots are a little lower than we supposed and our cultivators run a little shallower than supposed.

None of the investigators to be quoted have measured the depth of cultivation and so I can only use the terms shallow and deep. The former term will represent implements that run from $1\frac{1}{4}$ inches to 2 inches as extremes. The latter represents the use of the deep running cultivators of the West, made of pointed steel with a forward slant, which are supposed to run some three inches deep, but no one knows how deep. The small one horse plow is used, going twice in the row and runs 3 to 4 inches deep.

A trial in Minnesota gave nearly two bushels in favor of surface tillage. Illinois trials found nine bushels gain for shallow cultivation and five bushels gain for cutting the weeds with a sharp hoe over deep cultivation. There were indications that too much cultivation was an injury. The average of Ohio for four years was 46.6 bushels for shallow tillage, and 46.9 for deeper tillage. This is a draw. Some years one method was best and some years the other. Again in this case the deep cultivation was really shallow cultivation, being done with the Planet, Jr., cultivator, which simply went deeper than the other and very shallow culture. It shows that very shallow work will do in Ohio. A southern trial favored shallow tillage. Prof. Latta of Indiana got 50.84 bushels for shallow and

48.3 for deep tillage. A later trial gave one bushel more for four-inch tillage than for two-inch tillage, but less for six-inch tillage. Prof. Roberts got 52.55 bushels for shallow and 44.15 bushels for deep tillage. I made duplicate trials last year and got for tillage of one and one-half to two inches deep, or standard tillage, 73.6 bushels; for shallow tillage, 80.1 bushels; for deep tillage, 65 9. Plowing out 72.8 bushels.

In order to make the depth of cultivation more accurate, I had 4 sections of ground hoed 1, 2, 3, 4 inches deep respectively, while a fifth plat was cultivated 1½ to 2 inches deep. Some three hoeings were made. Unfortunately the ground grew richer, apparently, from the shallow to the deep tillage:

Hoeing one inch deep gave	84.8 bushels.
" two inches "	60. "
" three " "	83.7 "
" four " "	85.4 "
Cultivating 1½ to 2 inches	92.3 "

This shows that deep cultivation is not a destructive operation in its broad sense but one of loss, as the first two and last two pairs show, for the first and last are shallow and average better than the others, and are larger in yield than the plats adjoining them.

Later it will be seen that the scuffle hoe and shallow tillage also gave grand results. The season was wet at the start and dry at the close. While I have a dim recollection of a trial out of hand favoring deep tillage, the preponderance is very solidly one way, and we shall do well to heed the scales. Season, soil and other points have their modifying influences. But they are so complex that I will not enter upon a discussion of them. All of our wits must be bent to saving the water without cutting the roots of plants. Acting upon the suggestions of my trial it is not improbable that means will be found to reduce tillage and yet save more water than now.

AMOUNT OF TILLAGE.

If tillage restrains moisture from evaporation, shall it not be frequent? Reason has heretofore said yes, forgetting that the certain good may be overbalanced by the accompanying ill of root cutting so frequently as to at last seriously check the plant. This check would be serious were it not for the fact that the roots, later in the season of their growth and tillage, tend downwards in the soil. Facts only can determine on which side the balance is. An untilled plat with me last year gave 82 bushels of corn. The weeds were cut off once by the hoe, just at the top of the ground, so as not to involve tillage.

Cultivated	5 times	gave 75	bushels.
"	4 "	80½	"
"	3 "	68	"
"	2 "	80.7	"
"	1 time	77	"

Lazenby for an average of 3 years got for ordinary cultivation of 4 to 5 times, 52.8 bushels and for frequent tillage or 8 or 9 times, 50.1 bushels.

In 1887,	2	cultivations	gave	16.39	bushels.
"	3	"	"	16.47	"
"	4	"	"	18.84	"
"	5	"	"	21.65	"
"	8	"	"	16.58	"
"	9	"	"	18.19	"
At Indiana,	5	"	"	40.4	"
" "	7	"	"	40.4	"
" "	9	"	"	38 5	"
" Cornell,	7	"	"	54.6	"
" "	5	"	"	52.35	"

The average of Illinois trials was 89.5 bushels for frequent, and 84.4 bushels for ordinary tillage. The Kansas trials under Prof. Shelton, stood as 62.84 for ordinary cultivation and 58.17 for frequent cultivation.

The leanings are against more than 4 or 5 cultivations. It is evident when expense is considered that frequent tillage is unprofitable. Several trials that I have not reviewed, show as did mine that no tillage occasionally gives fine results—but the average is against the practice, heavily so, where the weeds are not removed and against it where they are removed unless some process is entered upon to save the water. The old adages and illustrations of the value of excessive tillage must fall to the ground.

TIME OF TILLAGE.

Perhaps no trials show more unique results than the following made at Ohio by Lazenby on time of cultivation:

Three	cultivations	two	days apart	31.3	bushels.
"	"	four	"	45.2	"
"	"	eight	"	51.2	"
"	"	twelve	"	55.3	"

These are the average of three years' trials. All of the preceding data go to show deep and frequent tillage are undesirable.

CHECK-ROWING AND RIDGING CORN.

No part of the inquiry is so important to us in its economic bearing as that involved in the above heading. To this final phase of tillage in my inquiry I have been drifting from the start of the tillage discussion. How valuable to us, if we can cross-till and ridge without loss.

Reason says we had better cross till twice each way than four times one way, as more ground is tilled and more weeds killed. True a little strip has its roots uncut when we till but one way. Yet the others get a rest in a corresponding section the other way when we till in the opposite direction. My trials are the only ones that I now have at command, indeed, if any others have been made. Cross-tilled gave 72 bushels, and tilled one way gave 69 bushels. The scuffle hoe gave 80 bushels. Here again, very shallow tillage does admirably. Cross tillage in the check-row plan does hopefully. Now can we ridge without loss of corn and so gather the weeds out without the hoe? How we hope so! But logic says the trough made by ridging lets the sun in to remove the water direct from a lower area and also forms ridges that will dry through and dry up quickly. They are likely to call the roots nearer the surface it may be said and to bring those in the center of the rows nearer the sun and drought. My trial was a careful one, the details of which I will not recount.

Yield from hilling, average of two plats,	71.9	bushels.
" level culture, average of two plats,	69.4	"
Ordinary tillage,	64.6	"
Prof. Roberts, ridging,	58.10	"
" deep tillage,	44.15	"
" shallow tillage,	52.35	"
Lazenby for ridge culture, got	20.75	"
" ordinary culture got	20.65	"

These data are a draw with the balance favoring hilling for the East. The data do not warrant drawing conclusions further than hilling seems in all probability not to be a bad practice and warrants our use of the system until we get unfavorable testimony, which is not likely to appear. Hilling gives the above ground roots better chance to root in the soil and so aid in the nourishment of the plant.

Listing may bear on the question. This practice as noted early in this paper, is a practice that puts the corn below the ground and throws a ridge above ground. While this is not ridging in the sense that I have used it, yet it results in placing much dirt around the corn when cultivated fully more than in the ridge system. Prof. Shelton in an elaborate trial of many plats got 46.61 bushels from listed corn and 40.54 bushels from surface drills. The Minnesota Station did not receive in the cold soil of the North, where the seed and roots are placed below ground, as good results as Prof. Shelton did with the lister, but the failure was not due to the principle of ridging which would apply North, if anywhere.

Until more fully informed I shall in my own practice plant in checks and cultivate both ways, hilling at the last round, enough to bury the weeds. In order to do this, if machine planting is practiced, the two rowed planter with the check-row attachment will have to be used, as in the West. One man should do the cultivating as in the West, using no driver, whether he use a pair of horses with a sulky cultivator or a single horse.

One man will easily go over thirty acres a week, which is often enough. This makes a liberal allowance for rainy days and a lazy feeling. Planted in the middle of May, he could go over it five times easily by the 1st of July and do other work. The first two times over it would be with the Thomas harrow, which would give but two days' work at a harrowing.

Since writing the above, and since the completion of this paper, other data have come to hand from experiment stations touching the points under discussion. Both those from the Geneva Station and the Ohio Station confirm the views expressed touching planting corn in hills, and tend to further justify our use of the system of check-rowing. The Ohio Station finds no disadvantage in ridging. It still finds excessive tillage no advantage and confirms other conclusions drawn in this paper. Very early planting is not as advantageous as at first appeared, but in a relative sense early planting is desirable. We will check-row and kill weeds by a slight covering of earth as advocated with some degree of assurance.

HARVESTING CORN.

In its ordinary acceptation, I would not harvest corn; that is, I would not husk much of it. It does not pay. As we are farming for profit, it matters little what tradition says if we make more money by the honorable process of reserving our waste force used in husking corn. Husking adds nothing to the value of corn, or to the amount of its nutritive matter. It costs 8 cents for each bushel of shelled corn. We then shell it, then carry it to mill, costing for both operations at least 5 cents more, while grinding costs another 5 cents, making a total of 18 cents—one-third of its selling value or $33\frac{1}{2}$ per cent. Not an ounce of food is added to it by each one or by all of these operations. Think of it.

But will not ground corn make more growth? A little more steer but not enough to pay. I shall not recount the large amount of data now accumulated on this point. For the shote a 100 pounds of whole corn it is now proven, makes more growth than 100 pounds of the same corn ground. The trials of the Kentucky, Illinois, Missouri, Wisconsin, Ohio and Maine Experiment Station each and all show this to be a fact. This is no accident. A law is discovered here. But, it will be said, we will have to husk it in order to give it to the hogs. Let us see. In the West a great amount of corn is snapped (broken off, husks and all) and thus fed. Almost all of the corn in the West is fed whole—shotes following and eating up the corn after it passes (such as is undigested) the steer. Prof. Henry found that between the two animals, the corn was as well used as by the grinding process. My trials were not quite so favorable, yet the evidence is practically conclusive on the point.

Put the corn after drying in the shock a few days, into the barn and feed it out to the cows and steers—having shotes follow them, as well may be done. There need be no hesitation about the results of this practice. The amount of corn fed may easily be regulated. If we assume that for every bushel of corn there are 14 pounds of cobs and 90 pounds of stalks, then for every 2.9 pounds, or in round numbers, for every three pounds of the whole plants fed, the cattle will get one pound of corn. Thus the amount of corn fed can be gauged.

It is everywhere urged that the whole plant cannot be dried and housed safely. I have done it in Missouri and believe it can be done in Maine. Maine has more rainfall and a more humid air. I would not speak for Maine with absolute definiteness. In New Hampshire I have put up 50 to 60 tons of stover. Successful storage of the whole plant must come not by distribution of it over the barn but through compacting it. Let it stand in the little shocks peculiar to the East, until well dried, or 10 to 14 days of good weather. When dry place it rapidly in one mass in the barn. Let each bundle (which should at harvesting be tightly bound with twine around the top) be placed in parallel bundles in the mow and closely together. Let it be well trod down. If thrown into the mow in any shape they leave air passages between, which we desire to exclude, as far as possible. Somewhat the same principal is in part (only in part) involved that is involved in the silo, avoiding, however, its costs. If Maine farmers do not find that it keeps well by this practice, then they will find it better to accept the 20 per cent loss of the silo than to lose 33⅓ per cent in husking, grinding, etc. If they find this system available, then they will also find that it will pay to cut it very fine before feeding in the winter, or that it will pay to use the cutter and crusher that so works it up that it will be all consumed in good management. The argument that Maine farmers must have some corn is a fallacious idea in its conception in its relation to this question. By the system proposed the farm should raise double the corn heretofore grown. Each animal can receive its corn in the proposed method and in as large amounts as it is fed in Maine. Furthermore the fodder that goes with it is good for all farm animals and has, as seen, a greater digestibility and as good composition as Timothy hay. If more grain must be had it can be bought as now, in the much smaller amounts needed, but the purchase should come in the form of bran and cotton seed meal, foods that so enrich the farm.

WHEN HARVEST.

Some years ago I advocated at the Farmers' Institute in Maine, the continuance of the growth of Timothy until seed formation. It was unpopular. It is now generally conceded that growth of plants continue much later than formerly supposed, and that the increased growth does not suffer less in character. It may not be wholly accepted for Timothy but it is practically so for corn.

We do not know definitely when growth ceases, but generally it is after the seed has passed the dough stage and when it has dried through to the center, yet has not acquired its full hardness, as yet crushing in the finger.

Trials by the writer in New Hampshire, showed that topped corn, the miserable old practice that loaded itself on to civilization a long time ago, gave 1,086 pounds corn. Stooked corn when well glazed gave 1,140 pounds. That allowed to stand until it ripened or dried upon the stalk gave 1,046 pounds. Another year's trial gave the same result, except a more unfavorable one for topped corn. Topping removes the leaves. It is the leaves that elaborate the food. Topping before the plant has ceased to take in matter from the soil is certainly and unmistakably destructive. Strangely enough a great amount of corn is still topped in New England. I made tests with the Dents in Missouri. Prof. Shelton (and Prof. Henry also, I think) have tested the Dents. Each investigator found that the Dent varieties will not do to harvest as soon as the Flint sorts as found by me. They must stand until the stalk is quite well along in drying. Happily it is not thus with the Flint sorts. Shelton tried the Flints and found that they could be harvested earlier than the Dents.

If we are to save the whole plant, we are more interested in the period when growth ceases with it, than we are when it ceases with the ear, for it may happen that though the seed gains in weight during the last stages of growth, as occurs in some plants, the stem is losing in weight to supply this seed growth.

The chemist of the Missouri Experiment Station, found this to be so with corn. The trial was a limited one and not fully satisfactory yet possibly correct as it agrees with some general information which is also limited. He found that after August 27th, the stem or stalk decreased from 183 grammes to 153 September 10th, and to 124 September 24, while the ear increased from 252 to 270 to 320 grammes.

Where the whole plant is to be saved this seems to make it appear that we need not wait so late for its harvesting, whether for ensilage or for dry storage whole. The above is for Dent corn where ear grows later than does that of the Flints. The Flints may not show as great a difference, yet they are likely to follow the law if it is a law even though it be in a weak way. The following data show that Flints appear to follow this law in a very weak way. Prof. Ladd of the Geneva Station, New York, found that corn increased in dry matter up to September 23d, when he pronounces it ripe in following ratios: September 1st, 181; September 8th, 243 8; September 15th, 235; September 23d, 326 grammes. This was for plant.

Prof. Whitcher of the New Hampshire Station found for Northern field corn that its weights were as follows:

	July 26. Tassle not formed.	August 6. Tassel not in sight.	August 19. Silk in sight.	Sept. 16. Kernel blistering.
Total green weight,	17,428 lbs.	35,428 lbs.	35,142	32,000
Dry matter in crop,	2,135 "	4,925 "	6,519	8,832

Although the green weight did not increase after August 5, yet the dry weight steadily advanced. Crops usually take in very little water from the soil after bloom. The inflow of food material keeps on until a much later date than bloom. Prof. Whitcher cuts his crop too early to show the greatest gain.

Prof. Roberts found the following data for corn: Cut July 24th, when coming in bloom, 18,762 pounds, and dry matter 2,000 pounds; August 8th, coming in roasting condition, 24,578 pounds and 4,039 pounds; September 3d, when mostly out of milk the weight of green matter was 27,674 pounds and of this 7,214 pounds was dry matter. This was cut too early, probably.

Prof. Caldwell of the Pennsylvania Station got of dry matter and green weights as follows:

	Tasseled.	Ears Filling.	Kernels Glazing.	Mature Corn.
Green weight,	12,430 lbs.	11,760 lbs.	25,710 lbs.	13,520 lbs.
Water free or dry matter,	1,561 "	1,641 "	4,264 "	6,360 "

Goessman and others find similar results. Whether for ensilage or for corn we must wait until the ear would have glazed if not sown too thick for that result, before we harvest. We must not plant too thick for this end, as shown under distance of planting. Thicker planting than will fairly mature ears is a mere gain of water which has to be carried to and fro for nothing. Indeed, quality is sacrificed in thus growing in the shade as already shown. Prof. Ladd found that in drills there was more water in plants than when in hills which again favors check-rowing corn. But we need more proof.

MISCELLANEOUS FACTORS.

There are several questions of much importance touching the corn crop that both the purpose of this paper and pressure upon my time forbid consideration of. The object in the main of this article is to set forth the peculiar value of corn, its adaptation to our conditions and the possibilities of its culture more extensively and successfully in New England.

The storage of corn would be a fertile and interesting field to enter. We shall soon come to a more successful system of preserving our corn. Whether it shall be by the silo or by a perfected system of dry storage, will soon be settled. To enter this field of inquiry would be to greatly prolong this paper. It is a question that concerns New England no more than the West and its solution will not put it to any disadvantage in corn growing.

The cutter and binder for corn is already invented. Whether successful or not need not worry the Maine farmer, so far as it may affect his ability to raise corn against the West is involved. It will come to relieve the work of some of its hardships. Maine must have it when it comes as it is coming, if not already here.

A method of loading the shocks is in use in some parts of the West that is claimed to save much hard work and the wastage of leaves. It consists of an upright part on the rear of the wagon. Across its top is a sweep or cross timber that is pivoted like a well sweep, one arm being longer than the other. A slip-noose rope or chain is attached to one end. This is drawn down and slipped over the shock of corn. The rope at the other end of the arm of the lever is then drawn down, landing the fodder on the load. By this means good sized shocks are handled quickly and easily and with little waste of leaves. The greater part of the growth of the plant outside of that of the ear it will be seen is that of leaf or the leaves of corn weigh far more than the stem. They are richer and more palatable. Harvesting requires nice attention to the preservation of the leaves. It is very easy to lose an important ratio of the leaves. Care in cutting and shocking and loading is therefore called for.

The shrinkage of corn in drying is one of considerable commercial importance. The practices of the country are so variable in the time of harvesting, and the influence of wet and of dry years on the ratio of water and rapidity of drying fluctuate so widely, that I find it practically impossible to give any average statement of value. In the West, early harvested corn is sold 80 pounds to the bushel of corn, later or in November 75 pounds, and in the latter part of November 70 pounds are regarded as a bushel of shelled corn. In these cases the corn is allowed to mature on the stalk from whence it is husked. With the western sorts and by the western practice, in a too short trial, Prof. Henry of Wisconsin found a shrinkage of five per cent. Prof. Shelton found only six per cent. The Kentucky Station found but ten per cent. I found by the western system of maturing on the stalk a loss no greater, but when the Dent varieties were cut up, as in New England early in September, the shrinkage by the September of the following year was thirty-three per cent. While I did not investigate that phase of the question, I feel confident that a part of the loss was of the dry substance of the plant and not of water only. Corn in the ear is exposed to the free movement of the air and its oxidizing influences. I have found a loss in corn fodder loosely stored and a smaller loss on it when carefully stored. Prof. Henry found the loss when stored as separate bundles to be twenty-six per cent. Again he found it in better conditions sixteen per cent. I believe little need be lost. With hay this loss was but one per cent. This whole ground needs going over more completely. I believe that we have something to learn of value and that compact housing will save us much fodder and in better quality. But to return to corn shrinkage. Prof. Alvord found in New York at Houghton farm, for the entire year, a loss of 10 to 15 per cent. The Pennsylvania Station 17.5 per cent. A farmer of the same State 17 per cent. In New Hampshire, I found a loss to April 16th of 33 per cent on the average of the trials. This was after the eastern custom of cutting up corn in the glazed condition and husking it as soon as it was dry enough to bin. These figures agree well with the result in Missouri by the same system. The losses quoted in the Central states was after a method that harvests later than by the Maine practice. If we assume the shrinkage of corn by the Maine practice to be 30 per cent in the course of the year, it will be seen that 50 bushels per acre, harvest weight, is no better than 38 bushels of dry corn the next fall. These facts are to be taken into consideration in making the balance sheet for the corn crop. We cannot afford to be deceived as to our crop nor in the purchase of corn partly dried.

RATIO OF COBS TO CORN.

The Kentucky Station, Prof. Scoville, Director, found that the cobs constituted 20.9 per cent of the weight of the ear, or it required 70.8 pounds of ear corn to make a bushel of corn.

The Dent corn of the Pennsylvania Station was 19.1 per cent cob or it required 69.2 pounds of ear corn for a bushel of shelled corn. Shelton found that Flint varieties in Kansas required 70 pounds for a bushel or 20 per cent of the ear was cob. The Flints do not do their best there. The Dents at the same place were only 16.3 per cent cob or 66.9 pounds made a bushel.

Prof. Johnson, at the Connecticut Station, found that in the water free substance, as low as 14.5 per cent of Flint corn was cob or 65.5 pounds water free ear corn would make a bushel of shelled corn. Corn, however, after harvest carries much more water in cob than in the kernel. At the end of the year the cob is quite light, and it is safe to assume that less than 70 pounds of ear Flint corn will make a bushel of shelled corn at the end.

RATIO OF STALK TO CORN.

This is an important consideration of great value in calculating the fodder from a given yield of corn, by which the total yield of food per acre can be estimated, without weighing the fodder. Unfortunately we have but very few tests of the moisture in the stover. The variation of moisture is so very great that a statement of the amount of the stover left after husking, means but very little. I do not find trials enough where the moisture has been tested, to strike a satisfactory average. It will be of value to enforce our lack of accurate knowledge by giving a table of the weight of fodder to corn by weight of the air dry substance, as found by various investigations.

		Pounds fodder to one pound corn.
Pennsylvania Station,		0.83 lbs.
" "	ave. of 15 chemical plats,	1.19 "
" "	" " 4 yard manure plats,	.93 "
" Farmer,	" " " "	1.74 "
" "	" chemical plats,	1.73 "
Kentucky Station,		1.38 "
Wisconsin "		1.14 "
Kentucky "	yard manure,	1.50 "
Missouri "	(trial by chemist,)	1.28 "
" "	" by yard manure for 5 years,	2.05 "
" "	" chemicals, (12 plats,) for 5 years,	2.09 "
Kansas "	" of many plats,	1.72 "
Minnesota "	" " 7 plats,	2 04 "
Illinois "	" " many plats,	2.19 "
Ohio "	" " 47 "	1.54 "
Average of Dents,		1.56 "

FLINTS.

New Jersey Station,			1.10 lbs.
Connecticut "			1.29 "
N. Hampshire yard manure, ave. of 3 years and many plats,			2.22 "
" chemical plats,	" " " " "		1.45 "
Maine,		average of 10 plats,	1.78 "
" Farmer,		" " " "	1.89 "
" "		" " " "	2.41 "
" "		" " " "	1.66 "
Average of Flints,			1.70 "

The Flints average to require as field cured corn fodder, 95 lbs., fodder for each bushel of corn and the Dents 87 lbs. The abnormally low results for the Pennsylvania Station may be due to the fact that they are based upon the water free contents of the fodder. I quoted the results from Prof. Henry who had used them. I had not the original bulletin at hand. Subtracting these three results and it stands 1.70 lbs. stover to one of corn as in the Flint sorts. But trials at Kansas and also at Connecticut both agree in showing that Flint corn has more fodder to a bushel of corn than does the Dent varieties. This is surprising and contrary to expectation. It indicates the probability that the best Flint sorts will prove as productive of ensilage in dry matter at the North as the Dents, inasmuch as they grow as much shelled corn.

But until we know more of the water content of the fodder we shall know little that is very definite. The water free matter as found by the chemist of the Missouri Station by a doubtful process, showed 1.28 lbs. dry fodder for the Dents per pound of corn, or 72 lbs. per bushel, while the Connecticut Station got for Flints .81 lbs. stover for one of corn or only 45 lbs. per bushel of corn. Evidently the figures are too far apart to receive acceptance, and too low in the Flint variety to receive ready acceptance. It is a sorry fact, but true that we do not know the relative amount of actual food in stover grown per bushel of corn. The figures given for the New Jersey Station are practically calculated on the water free basis. All of the facts that we have, make it probable that the fodder in the dry condition weighs no more than the whole ear, cob and all. As we harvest corn and at the time that it is stored, the stover will probably weigh 90 lbs. in round numbers per bushel of shelled corn. It will contain much more water than the corn.

RELATIVE WEIGHT OF PARTS OF CORN.

Prof. Johnson, as before stated under consideration of the proper distance to plant corn, made a most thorough test, not only of the influence of distance on development, but on the development of parts, not only of the Flint but of the Dent varieties. I will give the average ratio of the parts of the stalk or whole plant for Flint corn, for the three most productive areas per plant.

	Sound corn.	Soft corn.	Total corn.	Leaves.	Stripped stalks.	Husks.	Sound cob.	Soft cob.	Total cob.
Dry matter,	143.6	18.4	162.0	55.4	46.2	25.4	11.4	3.5	14.9
Per ct. dry matter,	48.2	5.1	53.3	18.6	15.0	8.5	3.7	1.2	4.9

These figures are surprising. The method pursued by the investigation was a sound one, and we have reason to accept it as representing the conditions found. The corn was grown by Mr. Webb, a successful farmer. The test received the care of the station officers.

Here over one-half of the entire weight of the plant was corn. How many of us have understood what a concentration of the weight of the plant is found in so compact a body as the kernels that surround the cob of a great corn plant. The large ratio of corn shows why it is that the corn crop is so marvelously digestible, as a whole, for so coarse a crop. I can hardly believe that the average crop has such a ratio of corn. Equally as significant is the fact that the leaves outweigh the stalk. The husk, as will be seen below, is as rich as the stalk. The leaves and husks together weigh nearly twice as much as the stalk. Further investigation would show that the lower and pithy part of the stalk that is uneaten, makes up but a small part of the plant, and cuts but little figure, however much show it may make.

Below will be seen the analyses of the parts.

	Water. %	Ash. %	Protein. %	Fibre. %	Nitrogen free extract. %	Fat. %
Corn,	27.04	1.06	8.57	.85	58.39	4.09
Leaves,	42.80	5 17	4 96	17.74	28.30	1.03
Stripped stalk,	59.66	1 88	2.83	14.02	20.75	.86
Husks,	53.94	2.03	2.44	14.71	26.23	.65
Cobs,	49.09	.56	1.28	18.61	30.28	.18

The above shows the excess of water in the parts not corn and that the leaves are rich in ash and protein.

Trials at the Missouri Agricultural College gave a ratio of leaves to stalk as great as those found in the table given At Wisconsin, late results are similar for the Flint sorts. This great leaf development of corn should arrest attention, not only because of the value of leaves as food but more especially because they are powerful factors in crop growth and go far to explain the ease with which corn grows, its indifference to nitrogen and the general value of corn as a renovating crop.

THE COMPOSITION OF CORN AND ITS FODDER.

I will give the analyses of all those made in this country as collected by the Connecticut station.

	No. of analysis.	Protein. %	Fat. %	Nitrogen free extract. %	Fibre. %	Ash. %
Dent,	80	10.33	5.10	70.66	2.88	1.54
Flint,	70	10.57	4.96	70.31	1.65	1.44
Sweet,	26	11.62	8.14	66.70	2.80	1.92
Average,		10.50	5.45	69.85	2.09	1.54
Stover,		5.38	1.45	40.30	25.18	4.86
Fodder corn,		4.23	1.08	33.79	24.07	4.65

It is usual to gauge the value of corn or food by the amount of protein in it. This is a fallacious guide, yet for corn, which has a tendency to fatten, I should prefer those sorts that gave the most protein, other things being equal.

There is no practical difference on that score, save in favor of the sweet varieties.

MINERAL CONSTITUENTS.

	Phosphoric acid.	Potash.	Lime.	Magnesia.	Soda.	Iron.	Silica.	Nitrogen.	Manure value.
Corn,	.773	.369	.015	.210	.031	.013	.018	1.99	$7.91
Corn and cobs,	.676	.433	.017	.198	.038	trace	.050	1.75	7.18
Cobs,	.177	.765	.028	.068	.073	"	.220	5.97	2.82
Corn fodder, stover,	.40	.54	.109	.16	.15	"	.135	1.25	1.69

The above is by Dr. Goessman and is taken from the Massachusetts Experiment Station report. It will be noticed that cobs have more potash in them than all of the other minerals put together. Nitrogen is excluded, which does not appear in the ashes of cobs. Cobs are a good source of potash and their ashes should be utilized where burned, as they are in the West, nor should they be wasted when not fed, in the East. Almost no lime is found in corn, it going to the stem. Thus lime should be fed to pigs having corn. But the discussion of its use in winter is a great question by itself. Thirteen years experiments with it leads me to give to both corn and stover a higher value than is accorded to either in the popular mind. I am not mistaken in placing their value very high, for I have the most indisputable evidence of their great feeding value.

VARIETIES TO GROW.

The largest varieties that will mature in a given place seem by the trials thus far made, to give the best results for that place. This I suggested in passing the point where consideration of the question in relation to ear was most appropriate. I have, however, advocated the growth of corn for the whole plant, opposing husking. In this case will the same law apply? I will briefly review a few of the trials.

The Geneva Station for four years averaged:

For Flint corn,	in tons,	15.88
" Dent "	"	14.95
" Sweet "	"	12.83
" Pop "	"	12.63

The New Hampshire received

	Green Weight.		Water free or Dry Matter.
For Southern corn,	20.45 tons,		10.060 pounds.
" Sanford "	15.31 "	Sanford,	8.832 "
" Northern "	16.00 "	Northern,	6.980 "
Dent, Pride of the North, (small sort)	12.54 "		7.411 "

The Minnesota Station had a full trial of many sorts. As a rule the southern sorts produced the most. Fifteen sorts of Dents averaged 24.9 tons; 13 Flints averaged 19.8 tons and 19 sweet corns averaged 19.8 tons. The Flint had less water than either, although the Dent varieties yielded the most dry matter, and the sweet sorts a little less, although a course sweet corn gave the largest single yield by far. That variety was the Egyptian Sweet.

The Wisconsin Station, received as follows:

	Green weight.	Water free weight.
King Philip (Flint),	26,200 pounds,	8,352 pounds.
Evergreen Sweet,	22,690 "	5,526 "
B & W.,	39,800 "	9,028 "
Sibley's Sheep Tooth,	31,490 "	7,785 "
Southern Ensilage,	43,700 "	11,060 "
Normandy White Giant,	37,390 "	9,906 "
Southern Horse Tooth,	42,060 "	14,070 "
Fargo Bros. Ensilage,	38,890 "	10,150 "

At the Connecticut Station, the Dent gave 399 pounds of dry matter where the Flint gave but 345 pounds.

The Vermont Station received from Sanford corn, 100; from Leming (a Western Dent) 153; from red cob, 188 (a coarse sort) and Stowell's Evergreen, 96.

The Vermont trial is for dry matter. It is fairly evident that even in these far Northern States the southern sorts and the coarser Dents give more dry matter than do the Flints. The exception at Geneva was for a small Dent.

But a review of the weights of the green and dry weights of the crops shows that we have to handle more weight of green matter to get a ton of dry matter in the southern sorts, than in the Flints. Again the Flints get more mature. We are morally certain that the more mature the greater the feeding value. Experiments we have in feeding but not enough. They favor maturity. Again, more important than all else, the Flints carry a far lighter ratio of leaves to stem than do the Dents and coarse sorts. The stalks weigh more than the leaves of the Dents, while the leaves weigh about 50 per cent more than the stalks in the Flint tried at Connecticut. Prof. Henry found that of the total weight of the plant, corn and all, the stalk of a Flint variety was but 30 per cent of the total weight while the Dents run from 45 per cent up to 69 per cent in the coarser sorts.

The greater the weight the more the ratio of water, the less mature and practically the more the ratio of stalk and the less of leaves. These are decisively important factors and must be considered. It is not unlikely that a selection of our coarse Flints for the larger plants will prove our best forage corn for dry storage whole and for green storage as ensilage.

I invite the special attention of Maine farmers to the fact that the great leaf development of our Flints means someting in recuperative farming. It means that the Flint sorts, of all varieties, have the most powerful ability to help themselves from natural resources. Truly they are tempered to the wants of New England, and are in keeping with her hardy sons in equipment for the conflicts of life.

THE QUEEN CROP.

Grass is king and can have no rival in mixed farming in New England, where stock husbandry is pursued. Corn is queen, the bride and companion of grass in all good farming. Productive itself it induces prolificacy around it. It is the foster mother of good tillage and of the farm wealth that springs from it. All hail corn as queen and accept its mission as a rejuvenator of New England farming! Those who study her charms will love her and give her an honored and a warm place in their agricultural hearts. So believes the writer who is not an advocate for but a votary of this grand plant.

IMPORTANCE OF SPECIALITIES IN FARMING.

By B. W. McKEEN, Member of the Board of Agriculture from Oxford County.

As we look out upon the world we find there is constantly going on a change. This change carries all things with it and will not be stayed; but is irresistible. Old ways and methods are constantly being superseded by new ones. Practices and customs that did well formerly are now out of place. These facts should be borne in mind by all who would grasp the ideas and methods of to-day—the methods that lead to success and a competency. In old times, when the country was new, when there were no railroads, and communications between towns quite near each other were difficult, when it cost much to manufacture any article of household goods and more to transport it, farmers naturally relied on their own productions to supply their wants. There was then no particular need of any cash crop, because nothing of any amount was needed outside of the resources of the farm. The flocks furnished the wool for good, substantial cloth, which was manufactured at home by the ladies of the farm and their daughters. The fields produced the flax which was made into linen for the finer articles. In many cases the orchards of fruit and of maple trees supplied the family with the necessary fruit and sugar. The productions were then very general, and there being no room for competition or division of labor into industries, there was no call for anything further.

Manufacturing of all kinds was then conducted on a small scale and by a variety of methods; there was no centralization of capital, talent or labor into one great center, or under one general management, which becomes a necessity in these days of sharp competition and nineteenth century progress. The laborer who might be employed to do any small jobs around the house or upon the farm was generally a man skilled slightly in all the general requirements of the different branches as then managed, and, while he was not capable of doing any job in a workmanlike manner, he was particularly useful in his way, a sort of Jack-at-all-trades, who was content to earn his living by turning his hand to anything that came along, and who trudged gaily to his humble home at night, laden with some of the many products of the farm as the reward of his labors. In many cases there was no need of any money, or any circulating medium of trade, other than that the farm products afforded.

In many places in Massachusetts, even near large cities, there can still be seen, small, eight-sided workshops in nearly every farm-yard, where, formerly, some member of the family worked spare hours on shoes for their own or neighbor's families, but they are now used for other purposes. I know of no place to-day where a young man can go to learn the shoemaker's trade. There are many manufacturies where certain branches of the business are taught, and where the laborers become well skilled in their part of the work, but none where a man goes through every branch of the business. The children and young people of to-day would hardly be content to wear such home-made shoes as graced the feet of their grandparents, and if the young idea would agree to the change, they could not be afforded. They would be far dearer than the finer finished shoes of to-day which are manufactured by skilled, special labor, and by machinery that can only be used where large quantities are manufactured. And in order to be able to pay for these machine made boots as well as for other necessary articles that must be purchased for cash or its equivalent, there must be some special crop that can be sold off the farm for cash.

This crop must be selected in accordance with the surroundings, the soil, the amount of available help, the markets and the tastes of the owner. This matter of taste should be carefully considered. No doubt it can be cultivated in a measure, but still there must be a natural fitness for the business to be able to accomplish good results.

Said Mr. Waxear to Mr. Chorister: "I am glad to see young Mr. Tocksin up in the choir; he is a most estimable young man, well read in the law too." In reply Mr. Chorister says: "He may be *red* in the law, but he is a *yeller* in the choir." Thus we may excel in some branch and still be "yellers" in others. Not only is this cash crop a necessity for meeting the running expenses, but, if a farmer is to put business into his farming, is to plan to farm for an income as well as for a sustenance, then this crop must be extended for that purpose. The time has passed, when farming was only a makeshift for a living simply. It is now elevated into a business that pays a good percentage upon capital and labor judiciously invested, and is ranked as worthy of having a special officer in the President's cabinet to manage its affairs and look after its interests. It is therefore of a National character. Its weal or woe affects each and every industry in which man labors, and its management is an earnest of success that affects, and should interest all men, all classes and all climes. The time has passed when the farmer was looked upon as a bore to be shunned by all cultivated people. Culture, education and refinement exist to-day upon our farms and in our New England homes in a greater degree than among the people of any other trade or profession; and public sentiment anxious to recognize all that is worthy, is rapidly learning that:

> "Sense and worth, o'er a' the earth,
> Shall bear the que and a' that,
> For a' that and a' that,
> Our toils obscure, and a' that,
> The rank is but the guinea stamp,
> Tne *man's* the *gou'd* for a' that."

So we find, while looking at our business from the stand-point of culture and refinement and social position, great incentives to renewed exertions to become efficient in our business, and to study and adopt the methods demanded by the times.

It is related that a large woolen manufacturer, after showing some visitors through his factories, where all the machinery in use was of the newest and most approved pattern, took them into the attic where they found, stored away, the machines for manufacturing in

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all departments. The visitors expressed surprise at this, and asked if these machines were worn out. O, no, said the manufacturer, but out of date. I cannot afford to use them. In order to compete with other manufacturers it is necessary that I have all those new machines you saw in use down stairs. What is true of manufacturing, is also true of farming, not alone in machines but in methods and practice.

The spinning wheel has ceased its melodious hum. The hand loom is no longer heard in our country homes. The little, low linen wheel, rich in associations and sacred recollections, has now no place outside of the shop of the gatherer of curios or the parlors of the lovers of bric-a-brac.

The old-fashioned cobbler, with his bench and kit of tools, traveling from house to house, is forgotten and the tap of his broad faced hammer upon the lap stone, as he worked and pounded the leather into shape is no longer heard. The country is now spanned by railroads, carrying the wares and productions of all sections into every village and town. Commerce has spread its sails upon our coast and inland waters, and her white wings glisten on all our shores, bringing to our doors the products of all lands. This change calls for a radical change of methods for our farmers. These articles must of necessity be purchased and in order to pay for them the farm must be made to produce some crop to be sold for cash. It seems folly to waste valuable time and land producing some article for home consumption even, when the same article can be purchased with the proceeds of a much smaller area of land devoted to some other crop, for which the land and locality is particularly adapted, and which the market demands. This crop should be pushed to the full capacity of the farm and labor at command. By so doing, much more will be realized from the farm than will be the case if it is divided up into patches of various kinds of crops, none of which are grown in sufficient quantities to produce a surplus for sale. The cash crop, then, becomes a necessity and the locality must determine largely what that shall be.

How many farms in this State are run strictly on business principles and up to their full capacity for production? How many farmers can tell whether any particular crop or animal is producing an income? Not very many, I assure you. Consult the merchant, the manufacturer, the professional man and how are all these things changed. A careful system of book-keeping tells them just what they are doing, just what branch of their business to push and which one to curtail. They are enabled to do this, because they have but one system to work on. Their entire time and thought and talents are concentrated upon that one object. All things else are made subservient to this one special idea, and by so doing they carry everything on their books and know just what they are doing. There is no guess-work. Some system of this kind is necessary for farmers, and as they adopt specialities they will work into it. By concentrating their thought and farms upon one special branch they will become more methodical and more business like in all their ideas, and there will be a certainty of results that will add much to the dignity and profits of farming.

Often there is but a small margin of profit at best, and success or failure turns upon so small a point that every detail must be thoroughly understood. These are days of sharp competition in everything, and economy of production can be made a great source of revenue, in fact, it is an absolute necessity.

All manufacturers and all professions are dividing their labor into specialities. Men are educated by theory and practice, in some one peculiar part or branch of their work, and in a short time acquire a skill and capacity for labor unknown among general workmen. Thus, in house building, where it is carried on extensively, one party of men puts up the frame and sees that each sill, plate, post, rafter and brace is in position in proper form and size. Then another party puts on the boards, still another lays the floors, another the bricks, another the plastering, another builds the stairs, another puts on the finish, and so on throughout the whole building. Every man doing just that he has had a special training for and nothing else.

The medical profession is a rare example of the benefits to be derived from special practice. No one man can be skilled in all branches, so they are subdivided into very exclusive, special subdivisions. Another great principle for us to consider is the necessity for intensive thought and concentrated action. The age demands quality. In order to place any article upon the market and compete successfully, it must be all wool, and of material that will wash.

Intensive thought brings the perfection that is demanded, and only undivided attention brings the ability to place ones whole self into the business in hand. When an eminent person, remarkable for his achievements in science, eloquence and business, was asked by what means he was enabled to effect so much, he answered, "By being *a whole man* to *one* thing at a time. Years ago, a trusted courier was sent across the Russian country by relay of horses bearing important despatches, which it was necessary he should deliver at the earliest possible moment. He exerted every nerve, and denied himself sleep and food and rest, in order to reach his destination. When the journey was nearly completed, he stopped at a country inn for fresh horses, and while waiting for the change to be made fell asleep on a bench at the door. The attendants attempted to awaken him by loud cries, and by shaking him by the shoulder, but tired nature refused to respond and it seemed there must be some delay. The inn-keeper, hearing the outcry, came to learn the cause and immediately bade the attendants stand back. Then he advanced toward the sleeping courier, saying in an ordinary tone of voice, "Your horses are ready Monsieur." As if by magic the man sprung to his feet, and wide awake ready to mount. Probably this man was not learned or profound, but he had his duty so firmly imbedded in his mind that the least allusion to it caused the drowsy god to leave him and set every faculty of his being into active play.

It is such devotion to purpose as this, that the world needs, and whenever we find it in any man we find that man successful. I believe the same necessity for undivided thought and action exists to-day upon our farms as in other branches of business. It may not be quite possible to so thoroughly divide into specialities, but enough can be done to place us upon much better footing than we are to-day. You have, perhaps, heard of the farmer who in early fall was sent to dig some early potatoes. He started out with basket and hoe, but after some search came back and reported that there were none planted. His wife began to upbraid him for his carelessness in forgetting to plant them. In reply, he said, now wife, don't blame me, you can't expect one man to think of every thing. Thus it is that the average farmer who keeps a few steers, a few cows, a few sheep and a few hens, whose fields are cut up into patches of various kinds of crops, has his thoughts so scattered by the various calls upon his time that he is constantly working at a disadvantage and produces nothing that is first-class.

If he will study his tastes, his soil and his market, and adapt his productions to these, he will find himself working more nearly in the line demanded by the times, and producing an article for market that will command a ready sale. I am aware there is an idea in the minds of many that it is unsafe to put our land into one crop largely or to stock mostly with one kind of animals, but this is a mistake. If all the necessary conditions are complied with, if the investments and choice are made judiciously, there need be no fear of results.

I believe there is one reason for adopting specialities that is overlooked by most of us. It is that we are all specialists by nature. We are particularly happy when tending some particular crop or animal. We are all naturally inclined to put our best efforts into what pleases us, and unless the heart is in the work I would give but little for the laborer. The sense of duty or the love of gain will sometimes lead us to labor that accomplishes much, but there is no real merit in labor accomplished by unwilling hands.

We must get above and beyond ourselves, must forget our very existence in the work in hand, if we would excel. One man working away with chisel and mallet on a piece of marble keeps doggedly at work thinking only of the weary hours that must pass before he is released from his labor. Gets no nearer perfection as time passes. But soon another man approaches, who asks him to stand aside, saying: "I can see an angel in this piece of stone." He takes from the hands of the time server the chisel and mallet and immediately there springs from that stone a figure of matchless beauty, which men bow down to and worship.

> "Polly's pansies grew so large and fair,
> Bright and fragrant that we can but praise them.
> They're the finest anywhere;
> Tell us, won't you Polly, how you raise them?
> What's your secret, little girl? Then Polly,
> With a look half bashful and half jolly,
> Smiles upon her flowers and kneels above them;
> 'This is all the secret, I just love them!' "

Many people are happy when at work in the fields, where they can see green things growing. The grass, as it glistens in the sun of summer, has for them a beauty unexcelled. The flowers of the field are to them full of rare beauty and of inspirations that lead to a higher and a better life, and that help to make the world full of bliss. There is music in every rustle of the branches of the trees and the undulations of the waving grain. They look through all these beautiful things in nature to the Great Source of all light and life, and find themselves in sweet communion with Nature's God. To such as these labors in the fields will bring success. To such as these will come a full harvest, and they shall be truly blest, as those who have caused two blades of grass to grow where but one grew before. Others may plod along through the labors of the year and accomplish something, who have no eye for the beautiful in nature, who are like the prosaic person described by the poet:

> "A primrose growing by the river's brink,
> A yellow primrose was to him,
> And it was nothing more."

Some people enjoy nothing more than they do the care and company of the horse. For them there is no sweeter music than the measured hoof beats of their favorite steed. No beauty equal to the symmetry and superb form of their beautiful equine companions. To all such will come success in caring for and handling horses because their heart is in the work and there is a genuine love for the business. Others are at home when they are with their favorite oxen; they enjoy the excitement of training and driving the steers of the farm. They have an eye for perfection in that branch, and can tell the qualities of an ox at a glance. In their hands are found the oxen whose matchless beauty and great usefulness are a credit to our State to-day.

Others enjoy the dairy, and can see nothing more lovely in nature than the deer like beauty and symmetry of form of their favorite Jerseys, Ayrshires or Guernseys, or the magnificent proportions of their Holsteins, while others would "rather gae supperless to bed" than milk one of them.

So it will be seen there need be no fear of overrunning the market with the products of any one branch of farming, as there will be so many people to choose and so many branches to choose from, and all will be doing the work adapted to their peculiarities.

If any man has the right matter in his make up, that will lead him to strive for the goal of success, pluck to push ahead under what may seem great difficulties, and a natural aptness and love for the business, he need not fear to embark in any branch of farming for which his tastes and situation fit him. There is a reasonable certainty of success in every honest effort that is put forth on business principles and with a view to the ultimate end.

Let him turn his attention to dairying, and as this is his exclusive business, he will naturally seek to post himself thoroughly upon it. His equipments will be first-class. He can afford to purchase all necessary articles for an outfit, and place himself in condition to command the attention of the market, and finally to place his own price upon his goods. One farmer in Fryeburg is stocked largely with cows, has a supply of ice and all necessary tools for making and shipping butter. He has made from thirty-five to fifty pounds of butter per week and sold it all direct to customers, having orders he could not fill, while his neighbors with so few cows that they could afford no special tools to work with and whose cows took care of themselves were scouring the country over to find chances to swap their butter for store pay and failed in the effort. What is true of dairying is true of all other branches of farming. And what is true of the individual is true of the community and the State.

Look for a moment at Kentucky, made famous by her horses! A trade mark which adds value to all good stock that comes from within her borders. Look at the Channel Islands with an area of only 112 square miles and a population in 1871 of 90,596, made famous the world over by the wonderfully beautiful and valuable dairy cows bred there. This perfectness is only reached by years of constant, undivided, united attention to that one particular branch of stock raising. Everything else is made subordinate to this, and every available atom of thought and labor concentrated upon the one object of breeding dairy cows. Look for a moment at Vermont, with a reputation for dairy products and fine horses unequalled. With an area of only 10,212 square miles she has succeeded by close attention to these branches, making them largely specialities, in placing upon the market these articles of such fine quality, and in such quantities as to command attention and attract sales, and butter shipped from Vermont, or horses raised among her verdant hills and in her rigorous climate, will sell anywhere, and advertise themselves. Turn our attention to our own State; observe the fine specimens of animals that were shown at our State fairs, and you will find that each animal of merit was raised by some one who was bound up in that one breed of stock. Notice the fine Hereford steers and oxen, observe the perfectness of form and uniform characteristics. All of these are the result of generations of breeding, with a definite, special purpose in view and are the consequence of thought and talent condensed upon one object. Then these animals themselves are raised and fed by men who honestly believe them to be the best cattle in the world, who go into the business with faith in the material they have to work with, and confidence that their endeavors will bring them success.

The most direct result of adopting specialities will be the benefits that will soon be apparent in the more uniform herds, and the greater usefulness of each animal for the business in view. There is no lack to-day of fine, pure bred animals of all the representative breeds of cattle, but there is a woeful lack of sameness in the average herds upon our farms. Many of us not having had any definite purpose in view have bred very indiscriminately, first to one breed and then to another, until our herds resemble those of Jacob of old. They have so many different strains of blood that none predominates. There is no peculiar, fixed characteristic, and they are comparatively worthless for any purpose when compared with representative animals of any special breed. But let us adopt some speciality and how will this be changed! The breeding will be conducted on some fixed principle that will tend toward the end in view. Individuals will be selected for that purpose, and as the lines are drawn closer and closer, the poorer ones will be weeded out and every animal will have the special qualities that will make him valuable for our purpose. As the breeding is continued generation after generation this quality will become so firmly fixed and stamped that it will be reproduced in the offspring, and then will come the beginning of a herd that will be uniform in color, form and natural characteristics. The valuable herds of cows for which Maine in now noted, and whose milk products command a ready sale at remunerative prices, are now largely kept by farmers who make them their principal stock, and whose attention is placed upon preparing proper food in sufficient quantities to produce the largest possible yield of milk at the least possible expense.

Observe the fine specimens of the different breeds of horses that may be found in the State to-day, and as you admire their beautiful proportions and characteristics that fit them for their peculiar work, you will be forced to the conclusion that each one was bred by men well skilled in that one branch of business. The breeding that produced the Percheron with his coloring, his size, his uniformly kind disposition and valuable characteristics for certain purposes, was conducted by men who gave their whole attention to that one object, who knew nor cared but little for anything else but to improve and perfect that one breed of horses. Notice our gents' drivers and trotting bred roadsters and the same truths hold good. Look at the wonderful records our Maine horses are getting and tell me if the breeding that produces such trotters is conducted by men who divide their attention among different kinds of stock! Talk with their owners and you will find them all horse. They will talk of nothing else and care for nothing else in business. There are many men who can do fairly well in all branches of stock raising, but they never can reach that perfection which alone brings remunerative prices and success.

Then, as co-operation is the watch-word for farmers and is a necessity to their very existence, and as certain quantities of any article are necessary in order to work to advantage, division of farming into specialities materially helps this very ground-work and underlying principle of farming. For example, notice the creameries now in successful operation in our State. They have been the means of educating the farmers in their localities up to the fact that it pays to give one kind of stock their undivided attention, and they are now surrounded by men who breed and feed only dairy cows. By so doing the business is concentrated and the output from one point is so large and so uniform in quality that it commands a ready sale. Quantity has much to do with market prices as well as quality. Very nice articles of manufacturers, stock or crops may be hidden from purchasers because there is not enough of them to command attention, and buyers cannot afford to spend time looking for such stray articles but confine themselves to localities where the articles they may need are produced in sufficient quantities to enable them to handle them at the least possible expense. Aroostook county with its fine soil and situation produces potatoes that are quoted in all markets and command a ready sale. If any one wishes to purchase potatoes he will go to that section because he knows he can find what he wants in sufficient quantities to ensure cheapness of handling.

In central and western Maine sweet corn is largely grown for canning purposes. The quantity and quality are such that Maine corn is known in all markets, but with sweet corn as with everything else grown upon our farms the quality must be first-class or it will be handled at a loss. The market is full of an inferior article that sells at a lower figure than Maine corn can possibly be grown for, and unless it is superior to this it comes in direct competition with it and goes to the wall. It is a paying crop or not just according to how it is planted and tended. It all depends upon the man as to what his farm will produce. Some men will make their fields a garden, and at the same time get an income from them. Some men will raise nothing but weeds, and a poor crop at that. Some will raise the mortgage that has hung like a pall over the old homestead for years, and carry joy to the hearts of those who watched and tended their young lives, by a few years of toil on the ancestral acres. Some will strive harder to find excuses for not doing their work in proper time than in any other direction except to talk politics, gossip at the country stores and grumble at the business of farming.

There seems to me to be an over-production of grumblers. As a business it requires no capital, talent or labor, and he who sets up in the business of grumbling may rest assured that he is taking the shortest cut towards the hatred of his fellows, and will *live* regretted, and die "Unwept, unhonored and unsung."

It all depends upon the man as to whether this life shall be a success, filled full of the golden harvest of rich returns from good deeds and honest efforts, or a failure, yielding nothing but regrets and remorse and sorrow for neglected opportunities which "like sunbeams" have passed them by. Every effort for success has two direct influences npon us. It accomplishes the object if well directed, and tends to better fit us for our labors in future. One of the greatest blessings that follows intelligent labor, if the heart is in it, is that it reacts upon the laborer, making him better fitted for his labor each day of his life, and with honest effort comes the ability to labor more and better. It all depends upon the man as to what he will get out of this Institute. If he is open to conviction, if he is ready to receive the ideas that may be presented, in exchange perhaps for his own, he will be the gainer.

If he is anxious to make the most of this life and place himself on an equal footing with those who fill other positions, whose inclinations lead them away from the farm, and he will put his whole being into the thoughts of the day, then he will get new inspirations and new courage that will enable him to return to his farm better equipped for the stern battle of life, and to accomplish more and better things for himself, his posterity and the world. I have had some experience in corn packing and have found the price received by farmers to vary so much that I have investigated somewhat, and I find in nearly every case where the farmer has planted sweet corn as his principle crop his returns are the best. The reasons for this are obvious. His fertilizer, his care and his attention are given that one crop, and these facts lead to everything being done at just the right time and in the proper manner, and when the harvest comes he has won the prize. It may be urged by some that it is unsafe for farmers to trust their all in one crop. Some may say that it is not wise to trust our eggs all in one basket, that markets change, and in order to have something to sell at a fair price each year, it is necessary to have variety. To all such I will say: If we are careless and heedless and drop our eggs, it makes but little difference whether they are in one or a dozen baskets, we shall lose them anyhow and deserve to. But if we have a mind on our work and exercise due care we shall stand a far better chance to reach market safely with one than a dozen baskets. That one object will be our all. Its safety is a necessity to our success. It is our treasure; and where our treasure is there will our heart be also. Our thoughts concentrated on that one object enable us to safely carry out our purpose. As an evidence of the beneficial results to be derived from adopted specialities, I will call your attention to the several communities in our own State where creameries are situated.

From the report of them given in "Agriculture of Maine" for 1887, we find that the New Gloucester creamery paid its patrons that year $18,817.18. This money was distributed regularly each month, and went to help improve the homesteads and add comforts and luxuries to the family firesides. The Turner Centre Dairying Association paid its patrons the same year in round numbers, $37,017.44, and in 1888 it distributed the sum of $68,000. Now no one will for a moment contend that these magnificent results could have been obtained if each farmer had had his attention divided amongst various kind of stock and labored himself to find markets for his products. There could have been no uniformity in quality, no certainty of finding any one article in sufficient quantities to make an object for handling. Butter factories by concentrating the labor into one place have placed the business all under one head and turned out a product that sells readily.

A wide awake New Yorker brought into Boston market a few weeks ago six tons of dressed turkeys all of his own raising which sold for five hundred dollars.

A man in the town of Albion, Me., makes pork raising a speciality, and by confining his attention to that one branch of farming is making it a decided success. His sales of pigs and pork last year amounted to four thousand dollars. He is able to place his goods upon the market and realize a good per cent of profit, even at the low price of pork at the present time.

A gentleman in Lincoln county, Me., tells me that during the past three years he has made something of a speciality of keeping and fattening oxen, doing his farm work with them which fully paid for the cost of keeping and fattening. His sales for this time have amounted to three hundred and fifty-five dollars, and he now has oxen on his farm whose value fully equals those he owned at the beginning.

Also look for a moment at places where are situated packing establishments. The corn factory located at Fryeburg paid out to farmers in that vicinity the past year the sum of $4,213.95 exclusive of its labor bill which was more than $2,000. This $6,213.95 will go a great way toward supplying our farmers with the necessary articles that must be purchased and leave something in most cases as a balance for improvements. Twenty-five hundred bushels of Lima beans were shipped from the town of Otisfield this season, worth $5,000.

A Naples farmer gathered one hundred bushels from five thousand hills which sold for $201.3 . Compare these sums with the income of any man who was not working any special line and you will find them far ahead.

The use of machinery also tends to cheapen cost of production and thus adds to the profits of the business. As an instance of what manufacturers are doing, notice the Columbus Buggy Company turning a finished buggy every eight minutes of every ten hours of every working day of the year. More than five hundred labor saving machines stand ready to do the bidding of the workmen, and the engine whose mighty heart-beats carry all this machinery represents the strength of one thousand horses.

As farmers come to fully realize the benefits to be derived from so planning their work and placing their operations all in one general line, and use the most approved machinery and methods, they will find themselves firmly placed on the high road to success, in the great industry which is the foundation of all others. The young men will no longer leave the farm for distant cities, for they will find profit and pleasure in cultivating the soil. The whole general system of agriculture will be changed, and there will be something to work for, something to hope for. They will find the same general principles of business being used on the farm, and the same system that characterizes successful business ventures in other directions, and will be content with the results that will surely follow.

In regard to the market. It always adjusts itself to natural conditions, and the man who keeps persistently at work upon a certain line, growing better fitted for his business each year, cheapening production and improving his product, stands a far better chance to get fair prices than he who is constantly changing crops and stock in order to catch a market that happens at that time to be lightly supplied. Following the crowd, constantly changing, buying high when others are buying, and selling low when others are selling, is like following a rainbow to its foundation, interesting perhaps but unremunerative.

A conceited goose waddling about in the farm-yard chanced to meet a horse, and at once began to boast of her superiority, saying, "you amount to but little, you can only run upon the land, you have no wings for flying or feet for swimming while I am at home in the air, the water or on the land." The horse arched his neck and with flowing mane and glistening eye gracefully moved across the yard; then replied: "I had far rather be a horse, perfect in one element, than a goose in all."

The sooner we learn that success and prosperity come from learning to do a few things well and not from attempting to half do a great many, the better it will be for us and the sooner will come that glad millenium when every one who tills the soil, will sit under his own vine and fruit tree and his heart will be made glad by the yield thereof.

FARM HELP.

By A. I. BROWN, Belfast.

The labor question has been discussed very fully and sometimes very bitterly during the past few years. In this discussion the farmer has taken little or no part, and has had only a casual interest, because his welfare has been only indirectly or remotely affected.

There is a phase of the question, however, which is becoming of vital importance to him, and for which, it seems to me, the time has now come for discussion. The matter now *forces* itself upon our attention, in as much as it is always difficult and often impossible to find reliable competent help to carry on the operations of the farm. Very many of our most energetic farmers have so far extended their business that a considerable force of helpers is necessary both in the field and in the house. I say "*in the house*" with no less emphasis than "*in the field*" because although in the former the number of needed assistants may be less, the scarcity of even a few is greater.

Furthermore, a man has no moral, and should have no legal right to hire done the work in his department of the business, unless he provide for the other department also. And in making farming more than a means of living—a business in the broader acceptation of the term—estimates should be made for stirring the dough as well as for holding the plow.

And this leads us to digress to consider whether we should be content to simply get a living on the farm. I will admit, that in many instances, if a man and woman do that, they are entitled to a good deal of credit. I will admit, also, that in perhaps a majority of cases a sudden abandonment of a life-long habit of farming and the adoption of an extensive business, with its attendant expenses, would result disastrously. I will say, however, that it should be our aim here in the State of Maine to make farming a business that shall enable the most of us to give remunerative employment to our sons and daughters, or to employ others, at fair wages, and at the end of a year find the balance on the right side of the account. It is hardly necessary to say that this is a great undertaking. But I believe that if we set ourselves about it rather as a reform than as a spasmodic effort we can bring it about, always remembering, however, that reforms, especially those that are far reaching and which affect the welfare of states and nations, are plants of slow growth but of exceeding beauty. They are the work of generations not of a summer. To induce any considerable number of our people to contribute well directed effort towards that reform there is a vast amount of fundamental work to be done.

It seems to me that we should, in the premises set ourselves to the task of teaching people that agriculture is of itself worthy to be the life work of ourselves and of our children. The drift is unfortunately away from the farm. The father and the mother tired with the labor of the day and bowed with the labor of the years, forgetting that other paths in life are narrow and beset with care, with toil and with privation, sigh for the "might have been" always to their deluded vision bright.

The children see too many of the shadows of the picture. It is not often hung in proper light which shall turn those shadows into symmetrical concomitants of a satisfying whole. I once very solicitously inquired of a hpyochondriac as to how she was getting along. "Ah" said she, "I enjoy very poor health." I have sometimes wondered whether people in every walk in life did not enjoy disagreeable things the best. It is very certain that if we would magnify our blessings as we have been wont to do our trials, the reform of which I have spoken would be well inaugurated. The idea that the farm is but a threshold to something different and better has been very detrimental to progress in this State. During the first half of this century the farmers lot was not only rigorous toil but actual hardship as well.

At the present time there need be no hardship, and as for toil it is quite generally acknowledged that the farm is no more exacting than the mill, the shop, trade or law. So that we cannot sit down and calmly and impartially give valid reasons why we should leave the farm. The chances are decidedly that we shall be worse off by so doing. Labor like everything else is subject to natural law. No field can very long be favored above another, and he who comes in on high tide to-day will likely enough be stranded to-morrow. We have pretty well established the fact that we can get a living on the farm and we may as well be considering how to do a larger business there as to go elsewhere. The necessities of the situation compelled our ancestors, in most instances, to make farming incidental to even a living. They divided their time between tilling the soil and lumbering. The latter was really the business because from it came the surplus if there were any. In the newer portions of the State it is sometimes so to-day. But in the older parts agriculture must, henceforth, be both the livelihood and the business. Now is there anything in it? We believe there is. In the neighborhood of our cities nobody will deny but that farming is a good business to men of judgment and energy. Without stopping to inquire whether general or special work is the better for our business, we will all agree that special dairy work, or horse breeding, or the sheep business or poultry raising afford special lines under the present condition of affairs that can be developed into a business far more remunerative than the average store, capital for capital, risk for risk, requiring a less expensive training than either law or medicine, and either of which is within the natural capacity of more people than are trade, law and medicine combined. Besides this, in two generations more Maine will be a great manufacturing State. The United States will then have a population of two hundred millons of people. Then will our water-powers be utilized and large towns will then have sprung up by hundreds. Then will there be a vast non-food producing population to be fed. They will be at our doors. We who are blessed in this present owe something to that future. Our ancestors cleared up these farms, laid the foundation of this government, and fought our battles for freedom. We owe to posterity a service no less arduous, an inheritance no less noble. We should emulate some small portion of the resolute endeavor which prompted them to freely undergo the rigors of those times, unselfishly and in the main for us.

In the great centers of trade it is the ambition of the father to train up sons to succeed to the business. This is not true of agriculturists, and it is not right. We should perpetuate a love for the homes which our father's founded and our mother's kept in order, and a love for the noble calling which evoked these homes, these places of business from the primeval forest. There are few ancestral homes among the farmers. We see them only now and then. One, in particular, I have often visited. It is a cottage house, modern in its outward aspect, looking southward from the base of a hill upon an intervale where elms and willows mark the windings of a scarcely flowing brook. Among the trees about the house are some tall pines—sentinels not shade—sentinels who stood there when the smoke of the settlers camp first curled upward on the air.

They were old then. They are older now, and when the wind is high they wave their arms and groan as if in pain at sudden wrenching of their weakened joints, and in the gentle sunset breeze they sigh as long, dark shadows mark the spot where they shall soon lie low.

The owner of the farm is a man long past the middle milestone of his life, and as he sits companion to the trees and smokes his after supper pipe, a stranger passing, always halts to pass the time of day, and look at the old pines and ask their age. The old man points across the garden plot and just beyond the house to where two headstones stand beside an old gray rock of monstrous size. My father, long since dead, has often told me they were lusty trees when he first saw them, nigh a hundred years ago. And they had many mates, when he and mother tramped for many a weary mile between their trunks, and slept one night on boughs beside that rock, for hut nor cabin was not anywhere around. They sleep there now, God bless them! And there *I'll* sleep, one day, Him willing. They made this farm—and I have kept this farm. I love these trees, that brook and all I see. A little child playing, stops his play, looks up with great round eyes, and says: "*I* love these trees, and I love you too, grandpa." Inside the house are both the old and new. And so this child will come to manhood breathing every day the atmosphere of the present and the past, feeling the influences of the present and the past; and *he* will keep the farm, and sit beneath the trees, and sleep beside the old gray rock.

Where there are but scores of these delightful object lessons, there should be thousands, where all the associations should draw us to the old home farm. And here I believe is the true solution of our question. Then our help would be abundant and capable, good, honest native farmer boys and girls and men and women. But to bring this all about there must be as I said before some good, sound teaching and examples for the young, some good sound teaching for and practice by our older friends. How often have we seen fathers and mothers striving to give their children such an education as will preclude their ever having to work on a farm. Turning them away from its comparative possibilities, its certainties, its moral safeguards into what; the world. They build high hopes upon the world. Can we expect the hired man or hired woman not to feel a sense of degradation, and do we wonder that so few are found to do the work too menial for our own sons and daughters. While we have been educating the latter out into the world, we have educated the former in the same direction, by a process less expensive but vastly more expeditious. A liberal education is desirable from any point of view. It will serve to adorn the farm no less than the salon and the drawing-room. In fact well educated farmers are among the things we need to elevate our vocation. But farming can never become a business, when sons and daughters are educated for something else. If education were a passport to success in the world the case might be different, but it is not a passport. Of course it is idle to claim that all should be educated for the farm. Gifts are bestowed upon man to be used in other directions. But after all, people are somewhat apt to over estimate or be mistaken about their talents.

I know of several instances where the so called "fool of the family" without any education beyond that of the district school and the shrewd knowledge which the farm is apt to give, has made farming his business, and about this season of the year sends spare rib and sausage to his poor relations in the city. Having thus far in a general way expressed our views as to where the farmer ought to look, and must look for help in the not distant future; we will consider the question logically, and it resolves itself under three heads, employer, employe and wages. In addressing myself to each of these heads of the subject, I shall, at the risk of offending somebody, use plain language. There is a power in the world to the study of which, studious people have for a few years, been devoting considerable attention. It is called natural law. According to natural law the best employers as a rule get the best help. Now if we can analyze and show up a good employer we shall have taken another step towards the solution of our question. To consider him negatively he is not a man who looks upon a laborer as a mere machine, capable of turning out so much work in a given time on each piece of which is a certain amount of profit. He is not the man who holds the old rule that a day's work is from sun to sun in summer, and on special occasions even longer, to be still in vogue. He is not a petulant, fault finding, avaricious task master. He does not consider the payment of the stipulated sum in wage money to be the whole extent of his obligations. He does not show by his habitual bearing that he is conferring a favor by tolerating the presence of the workmen in his fields. He is a man who in the first place thoroughly understands his business, thus commanding respect to his ability and judgment. If not the hardest worker on the farm, he at least accepts the truth of the old couplet,

> "He who by the plow would thrive,
> Himself must either hold or drive."

While he conducts his business on business principles he realizes that he has obligations outside of the payment of daily or monthly wages, and he is ever ready to discharge them promptly. He recognizes the brotherhood of man. Henry Wood, an able writer, says that "the exercise of the kindly and brotherly elements that are inherent in man's nature, while not strictly entering into business itself, surround, gild and refine it, lighten its burdens and soften its cares. They are like the springs and cushions of a carriage, which, while they have no direct relation to the speed or distance render our progress much more comfortable and easy." The right kind of an employer does not hold himself apart but shows that interest in his workmen that dispels all feelings of antagonism—that gives them the impression that they are the staff not the crank on which he depends. He has that noble manhood which stoops not to flattery and smooth words, but has genuine praise for faithful service. He is a man who knows that the advantages are not or should not be all on his side but should be mutual. He is a man who pays promptly and cheerfully. And finally, when his eye looks over fertile meadows basking in the sunshine, uplands smooth like velvet carpets, with no stick nor stone on their green bosoms, pastures well fenced, acres upon acres of corn, potatoes, oats and other crops, orchards bending their boughs earthward redolent with wealth of fruitage, huge piles of wood, a certain mark of thrift, neatly stored in sheds, sleek cattle, these and all the other evidences of success, he does not boast and say "see what I have done," but gives due meed of praise to the weary arms that swung the axe at wood-shed door, the willing hands that ploughed and hoed, that bound the sheaves of corn and toiled the summer through. This is what makes the men contented. This makes the eye grow brighter and the form take on a manlier look. This has a sweeter sound than dollars to a sensitive, honest mind. This calls forth the most efficient service, the best feelings of those whom we employ. The instances are rare where such an employer as I have depicted, fails to secure all the help he needs. Those who are everything which a human being should not be, deserve no sympathy. Let them lack for workmen till they learn humanity.

EMPLOYE.

Many of the above principles apply to the employe with no less force than to the employer. The most competent and faithful workmen command the best wages, are hired first, are retained the longest. A conscientious laborer will subserve the best interests of his employer. He will be no eye servant. He will not rely on circumstances but merit to give him good wages. He will realize that good honest muscle, skill and energy are salable no matter where he goes. He will rejoice with no selfish rejoicing when the business is profitable knowing that on his employer rests the risks. A man who is the reverse of all this must expect jobs to be scarce and wages low. It seems to be the fashion to consider that it is a condescension to work on a farm. When we come to study the matter we find that, perhaps, the idea originated a long time ago in Europe, during the Middle Ages. A sovereign victorious in war gave vast tracts of conquered territory to his favorites, and the subjugated people occupied the land as vassals. To compensate for their lives being spared, they held themselves bound to bestow personal service at any moment, and to fight the battles of their lord. In times of peace they tilled the soil. Socially they were despised. A stigma was upon them. They were considered to be degraded, and doubtless many of them became so. How much of the social feelings of those days we have inherited we cannot tell. I am inclined to believe that the influence of that state of affairs has been strongly felt in America. Education of the masses has shown the error, however, so that the more philosophical among us are convinced that the farmer's calling is as honorable as any, and more so than *many* others. I do not know as the farm is the only place where folks do not like to work. I am somewhat afraid that too many people are putting the deepest of their studying into how to avoid it, rather than how to get the best results out of it. It has been computed by political economists that the consumption of one year is equal to one-fifth of the property of the world. So that five years of idleness would consume all that man possesses. It follows, therefore, that four-fifths of mankind live on the proceeds of labor. Four out of five must work with hand or brain. The competition among idlers is becoming altogether too sharp for ordinary people to get a living by their wits, as they express it, by a very much harsher name I state it.

Let us not be led astray by the doctrine that the world owes us a living and that we will not work to get what belongs to us. That doctrine has filled a good many poor-houses and a good many prisons, has made a great deal of unhappiness, as is apt to be the outcome of false doctrines. The world does not owe us a living until late in life and only then upon conditions. The fact is, that for at least the first fifteen years of life, we are indebted to the world for all the necessaries of existence, for its forbearance, its patience and its teachings, no small sum in the aggregate, when reduced to dollars and cents or to days' works.

If for the next ten years we can pay for our support and for an education or a trade we shall have done well. Then in the prime of life the years should be devoted to paying our debts and in placing a balance on the other side of the ledger on which to draw in old age, else we shall come out finally in debt to the concern. It is little wonder that when the wise old world hears people say you owe me a living, she puts her choice baked meats and dumplings out of reach. Industry is the key to her heart, the ticket to the first table. Labor is honorable in any honorable calling, and the employe need not be one whit less a man than his employer. A man at work for hire should aim to be an employer himself, and with that end in view he may find a solace for fatigue, an incentive to persevere.

WAGES.

We now come to consider the most important and interesting part of the subject, wages. How many people there are who hear and use this term and realize but little what it signifies. What are wages? Webster says: The reward paid or stipulated for manual labor. The term is also used in connection with seamen and soldiers. We do not use the term in speaking of municipal or other officers, to whose reward the name fees or salary applies. This definition does not strike deep enough. In what do wages really consist. I should say food, clothing, home, education and surplus, provided, parenthetically but firmly, that these be sought in some pursuit where honor and morality may be not only preserved but strengthened. As we consider each of these five elements in turn we shall see that the farm can pay better wages than other callings in some if not all of them. It may seem strange that food is placed first on the list. As an element of wages I think a little reflection will show us that from the savage to the civilized man, a step measured by thousands of years, the acquisition of food has been the primary impulse to exertion. Then, if food is the first consideration, we must have good food or the wages are not good. Now where should we expect good food if not on the farm where it is produced. But is the farmer's table pre-eminent for quality and abundance of such as is suited to working people? Does it excel the average boarding-house? Has the era of salt pork or salt fish and potatoes, varied by beans twice a week, entirely given way to fresh meat, vegetables of all kinds, and fruits of this latitude each in its season? If not, then our farmers who board their helpers are not paying good wages. They are not getting good wages themselves. I hold that a good bill of fare costs the farmer no more, if as much, as a poor one. A little foresight is all that is necessary. A vegetable garden planted early with choice varieties and well cared for, so that it shall yield something seasonable every day in the year is the most profitable half acre on the farm. A variety of small fruits should be available for dessert. We should raise these things to eat ourselves if not to sell. We must put good fuel in the furnace if we would have plenty of steam in the boiler. The tiller of the soil is entitled to the first fruits thereof. It is a just retribution upon us, that, if all the spring chickens, the fat lambs, the strawberries and the turkeys go to town, the hired man, the housemaid and our children too make haste after them. I am strongly tempted to dwell longer on this point, but from what has been said it may be seen that the first great element of wages, food, can be and should be, on the farmer's table, of quality the best, in variety the greatest. If the farmer who takes it at wholesale cannot afford it, nobody who buys at retail can, unless the farmer or farming be a failure. By the inflexible principles of natural law, no business which produces necessities can be a failure. It may suffer depression but desertions to other lines will commence and continue until adjustment comes, or what is more likely until a reversed condition exists. Farming being a business which produces a greater line of necessities than any other business need not be a failure, especially since the production pays so large a part ot the wages—food. It is true, as stated in the introduction, that a gocd many of us are having all we can do to get a living. But I fear that in too many cases the trouble originated through the efforts of a former generation to take the maximum of their wages in suplus, the minimum in the home—the farm. The present generation, quite a part of it, are pursuing the same ruinous policy. In other words the apparent failures are not due to the business but to something else.

There are at the present time, a great many benefit associations which are organized for the purpose of securing a sum of money to the family of each of its members at death. I know hundreds of men whose lives are thus insured. Most of them are men who work, and about all their surplus goes to pay their assessments. This is mentioned to illustrate this point. Had it been the settled policy of the farmers of Maine, for the last fifty years to invest their surplus in the farm and improvements, any intelligent couple would now have no difficulty in getting good wages themselves, and farming would be so much a business that as a rule we should employ help and pay them good wages. Bonds, investments and savings banks may have been to the apparent benefit of the farmers who made use of them but have been rather hard on the farm and the subsequent owners. A farm in good condition as to fertility, well equipped, and with the associations always connected with it is valuable of itself and is a business in addition. It is a nobler legacy than a life policy which is just a given number of dollars. The moral which I would draw is this: feed the farm and it will feed us, and gradually we shall be able to do a better and a larger business and finally leave a richer legacy to our children than some of our fathers have left to us.

CLOTHING.

It has been said that clothing represents the civilization of a people. This may be accepted as a fact with certain reservations. The utter absence of clothing would stamp a people as savages certainly, but the most faultless apparel does not necessarily mark the wearer as individually of the highest type of civilization. What refinement would consider as well adapted to a business man, it would find unsuited to a clergyman. The tailor's clerk and farmer boy would each be clad in very poor taste were they to exchange either their working day or holiday attire. So the matter of deciding when a man or a woman is well dressed is a comparative test. On a farm, a person may be well dressed either for work or for church, without drawing so heavily on the other elements of wages, as the tailor, the clergyman and many others are obliged to do. I have often thought that one reason why so many young people, and older ones too, were so anxious to live in towns was somewhat due to the fact that tall silk hats, kid gloves and canes were less *au fait* in the country. If a person wishes to take the major part of wages in clothing the town is a very good place, and if silk hats, kid gloves and canes made men, or silk gowns and satin slippers made women, the town might show some advantages. Somebody has said, I think it was an old German writer, that the body in its inordinate vanity is quite apt to appropriate to itself the approval which is bestowed upon the clothes.

An American, more concisely stated the same fact. The tailor does not make the man. Then if it is desirable and right to appropriate only such portion of one's wages to clothing as true manhood and womanhood would dictate as suited to that which society and good taste and comfort has a right to demand, and to use what is thus saved, for a nobler purpose, then the country and the farm pays better wages in the second element.

HOME.

There are real homes and artificial homes everywhere. I think the man who works for wages too often lives in the latter and that this is one of the greatest faults in our industrial system. Home cannot be otherwise than artificial if it be in a boarding-house. It matters little to a tramp where he is. We would have the farmer employ people of character. He cannot really afford to hire any other. He should then see to it that the third element of wages is of standard coinage. Our horses are content and do good service if they eat and sleep. But a human being intelligent enough to do good work is intelligent enough to enjoy more than food and lodging. A man who works hard demands rest, and rest does not wholly consist in relaxation from toil. Diversion of some kind is required and sought. Our employe of character needs something that appeals to the eye, the ear, the mind, or to his noble nature. All that is at once pure and necessary abounds in the real home, and should be accessible to employes who compose a part of the family. A great many men refuse to work on a farm because there is nothing there that they seek except the work. That element of wages, home, is not to be had there, and the most desirable, the most faithful are those in whom the home instinct is strongest. To pay good wages in home delights the farmer must necessarily have a real home himself. To definitely show just what a real home comprises is difficult, but it is often easier than to collect and combine the various charms which make it, to say nothing of the persistent opposing circumstances that have to be overcome and kicked out of the way. It can never be done if we attack them all at once. Better take them one at a time and if they are pretty well intrenched take the weakest first. A large house, a piano, and bric-a-brac do not make home. It is rather that nameless something which pervades some very humble houses that we know of. They seem just suited to the owners, and the owners to the houses, and they have no thought of parting company. Our ancestors emigrated from the Eastern Continent and settled upon the eastern shores of a vast territory. They undertook the task of subduing and peopling the whole. Their descendants have been striking out as we call it ever since. If the Pacific Ocean had not set a limit to our expansion we should by this time have become a nomadic race. The wave is now receding. It is time and past the time for a different policy. Too many homes have been but nests, good enough to be born in but from which the fledglings hasten when it has served its purpose. They expect to build in taller trees, in sunnier nooks, in a more genial climate. Some of us have fostered that feeling, forgetful of the tempest, birds of prey, and fowler's snare. We have builded for the present only. If we wrought more for the future, looking to the time when grandchildren and great-grandchildren should till these acres, kindle altar-fires on these hearths, and gather at night within these homesteads, how many more real homes should we build up. How deep would be the impress of our work.

EDUCATION.

What it should be, how obtained and how utilized, is a subject too vast and too important to be superficially treated. It deserves an hour to itself, therefore we will not here attempt the task. Observing only that a *young* person will do well after food, clothing and home have been earned, to take the balance of wages in education.

THE SURPLUS.

There never was a nation on the face of the earth which had a more inordinate craving for wealth than the American. Almost everybody starts in life with the feeling that not to accumulate a fortune is to live in vain. It is clearly prudential to take such a part of our wages in surplus as shall enable us to live in comfort after we are no longer able to earn the vital elements, food and clothing. If we can leave still enough more at death to aid our proportion of the next generation, to that point when it shall first be able to draw its element of surplus, we shall have done well, all that ought to be expected. I believe large legacies tend to break down genealogical trees with a load of dissipation, ill-health and decay. We have come to estimate and compare people too much by their surplus. The desire for it has become a passion, a fever. We need to shake off its delirium and forget it. When a man has sufficient intelligence to perceive what he ought to be, judgment enough to discern what he may be, and decision enough to determine what he will be, with industry and perseverance on his part the surplus will take care of itself. The practical question with farmers who have a surplus is what shall be done with it, how shall it be invested? The answer is plain. If farming is to be a business put a large part of the investment into the farm, to get more home comforts, better wages, a more valuable business in the future.

If farming is to degenerate, if it is only a makeshift, very likely there won't be any surplus. But if as sometimes happens in a favorable season, there is a small balance, hang on to it, and pray for another good year. A man who hires out ought to aim to have eventually a surplus sufficient to start him in a moderate business of his own. To such a man I wish to offer, in closing, a few words of encouragement. He who has health need not fear the future. Suppose from the time he is twenty-one till he is sixty-one years old, he draws fifty dollars of surplus each year, at six per cent simple interest the amount would be about $4,400. If the interest be compounded annually the sum total would amount to something over $8,000. It is slow work at first. It usually takes longer to get the first $300, than to get $500 afterwards. It is well to invest our surplus safely until we are able and wish to make a business for ourselves. The lessons that we shall learn while getting a start will be just what will come of use and be valuable when applied to the judicious purchase of a farm, and to the carrying on of the business. The possession of a large amount of property makes a man wealthy, but after all, I know *some* men who, with their small farms among the hills of Maine are richer than Vanderbilt or Gould.

The richest man I ever knew is seventy years of age, yet not infirm, but still in strength a match for many men at fifty. He was the youngest of a family of ten. Born and reared in a log house, he commenced life for himself by working on a farm at eight dollars a month, and on a farm he has worked ever since. His real estate consists of about one hundred acres of land, one-third of which is in fields. The buildings are not large and have nothing about them to attract the attention of a stranger, the whole being worth in open market about fifteen hundred dollars. To look at, it is hardly an average Maine homestead as they actually exist. The great bulk of the owners wealth is in personal property. In all the country round about, he sees no such thrifty saplings as grow on that eastern ridge, where the sun comes struggling up in summer mornings. In Italy nor elsewhere are there such gorgeous tints, such bewildering glory, such restful shadows as are seen from that low porch door at sunset, reflected from the chain of wooded hills ten miles away. The most marvelous corn in all the world grows in that upper field. The oats upon the low lands have the plumpest kernels, the orchard bears the reddest Baldwins, the yellowest Bell-flowers, and—*by King*! (this is his mightiest oath,) you ought to see the grass that grows down there in the run, where he once dug a ditch, straight as a line, for forty rods and more! Should you, belated on a winter journey tarry there all night, you will see the cows, "Old Jersey" and "Young Bess," the black nosed sheep, the oxen, "Buck" and "Bright," the old mare and her colt, there are none better anywhere.

The supper over, before the open fire of maple logs, the host will shrewdly seek to know from whence you came, and what has brought you to these parts, and sound you on your politics. Then, when the cheerful blaze has warmed the new-born friendship, somewhat in confidence, somewhat in reminiscence, he will tell you of the times when here was forest—will tell you of his toils, his triumphs, will show all his wealth in these three coffers—honor, purity, contentment.

Has life brought even this to those who played with him about the cabin door, and sat with him in school, but sought a fortune where sin walks boldly on the crowded streets and swarms in every alley, and whose wages are but death? Can life bring more to you or me than it has brought to him? Surely the farm has paid this man good wages. And better still his honest head will one day wear a crown.

FARM ACCOUNTS.

By JOEL RICHARDSON, North Newport.

No class of men doing business except farmers think of carrying on their business without some form of book-keeping. The success or failure in any business depends in a great degree upon the care and accuracy of the accounts kept. Many of the failures in business can be traced to the want of clear and accurate accounts. Merchants know by their books the exact cost of each article with freight and other charges, and mark their goods with cost and selling prices, and can tell at a glance what their profit or loss is. Manufacturers keep accurate account of cost of material, cost of labor and interest and taxes on property invested, and know to a fraction of a mill what each yard of cloth or pair of shoes or other article costs them. They are able to tell when their goods are sold what the profit or loss is, and to judge more correctly how to continue business. Farmers who keep no books have no means of knowing what branch of their work is paying them a profit or what is being done at a loss, and for want of this knowledge often give most of their time and attention to crops or animals on which they are losing money, and neglect those which are paying a good profit. Not much has been said at farmers' meetings or by the agricultural press about the necessity of farm accounts, and what has been said has been of a discouraging nature. Some years ago a gentleman of great wealth, who was running a fancy farm, talked on farm accounts at several institutes and told the farmers they must keep a full set of double entry books. Another, a college professor, gave forms for farm accounts full of personal matters which confused and mixed the accounts so as to make them worthless. These men required too much, and, therefore, discouraged farmers from doing anything in keeping farm accounts. Farming is often said to be a science but not an exact science. If our knowledge was sufficient to thoroughly understand all the facts of plant growth, farming might be an exact science. This want of full knowledge interferes somewhat with strictly accurate farm accounts. The man who has the best knowledge of the requirements of crops will be able to keep the most accurate accounts and will not only know what crops pay him the best but will be able to judge more correctly as to what changes to make in his farming. Having for sixteen years kept full accounts with my cultivated crops and partial accounts with animals, also records of many experiments, and finding it to require but little labor and of much benefit in showing what has been done at a profit and what at a loss, I wish to call the attention of farmers to simple forms necessary and what this system of accounts has shown as the result of sixteen years of practice. A full and accurate account with animals requires that they be fed separately and their feed all weighed, involving more labor than the common farmer can afford. But any one can try an animal for a week without much trouble, and while such experiments are not conclusive they will enable a farmer to judge more correctly as to the profit or loss in keeping such animals. Take a herd of cows, feed and milk them separately for a week, weigh the milk of each, also the butter. This will often prove that the one you had thought was your best cow is not paying so well as another you thought inferior. It will also indicate what cows are paying a profit and what ones you are keeping at a loss. Try different feeds and different amount of feeds with your horses and oxen. Many horses are overfed—the feed being worse than thrown away. Compare different kinds of grain, different kinds of grasses, different kinds of potatoes, giving them equal chances and note the results in your farm accounts, and you will find that in a few years you will have a record of facts that will greatly benefit you in your judgment and in your purse, and have a book you would not willingly part with.

In keeping accounts with cultivated crops all of the items are readily seen and valued except the amount of manure and of fertilizers taken by that crop. This will vary with the kind and amount of the crop. After sixteen years' experience and close observation, and comparing the opinions of many good farmers, I think that the average will be one-third. The cost of labor will vary with locality and kind of labor employed. Boys and ordinary hands at thirteen to fifteen dollars per month should be charged less per day to the crop than good men to whom you pay twenty to twenty-six dollars per month. The farmer should charge for his own labor and for that of his team in like manner. The charge for seed should be charged at the market price when used. Interest and taxes on the value of land which will vary in different localities should be charged accordingly. In crediting, the crop if sold may be credited with the amount received, but as it is often a part sold and part used on the farm, perhaps as just a way will be to credit the entire crop at the average price of the selling season. The point to be constantly aimed at in keeping farm accounts is to charge every item of cost at a fair price, and credit every item of value returned by the crop at a fair value.

I will now introduce a couple of pages from my farm accounts to illustrate the simplicity of forms of keeping these accounts and which after long experience, I think are better than more complicated methods.

IN ACCOUNT WITH 6½ ACRES WHEAT.

1886.	DR.	
May 14....	To 10 days' work plowing	$10 00
	5 " harrowing	5 00
	1 " rolling.................	1 00
	13 bus. seed at $1.33⅓	17 33
	3000 lbs. Phosphate, ⅓ to this crop......	19 00
	sowing..............................	2 00
	interest and taxes on land..	9 75
Aug. 21....	harvesting........................	18 00
Nov. 18 ...	threshing	17 00
	Total cost	99 08
	value of straw	27 00
	cost of grain........................	$72 08
	cost per bu. 38 7-10cts.	
	CR.	
Nov. 18....	By 188½ bus. wheat at $1.25	$235 62
	9 tons straw at $3.00 per ton...........	27 00
	Total receipts......................	262 62
	cost	99 08
	profit..............................	$163 54

This simple method of keeping farm accounts has shown the following results with my cultivated crops, which I hope may not only induce others to commence farm book-keeping, but show them farming in Maine still has a fair share of profit. By taking up the land cropped, with two-thirds of the value of the manure in the soil, it being laid down to grass, and charging a portion of the value to each hay crop the cost of a ton of hay may be closely estimated. The land on which the above crop of wheat was grown was in potatoes the previous year and was manured at a cost of fifty-one dollars per acre. Allowing one-third to the potatoes there was thirty-four dollars to charge to the coming hay crops.

Potatoes.

Average cost per acre for 16 years	$40 70
Average yield per acre for 16 years, 158 bushels.	
Average cost per bu. " "	25¼
Average profit per acre " "	33 40
Whole number of acres raised, 58.	
There was a loss in two years amounting to.....	114 60

Wheat.

Average cost per acre for 15 years	$18 73
Average yield per acre for 15 years, 19⅞ bushels.	
Average cost per bu. " "	65
Average profit per acre " "	19 22
Whole number of acres raised, 47½.	
There was no loss in any year.	

Oats.

Average cost per acre for 6 years.............	$16 16
Average yield per acre for 6 years, 51⅛ bushels.	
Average cost per bu. " "	21
Average profit per acre " "	14 85
There was no loss in any year.	

Beans.

Average cost per acre for 3 years	$39 75
Average yield per acre for 3 years, 23⅓ bushels.	
Average cost per bu. " "	2 10
Average profit per acre " "	8 12

These averages are not the results of favorable circumstances but the work has been done on an old worn out farm of thin, light soil. Many a farmer in Maine if he had kept accounts with his crops could have made a much better showing, and I hope more farmers will in the future, by book accounts, understand better what is being done at a profit and what at a loss. Reference to the records of our past farm work will often bring to mind facts we had entirely forgotten and which will show us whether or not it is best to make changes in our work, and whether this or that kind of crop or manner of cultivation is best for us at the present time.

BUSINESS DAIRYING.

By R. W. ELLIS, Belfast.

Before discussing the main question of dairying I may as well say a few words in answer to the question that is constantly coming up in the mind of every one who is thinking of going into the business, to wit: If we all go into it are we not going to meet the same results we have in the beef business? And surely this is a very pertinent question to ask. We must remember in the start that the production of beef and butter call for altogether different methods and conditions. The production of butter for the general market cannot be carried on successfully below certain degrees of latitude, while the warmer the climate the better for the production of beef. The beef markets of the East have never been seriously affected by competition from any of the states that have or may go into the butter business. In fact, those very states, such as Ohio, Indiana, Illinois, Iowa and Wisconsin have been largely driven out of the beef business by the immense ranches of the South and Southwest, where about the only cost of raising beef is in looking after their cattle and rounding them up once or twice a year and branding them, while the production of butter can never be carried on in that climate or by those methods. Good butter has got to be made by the same methods whether East or West. Cows must be housed and fed, cleaned and milked, and all the details attended to the same in Iowa or Wisconsin as in Maine, and it is no more work to do it here than there. They have as severe winters as we do, though perhaps not quite as long; we can raise as much cow feed to the acre as they can; they have to dress their land the same, though may be not quite as much. The only material advantage they have in raising their feed is in the much larger areas they can cultivate in a body without obstruction. And to offset this, we have our nearness to market, less cost of transportation and the ability to place our butter upon our customers' tables in much less time and in better condition. This is being appreciated more and more each year by those who are the best paying customers. Then take into account the fact that the State of Maine has in no year yet produced butter enough to supply its own market the whole year, and the further fact of the small amount that Maine could make in comparison to what is made in all the other great butter States. Suppose all her farmers should go into the business. It don't look as though we should overdo the business right away.

Now we come to the main question,

WHAT OF DAIRYING AS A BUSINESS?

First, I will say it is the best business the farmer can carry on to enrich the farm. This must be the corner-stone upon which the New England farmer must build if he wants to be permanently successful. It is suicidal to adopt any system of farming, although it pays well for a time, if it is at the expense of the fertility of the farm. There is no farm product we sell that carries away so little plant food according to its value as butter—not over twenty-five cents worth to the ton. The plant food is practically all left in the skimmed milk and buttermilk, and when we feed that out on the farm we have lost comparatively nothing. The chemists tell us that the dressing resulting from the feeding of skimmed milk if properly saved both liquid and solids, is worth one cent per gallon. Then the cows are at the barn more than most any other animal we keep, and their droppings both liquid and solids are the very richest in plant food. I have found from my experience that each cow in a herd will make if properly supplied with bedding, two cords of dressing per year besides what results from feeding the skimmed milk. So you see that for enriching the farm there is no other kind of stock to be compared to the dairy.

Then again it requires less capital to carry it on than is the case with most any other line of work from the fact that it brings quick returns, and you can have your money to turn over every month if you choose. Getting your returns so often enables you, if you keep an account with your business as you should, to know at all times how you stand, whether you are making or losing by your operations and how much. Hence I say it is the safest business we can engage in.

Again, it more thoroughly developes the farm than any other business. There can be more other branches brought in as auxiliaries, for while making butter the main reliance for revenue, one can with his skimmed milk raise calves, pigs, colts, lambs or poultry. In fact there is no young animal grown on the farm but will grow faster and do better on skimmed milk than anything else they can be fed upon. So that the dairyman can bring in as a sort of side issue that which is most congenial to his tastes and that of his family. And there is no crop grown on the farm but can be fed to some of these growing animals. This diversified industry tends to more thoroughly develop the man and his family than any other. Each can have something suited to their taste to care for and be interested in, and this business taken as a whole gives a man more chance for profitable study and experimentation than I think I might safely say all other branches of farm industry combined. This has a direct tendency to broaden and elevate the mind not only of the head of the family but of every member thereof, for there are so many things to be looked after, and each having a profit in itself if properly cared for, that each can have something of pleasure and of profit to engage in.

It stimulates the farmer to constantly increasing efforts to increase his products and his income. He can see every night when he goes into his milk room how many inches of cream he has for the day, ten or twelve cents for every inch, one dollar for every ten inches. It excites his ambition to try and increase it by better cows, better feeding or better care, or by improving his farm and changing his system of crops so as to make it carry a larger herd and thereby increase the number of dollars coming in every week. There is a constant inducement to improve. Then there is a healthy spirit of rivalry comes in among neighbors, each knowing how the other is getting along and not wanting to be outdone. The ambition to excel runs through whole neighborhoods and towns, begetting general thrift and independence. This is noticeable by the observing traveller as he passes through sections of the country where this has been the leading business for any length of time.

If judiciously managed it will pay better on the average than any other business that the Maine farmer can engage in. With first-class butter at twenty-five cents per pound, round hog at six cents and dressing at four dollars per cord, a man with money to invest can pay forty dollars per head for his cows, ten dollars per ton for hay, twenty dollars for corn meal, twenty dollars for shorts, and twenty-four dollars for cotton-seed meal, feed his cows from the barn the year round, pay all his bills and make a larger percentage on his money invested than most any other manufacturing business he can engage in. This is no idle theory or guesswork but a candid judgment based upon an experience of more than thirty-five years, with many carefully conducted experiments running through months and years at a time. There is no jugglery about this business, no dark or devious ways hard to find out or to understand. Anyone having a good cow can if he will, go home and in one month's time find out whether what I am saying is true or false. With a good herd of butter cows, fifteen pounds hay, three pounds corn meal, three of cotton seed meal and two of shorts ought to produce one pound butter per head for every day during the milking period, which should be 300 days. Of course to do this they must have proper care, and everything must be in first-class condition. Go to all the leading butter makers in the State, who are conducting their operations on strict business principles—weighing, measuring and keeping a strict account with everything, and ask them what it costs on an average the year round to produce a pound of butter and I venture the guess they will all come between twelve and sixteen cents a pound. Of course there will be variations in cows and in methods of feed and care.

I never had my cost when I have kept accounts go as high as the highest figure named. I have had it go lower than the lowest. I have often had farmers ask me how much net profit a cow would pay in a year, and when I told them from ten to twenty dollars they would say, "that is rather small pay for taking care of the cow and making the butter." But don't you see she has paid you market price for everything you have raised on the farm right at home, and given you all the plant food there was in them for your next year's crops; and if she does nothing more you should be satisfied. (There is scarce another animal we keep that will do that.) But in addition to that, if she is a good cow and well cared for, she will give you a net profit of from ten to twenty dollars. The only astonishing thing about this is, that with all the testimony there is, and all tending in the same direction, the farmers who are situated so they can, do not all go into the business.

What are the requisites to success? Remember my subject is Business Dairying. It has nothing to do with the farmer who keeps three or four cows just to supply the family with milk and butter, raise a few calves from and let them shift for themselves without any particular care. My subject pre-supposes that a man has some capital and wishes to engage in some farm business. It makes no difference whether it be woolen goods, toothpicks or butter. You want to apply the same principles to one as the other. In the first place you want the best machine you can get, one particularly adapted for the business in hand. In this business the cow is the machine and you want the one that will give you the largest amount of the best article at the smallest outlay of feed. In my experience I have found more difference in quality than quantity of milk; and as a rule the milk that makes the largest quantity of butter also makes the best quality. This may not always be the case. The first trial that I ever made of different cows' milk was more than thirty years ago. I bought a cow of a widow lady which the neighbors said was a very nice butter cow. I paid a large price for her. She came in shortly after I bought her and I did not feel very well satisfied with her. I could milk her any time in a six quart pail. I bought another cow about the same time that gave a ten quart pail running over full, and I thought was a much better cow. There did not seem to be much difference in the milk. It all went in with the rest of the herd together. The next winter No. 1 was giving four quarts per day and No. 2 seven quarts. My wife suggested that we try the two separately, so she took two days of each which made eight quarts of one and fourteen quarts of the other, set it, skimmed it and I churned it in a can, and from the eight quarts we got lacking one ounce of two pounds of very nice butter, and from the fourteen quarts we got one and one-quarter pounds of very poor frothy butter. I tell you this was an eye opener for me, and from that time to this I have not kept a cow in my herd for any length of time without knowing what kind of milk she gave.

Pardon me for citing one more case in point, and I do it to impress upon the mind the importance of this matter, for I believe on this particular point more then any other turns the success or failure in dairying. Some years ago I sold to one of my neighbors a Jersey cow in the fall of the year. He had another cow at the time about the same size and which looked very much like her, though not a Jersey. He said she was a very nice cow and if the one I sold him was as good he would be satisfied. They both calved in January. He fed them both alike and they made twenty pounds butter per week, the two. He was very much pleased. I asked which he thought was the best, and he said there was not much difference, they gave the same amount of milk, and there did not appear to be much difference in the quality. I persuaded him to try them separately for one week. He did so and the next time I saw him, he said, "Well, Ellis, I am beat. The cow I had of you made twelve pounds and nine ounces and the other only eight pounds, and no man in the world could have made me believe it if I had not seen it with my own eyes," and he said the cow I had of you made much the best butter. He said there was not much difference in the milk, but a very marked difference in the cream. I have given these two instances (and I might repeat them almost indefinitely) to show, as I have said before, the importance of having the right kind of machines to work with. There are hundreds of cows kept in this State, the owners of which would be better off to kill, take their hides, and give their meat to the hens than to keep and feed them. I am not blowing for any particular breed. I am not a dealer in any kind of stock, but I do want to impress this upon your minds that it is very much more profitable to feed cows that will make 300 pounds of butter in a year than those that will make only 200 on the same feed. Good cows are not all confined to one breed. You will find them in most all herds, though more in some than in others. I think the Channel Island cows which have been bred for centuries especially for butter, are the most profitable all things considered for the dairymen of Maine. But I would not advise those having other cows to sell them off at a sacrifice and pay high prices for others to take their places, but test the cows you have. Very likely you have some good ones. Breed these to a thoroughbred bull of some good butter strain and dispose of your poor ones as soon as possible, and replace them with some you know to be good.

Next you want to understand thoroughly the nature and requirements of the machine you are dealing with. It takes a certain amount of food to keep it running and the animal will take that every time before they give us any return. We want to make this loss as small as possible. A certain amount of this food is used for fuel to keep the animal warm. The temperature of the body is about 98° so you see if we keep them in a tie-up where the temperature is 30° it will take about double the food to keep them warm that it will if it was 60°. Hence the need of tight, warm cow stables. Next, physical force is supplied by food. Every movement or exertion draws on the food they eat, so we want to keep our cows as quiet as possible, giving them no more exercise than is absolutely necessary. Then there is a constant waste of the system going on all the time which must be supplied by food. Suffering from any cause whatever increases this waste. Every observing dairyman knows that when his cows are uneasy, nervous, excited or restless from whatever cause they invariably shrink in their milk. Why? Because it increases the waste and thus draws more from their food and leaves less to go to milk. Not only this but it hinders the digestive and secretive organs from performing their proper work. So we want to keep them just as warm, comfortable and happy as possible. When we have looked after all these things we have reduced the maintenance ration down to the minimum.

Right here I may as well bring in the matter of *kind treatment* and regularity in every detail, any harsh or unkind treatment that causes nervousness or suffering takes just so much from the profits. When possible have the same person care for and milk the same cows. Have all chores done at the same time each day. Whether fed twice or thrice, watered once or twice, let it always be at the same hour, and the same with the milking. Then they know what to expect and when to expect it and are contented the rest of the time. But when the chores are done when most convenient or at any time of day that happens, they are in a constant state of uneasiness and expectancy and are never doing their best.

Next comes the feeding problem. This calls for more careful study and experimentation than any other in all our farm management. Happily we are not left to grope in the dark. Science comes to our aid. Chemical analysis gives us the different elements of which the feed is made up. The particular office of these different nutrients in the animal economy are also now well defined. Now don't say you want no book-farming, for I tell you the farmer who is not willing to take all the information he can get from whatever source it comes is going to get left. Not that I would have you believe all you see published in books and papers called science by any means, but when the chemist tells us corn meal for instance is made up mostly of carbonaceous or heat and fat producing elements and but very little of the albuminoids or bone and muscle producing matter, and we take a pig and feed him on corn meal alone and find in a short time we have got a lump of fat without legs sufficient to hold him up, we must admit he is right because it agrees with practice. And when they tell us there is practically as much albuminoids or muscle producing elements in skimmed as in whole milk and we take two calves and feed one on skimmed and the other on whole milk and find one has as large a frame as the other we are bound to say they are right. So we must prove all things and profit by that we find true. There is no crop the farmer produces but has all the different elements in it only they are found in different proportions in different plants. So with all our cattle feeds. There is none but have all the elements of nutrition in them, but some are richer in certain elements than others, so we must make up the ration wanted to correspond with what we want to produce as nearly as we can. Here comes in a very perplexing problem and one which requires a great deal of study and close observation to determine.

Animals are not all alike in their makeup and in their tendencies. Some are inclined to take on flesh at the expense of the milk pail; others run to milk and grow very poor, while others still give a large mess of milk not very rich, and still others give rich milk but a very small mess. All these tendencies have got to be taken into the account in making up the ration of each animal if the highest point of attainment is to be reached. The animal stomach is capable of doing a certain amount of work and doing it so as to get all the benefit from the food eaten. You may crowd more through the animal but a portion of it will be lost from imperfect digestion and assimilation. As it takes a certain amount to supply the wastes of the system for which we get no return, the larger amount above that we can get them to eat, *if properly digested and assimilated*, the greater the profit, because the smaller the percentage of loss. Good hay contains all the elements of nutrition, and in fair proportions for the productions of milk and butter, but it has long been known by all our intelligent feeders that it was not profitable to feed alone because it is too bulky and the animal stomach can not thoroughly work over enough of it. Hence the custom of late of feeding quite largely of more concentrated feeds. But I think there are but few farmers who have got down to the minimum on coarse fodders or up to the maximum on concentrated feeds in order to attain the largest amount of profit. In these days of low prices and small margins here is a matter worthy our most careful consideration. I think if our experiment stations would take hold of this matter and by thorough and careful experiment show us the relative amount of coarse and concentrated feeds that would give us the largest returns for the outlay, they would confer a greater benefit upon the stock men of the State than in anything they could take hold of. As far as my experience has gone, the smaller the amount of coarse foods in proportion to the fine the greater have been the profits; and as far as I have been able to learn from others who have kept debt and credit accurately the results have been the same in almost every case. A large part of the experiments that have been made in feeding have been to determine what method would give the largest results without regard to net profit.

Let me cite a case: At one of the institutes held a year ago, one of the speakers advised fifteen pounds of hay per day as a fair ration for an ordinary sized cow. One of the farmers present said his cows would eat twenty-five pounds and he believed they were the best judge of how much they needed. So the next winter when his cows came to the barn he thought he would experiment a little. He commenced giving them twenty-five pounds per day in five feeds with a liberal grain ration, and weighed his milk for a certain number of days. Then he cut them down to fifteen pounds per day for a while, and weighing again he found they had fallen off in milk a trifle over one and one-fourth pounds per day per cow. Without stopping to figure cost or profit he jumped to the conclusion that he had knocked the light ration theory higher than a kite, and so declared. If he had figured the experiment out he would have found his extra amount of milk cost him ten cents per quart, or when he was feeding twenty-five pounds per day his milk cost him three cents per quart, and when he fed fifteen pounds per day it cost him only two and one-half cents. If he was making butter it would make four cents per pound difference in cost, and in these close times that is an item worth saving. Thus you see the matter of feeding if we wish to succeed demands our most careful study and experimentation. From what knowledge I have been able to gather up to the present time, I should say about three-fifths by weight of the ration for milch cows should be made up of coarse foods, such as hay, straw, corn, stover, etc., and two-fifths of concentrated feeds, such as corn meal, oatmeal, cotton seed meal, shorts, etc., or from twelve to fifteen pounds of one, to eight to ten of the other for an ordinary sized cow from eight hundred to ten hundred pounds live weight. But I am by no means certain these figures are correct, but am still seeking for more light and better knowledge.

If the dairyman intends to raise his own feed for his cows (which I think every farmer should do,) I think he cannot do better than to raise corn and oats and peas mixed. Grind his corn on the cob and give his cows about six or seven pounds of cob meal and about four pounds of oat and pea meal per day, and he will find it a most excellent ration. If he buys his feed he cannot do much better than equal parts corn meal and cotton seed with about one-half as much shorts by weight.

Then the matter of cleanliness comes in which must be strictly adhered to in every particular, from the cow stable to the butter firkin, for when dirt, filth or bad odors of any kind once get into the milk they never can be eradicated.

First-class butter (and no other can be made to pay) can never be made except from perfectly pure, clean cream. Have your tie-up so arranged that it will be but little work to keep the cows clean, and if they are kept clean there will be little trouble with dirty milk. Plenty of sawdust is a very fine thing about a cow stable. It readily absorbs all the moisture, and is a remarkably good deodorizer.

I have thus far said nothing about the different methods of manufacture whether by private dairy or the associated plan. That must be governed in a great measure by circumstances. Just as good butter can be made and as good profits realized from the private dairy as any other if circumstances and conditions are favorable. Near all our cities and large villages butter can be made and furnished to private customers at better prices than can be obtained for creamery butter. But if the butter has got to be shipped away and sold in large lots the associated system is much the best, for the product is more uniform in quality and brings in wholesale markets much better prices, often enough more to pay the entire cost of manufacture. Again, cream can be collected and butter made at one place cheaper than at fifty different places, and sold at less cost in one lot than in fifty lots. Then another thing which is of more consequence oftentimes than all the rest, it relieves the household of a great burden of care and labor. Where the neighborhood is not large enough to run a full fledged butter factory, a half dozen neighbors can associate themselves together and one of the number finish off a room somewhere in his buildings, collect the cream, make and sell the butter, and the time he is not engaged in that he can work on the farm, so there is no time lost, and but little money invested, while all the advantages are obtained that would be in a large business. But in whatever way done remember always that a first-class article will always sell at a remunerative price, while an inferior article will not pay for making.

Now, brother farmers, here is an occupation for all classes, the young, those in middle life, or the old, which I believe will prove both pleasant and profitable. There is no occupation which offers greater inducements to the young man of brains, education and culture, or where he has more chance for thought, study and scientific research and where extra care and attention will find better reward than in *business dairying.*

From a long experience I feel perfectly safe in recommending it to you, one and all. I believe if you will go into it with all the energy and intelligence of which you are the possessors, it will make your old run-out farms again blossom like the rose; make your hillsides and valleys grow greener; give you broader fields of waving corn and grain; fill your barns and bins fuller in the golden harvest; give you fuller wallets, thus enabling you to beautify and adorn your homes, making them more pleasant and attractive, and will surround yourselves with more of the comforts and luxuries of life. Your sons and daughters will cling more closely around the old homestead instead of drifting into the cities or away to the far West, thus building them up into a higher and nobler manhood and womanhood and preparing them to fill the place which God in his infinite wisdom intended the farmer should occupy, the front rank in society.

LEAKS ON THE FARM.

By F. S. ADAMS, Member of the Board, Sagadahoc County.

One of the most important lessons to be learned by every man who would get on in his calling is the art of economy. This applies more forcibly to farming than to any other occupation, from the fact that we farmers as a rule are engaged in so many different branches of farming, that there is more of a chance for a waste if economy is not practiced. So on this question depends almost entirely the success or failure of the farmer. The business of farming is one in which no man need fail who uses prudence, is industrious, persevering and economical. The farmer feeds and clothes the world and every product of the soil has its waiting customers, but there is a constant complaint that farming don't pay, and many are leaving the farms and going to the cities and villages. It is not my purpose to attempt to point out all the causes which tend to bring failure to the farmer, but to mention a few of the more common reasons why many fail in their business. In most every instance it is because of too many leaks on the farm. A leak will just as surely drain a man's pocket as it will a barrel, and if there are several leaks in the barrel it will run out as fast or faster than you can turn in at the bunghole.

One of the leaks upon many farms, I will not say all, is a waste of time. Unfortunately, habits of indolence and procrastination once firmly fixed cannot be suddenly thrown off, and the man who has wasted the precious hours of life's seed-time finds that he cannot reap a harvest in life's autumn. There is a saying that cannot be too often repeated that "lost wealth may be replaced by industry, lost knowledge by study, lost health by medicine and temperance, but lost time is gone forever." The men who achieve the greatest things on this globe do them by steady, unremitting toil. They have a genius for hard work—the most desirable kind of a genius. "A continual dropping wears the stone." A little done this hour, and a little the next, hour by hour, day by day, and year by year, brings much to pass. The largest houses are built by laying one brick upon another. So with our farms. If we drain that wet and springy place this year, and clean the rocks off of another piece next year, we shall soon get all over our fields and have the pleasure and satisfaction of having the best place in town. If this leak of waste of time or indolence does not exist there is not much danger but what the other leaks will be taken care of.

While we thus urge upon farmers the necessity of economizing time let us not be misunderstood. We advise no such saving of time as will rob him of necessary recreation or sleep, nor time to read and keep himself posted on what is going on in the world. This may be carried to the other extreme, and a man may try to do much more than he can possibly attend to, so that some things have to be neglected. This must of necessity cause a waste. The man who would get along must single out his speciality, and into this must pour the whole power of his activity; all the energies of his hand, eye, tongue and brain. Broad culture, many sidedness are beautiful things to contemplate, but it is the narrow-edged men; the men of single and intense purposes, who steel their souls against all things else, that accomplish the hard work of the world, and who are everywhere in demand when hard work is to be done. The great state of New York which leads the Union in commerce has but one port on the ocean. The state of New Jersey has several, but so poor, that all of them with their shallow water and narrow limits are a miserable substitute for one good one. What is the result? The harbor of New York is whitened with the sails of all the world; while the sailors shun the shallow harbors of New Jersey. So with human talent. One well cultivated, deepened and enlarged is worth a hundred shallow faculties. So with the farmer who concentrates all his efforts on one or two special crops; he will not be so likely to neglect something and thus bring about a loss, as the farmer who is cultivating a great variety of crops. I remember one time when I was a boy of buying a knife that contained half a dozen blades, two or three corkscrews, a file, a small saw, a toothpick, a pair of tweezers, all of which were so wretchedly adapted to any of the purposes that it was soon thrown away in disgust. In ninety-nine cases out of a hundred, the old adage proves true that "a Jack-at-all-trades is good at none."

One of the most common leaks upon the farm is the waste of fertilizing material. Amongst these may be mentioned the liquid manure. We are told by the chemist that the liquid is nearly as valuable as the solid. If this is the case, how much runs to waste on the farms in Maine? Enough to pay all the indebtedness of the State, cities and towns, in a few years. How can the farmer expect to succeed with such a waste going on? Besides it requires the same time to handle the inferior material and thus a double loss occurs.

The farmers of Maine are annually paying out thousands of dollars for commercial fertilizer, and at the same time letting thousands of dollars of fertilizing material waste for want of proper handling. Farming must certainly be a good business. If it was not the farmer could not live at all under such a system of waste. The question may be asked how can this be stopped? I would say, build barn cellars or manure sheds, use absorbants round the stable, save everything that accumulates on the farm in the shape of decaying vegetables and other refuse matter, and deposit them on the compost heap. It is a generally recognized fact that the manure heap is the farmer's bank; therefore he should guard it as though it were dollars and cents deposited in a savings bank, and try to add to it year by year.

Keeping inferior animals, especially milch cows, is another leak which is not fully realized. The difference between a good and a poor cow means a difference of thirty-five to forty dollars to the pockets of the farmer for each cow. A poor cow means an annual loss of from fifteen to twenty dollars while with a good cow there is a profit of that amount. I recently noticed an account of an experiment at the New Hampshire Experiment Station. Two cows were taken for the experiment, one the best and the other the poorest at the Station. The object was to find the difference between the two cows in the cost of producing a quart of milk. The average cost of a quart of milk from the good cow was a fraction over one and one-half cents, while from the poorest cow it was a fraction over four and one-quarter cents. The average cost per quart from the whole herd was two and three-fourths cents. How important it is, then, for the farmer to test his cows and keep only the best. The same is true of all other farm animals. The cost of keeping a poor, old broken-down horse is fully as much, and often more than the cost of keeping a sound and healthy one; and the amount of labor each is able to perform is vastly in favor of the superior animal. Keep only the best should be the rule that should apply to all farm animals.

Poor feed or feeding in a careless, slip-shod manner is another leak. If an animal is fed just enough to sustain life, there will be no profit either in the production of beef, butter or mutton. The good feeder is the man that makes the profit by keeping the animals at their best all the time. I can remember when the farmers in the town where I live did not feed grain to their cows to any extent. The result was that their cows were dry nearly half the year and were kept at a loss. An experiment was recently tried at the same experiment station I have already mentioned, to find the difference in the cost of a quart of milk between a good and poor dairy ration fed to the same cow. When the cow was fed the best of five different rations the cost was about one and one-third cents. When the same cow was fed on the poorest of the five rations the milk cost five and one-third cents, and this experiment was with the best cow. If it had been with the poorest cow no doubt a quart of milk would have cost four times as much.

Neglect to perform necessary labor at the right time is another leak. Instead of your work driving you, drive your work. We know of no occupation where promptness in the performance of necessary work is so important as in that of farming. The delay of a few days in planting the crops in the spring may prove disastrous as far as that crop is concerned. If we start in behind in the spring we are apt to keep behind all through the year. We will be planting when our neighbors are hoeing; and hoeing when they are haying, or else letting the crops go without being hoed and given up to the weeds, which is too often the case with the man who is behind with his work. Brother farmers, make up your mind that you will keep ahead of your work and also ahead of your bills.

The inconvenient arrangement of farm buildings, fields and pastures is still another serious loss. Have your buildings arranged so you can take care of the animals with as little labor as possible and have them comfortable. Have the water convenient, in the barn if possible. Have things "handy," and you will get along faster, easier and better with your work and have more time for reading and the enjoyment of the social faculties so much needed by farmers.

Poor fences is another serious loss. It will cause more trouble amongst neighbors than any one thing, besides running the risk of having crops destroyed. And then it is a serious drain on the wood-lot to go every year and cut the young trees for fencing. Building old fence is the most unsatisfactory work that is done, for when you get through you have nothing to show for your labor. As cheap as wire is now there seems to be no excuse for old fences.

The credit system causes the financial death of many farmers. Purchasing the necessities of life in small quantities and running an account at the village store is poor economy, for the reason that they can be bought for lower prices proportionally in large quantities for cash, besides the saving of time spent in making the purchases. The merchant who trusts out his goods must charge higher prices. It is better to pay cash when you get your goods even if you are compelled to borrow money in order to do so. The farmer who keeps a year behind with his bills paying last year's grocery bills and last year's taxes this year, is not prospering. Take this for your motto—"pay as you go."

Poor and inferior farming tools and not taking care of what you have is another loss to the farmer. No farmer can afford to use poor farming tools in these days of sharp competition. He must have the best of plows, harrows, etc., and a good team to draw them. With the improved plows that we have now, and a pair of horses, one man can do more work in a day than two men and two yoke of oxen could formerly. If he is engaged in dairying he must have all the improved implements and machinery for making butter; for by so doing he will save a vast amount of labor for his wife, and will make a superior article of butter.

In the haying season, without the use of the improved haying implements the farmer will find it an expensive undertaking to secure his crop of hay. A mowing machine is necessary, of which there are so many different kinds that it seems as if every one might be suited. Also there will be needed a hay tedder, horse rake, horse pitchfork, carts, and a number of hand rakes and hand scythes.

Then after a farmer gets the proper tools he should take care of them. If they are left out of doors exposed to the sun, rain and snow the year round, loose joints, cracks and rust are the results, causing more damage than all the wear given them when in use. We read "that order is Heaven's first law." How can a man expect to prosper when violating this law? Tools of all kinds left where last used so that neither the man who used them nor any one else knows where to find them. An implement, with proper care, may be made to last a lifetime, but will quickly be destroyed or made useless when left exposed to the weather. "Have a place for everything and keep everything in its place" is a motto that we ought to have framed and hung over the barn door where we can see it every time we go into the barn.

Losing too many boys and girls from the farm is another leak. Boys are leaving the farms and going to the cities. We have evidence of this fact all over New England, in deserted farms and buildings going to decay. If we could induce the boys to stay at home on the farm the agricultural future of the State of Maine would take care of itself. There must be some cause for the boys leaving the farm. If we can remove the cause the evil would cease to exist. Many leave the farm because they are allowed no privileges and pleasures, and see nothing in farming but hard work and little money. Strive to interest the boys in their work.

Talk to them about the farm work, tell them your plans; give them something on the farm for themselves—a piece of land to plant, a yoke of steers, or a colt and when it is sold let them have the money, and not the father to take it as is too often the case. A professor in one of our Western agricultural colleges well says, "If you wish to make your son like his business, place him in responsible places, trust him, consult him about the work he is to do. Let him do part of the thinking. Give him nearly the sole care or responsibility of something on the farm, the fowls, the pig, some of the stock or the garden. Suppose he does not do everything just as you would, advise him, it is much better that he should fail while he is yet young and has time to learn under your training then to fail when he gets into business for himself."

And I will say to the young man who thinks of going to the city to find a business, buy some of the farms that are for sale in the State of Maine, stock them with good dairy cows or sheep, and in my opinion you will stand a better chance to succeed and enjoy more of life than you will to go to the city.

The matter of keeping accounts or book-keeping is neglected amongst farmers. They seem to think that this accomplishment belongs to merchants and other business men, when in fact it is just as needful for the farmer. The fact that the farmers escape total failure only goes to prove that farming is much safer, and will stand up under more bad management than any other business. What should we say of the merchant who sells his goods without knowing what they cost? We should say that he would be likely to fail. But the farmer carries his produce to market without knowing what it cost him, so he is unable to tell whether he is selling at a loss or profit. Each department of farm work should have a separate account. A complete inventory of farm products, stock and tools should be made once a year. Then an account of the expenses and income of each department kept and at the end of the year the profit or loss can be ascertained.

It would pay to keep a separate account with each crop raised, the cost of cultivating and the value of the crop raised. Such a record will be valuable to ascertain which is the most profitable crop, and the most economical method of cultivation. There are many other ways where book-keeping will prove valuable which will suggest themselves to those who adopt it. There are many reasons why we would urge upon farmers the necessity of book-keeping. By keeping an exact account it will often save trouble with his neighbors or whoever he has business with. Without it he will never know how he is standing financially. It will be handy as a reference for dates and prices and he will not be so likely to neglect to settle his accounts.

The lack of co-operation amongst farmers causes a loss. The merchant and the mechanic understand this, and they all have their societies and organizations for mutual protection and benefit. By this plan of co-operation the farmer can obtain a better price for what he has to sell. By a whole community joining together they can send some one of their number to find a market for their apples, potatoes or whatever they have to dispose of, and not be obliged to sell to the speculator, thus saving the profit that he would make. The same is true of buying. By joining together and buying our grain, flour and fertilizers by the car load and paying cash, we can make quite a saving.

And let us carry this matter into politics so far as to say that we will not vote for any man, be he republican or democrat who will work against the interest of the farmer. The Grange has accomplished a great work in this direction and it still has much more to do.

And to sum it all up, attention to details is the great element of success. All successful men have been remarkable not only for general scope and for vigor, but for their minute attention to details. Like the elephant they can move colossal masses to pick up a pin. The general whose name rings in every ear and thrills a nation with pride, does not become a hero by lofty conceptions alone, but by the patient study of military details and a business-like care for the food, dress and health of his men, ten thousand tedious trifles attended to, ten thousand orders given and disappointments borne. "See the conquering hero comes" is an excellent tune, but before this he has to march in the mud, pour over maps, and work hard problems after midnight, by a flickering lantern in a gusty tent.

While you were peacefully slumbering in a feather bed, he has slept on the ground in wet clothes, and been subjected to many hardships and exposures. He has brooded with ceaseless interest over military problems during times of peace; he has kept his soul up in arms and his wits at his fingers' ends year after year, and now but not until now, has the steady fire of his life burned up into a national triumph. So you will find that the successful farmers are the men who look after the minute details of their business. They never consider them beneath their notice. Is it not the little things that in the aggregate make up whatever is great? "Is it not the countless grains of sand that make the beach, the trees that form the forest?" Is it not strange that in face of these facts men will neglect details? Stretching out our hands to catch the stars we forget the flowers at our feet, so beautiful, so fragrant and so various.

INTENSIVE POULTRY CULTURE.

By Dr. G. M. Twitchell, Fairfield.

In the changes to be noticed in every department of business there is a turning towards intensive methods and measures. Every condition seems to tend in this direction, every change only makes more necessary the practices indicated in this paper. That poultry culture is profitable is admitted. Only those who utterly fail to recognize the conditions, question this statement, but even here there has been a radical change during the past few years. The business cannot be conducted as it once was, because the market is more exacting and price is to a larger degree governed by merit. Intensive poultry culture is the application of business to this industry in accordance with the demands of to-day.

The flocks left to themselves, to get their living during the summer months as best they may, steal their nests and bring out their broods at pleasure, can not yield a fair return. Such methods belong to the past, they have no place in the present, and in the future must be discarded. Intensive culture means the taking of the flocks and housing, caring for, giving attention to, and feeding, with the one thought of realizing everything possible. It is an easy matter to urge attention to details, but when these are enumerated the business looms up before us as one of magnitude. The census reports give the average egg production of the hens of Maine at seven dozen yearly. The price received at shipping points along the line of the Maine Central for a series of years has averaged a fraction over nineteen cents. The income would be from $1.35 to $1.40 per head. Deduct the cost of keeping and the balance is not satisfactory, not encouraging. But let us look a step farther. Here is a breeder keeping five hundred hens. By giving them attention he realized for 1889, an average of one hundred and seventy-five eggs, $14\frac{7}{12}$ dozen. These sold for twenty cents a dozen giving a gross income per head of 2.91\frac{2}{3}$. This is intensive poultry culture. Let us carry our thought still another step.

The expense of keeping a hen at present prices paid for grain, allowing them more or less liberty during the summer, varies from one and three-fourths mills daily to four mills. The lower figures indicate what may be by studying the question of rations, and the latter what often is, the expense by neglecting all consideration of this question. If by intensive methods one obtains an average production of 180—fifteen dozen—yearly per head, at a cost for keeping of two mills a day, the expense per egg will be practically four mills. If he gets but twelve dozen the cost increases to five mills, if but eight dozen, eight mills, and if but seven dozen, nine mills or almost a cent each. Again, if this party sells his eggs for twenty cents he realizes three dollars, leaving a net income of two dollars and twenty-seven cents, but supposing only twelve dozen are secured the cost rises and the income drops to two dollars and forty cents leaving the net balance but one dollar and sixty-seven cents, and if the total is but seven dozen the receipts will be but one dollar and forty cents leaving a balance of only sixty-seven cents after paying for feed. Admitting that the flocks can be made to produce fifteen dozen, as they surely do in individual cases, and that the cost of keeping is increased from two to four mills daily per head the same disastrous results will follow. It becomes necessary then that the annual product be increased to the utmost, while the cost of production be kept at the lowest possible figure. This is intensive poultry culture. It is not visionary, not impracticable, but something real and tangible. If it be claimed that heavy burdens are falling on the farms, that margins are narrow, that competition is close, then there is surely the greater need for reaching steadily after the highest possible production, while seeking carefully to obtain this at the lowest cost.

On the one hand by a study of the laws of breeding the tendencies of heredity and the natural adaption of the animal it is surely possible to secure a larger product in the future than has been obtained in the past, on the other it is equally true that by a study of the food question, cost may be reduced while providing all the elements for extensive production. This is applicable to flocks large or small. The individual hen of any breed is best adapted for one line of work. If that line be followed the greatest profit and best results will be secured. The individual breeder is also best adapted to some special lines, and while it is true that possible profits may encourage one to enter new fields yet it is a serious question whether more would not be gained by following one's fancy. Intensive poultry culture covers all these questions because their consideration are necessary to-day.

Here is a Leghorn hen bred for generations for highest production of eggs. Gradually there has come the form best adapted for that special purpose, and this in and of itself would prevent her being most profitable for the market. The two extremes are not compatible. The style and shape most desired in the market and which commands the highest price can never produce eggs by the side of the Leghorn just described. As years pass and the question of breeding is better appreciated, these points are coming into prominence and receiving their proper share of attention.

The Jersey of to-day excels as a butter cow, because for generations she has been selected and bred for butter production; and no animal can make beef as cheaply as the white-faced Hereford. Yet, if one casts one side the underlying principles governing each, the standard of excellence rapidly falls. This is a thought which cannot be too strongly emphasized, for success depends entirely upon its recognition. All the breeding of the centuries, in every direction enters in to complete the work attempted by the breeder of to-day.

As we pass beyond breeds which are only what men make them, and consider the food question, a great field opens for investigation. No one will deny that there is a difference in the value of food for producing what is wanted. Admitting this and it follows that there is a ration which will produce eggs or poultry at the lowest possible cost. This being true the whole question of balanced rations opens up for discussion. It is as applicable to the poultry as the dairy cows.

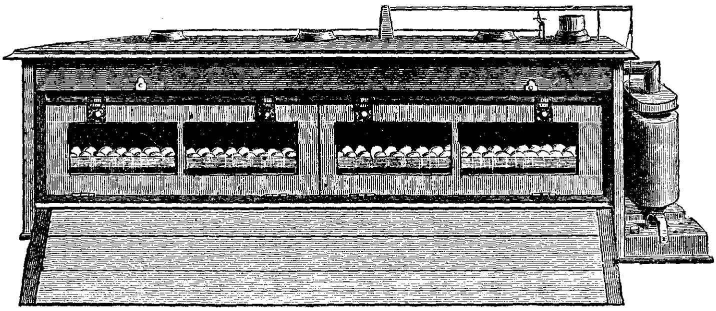
It is useless to expect to secure a yearly product of fifteen dozen eggs on food rich in starch and sugar, at a cost of four mills per egg. The food must be egg forming, rich in the albuminoids. If any element be wanting production will be reduced There is no question of greater significance than this of feeding. Egg food for eggs, poultry food for poultry, milk food for milk and butter food for butter; this is the problem now to be settled, and in settling the one great item is to obtain the supply of elements from those sources which will give what is wanted at the lowest possible cost The elements must be had but we should obtain them from most inexpensive sources, and cost per pound can never determine value, for it rests entirely upon power to produce. Intensive poultry culture is the production of the product at less expense per pound or dozen, and all that this implies is possible to the individual with small flocks and multiplied duties.

There is another field inviting investigation and to which the Maine Board of Agriculture has never before given extended attention, that of artificial incubation and rearing. The reason why this has not been done is that the field is one that is exacting. One cannot enter here save by surrendering other interests. Artificial incubation is neither profitable or practicable unless one intends growing poultry by the hundreds. When we attempt to supplement nature and do her work we attack an intricate problem, one calling for careful and prolonged investigation. It is such a complete change in customs and methods that no one is justified in urging its advantages only as there is carefully set forth the underlying conditions.

By reason of the exacting demands the farmer with his many cares will hardly find the incubator and brooder a source of pleasure or profit, but it is a fact that because of the financial results promised there are those who can and will succeed in intensive poultry culture by the use of artificial means

For thousands of years the mother hen has been the friend of mankind because of her willingness to patiently perform the duties and bring forth the broods. If in the early stages of the world's history eggs were placed in ovens and chickens were hatched there, the business has never attracted universal attention, and not until 1848 did incubators begin to appear. Since then they have multiplied rapidly until to-day they may be counted by the hundreds. Some of these are simply hot water machines protected so that the atmosphere of the room will not affect the temperature within, and the heat necessary is supplied with hot water; others are more elaborate, a lamp being used to supply heat to the water tank, and automatic or electric regulators added to control the temperature. As to the results with either there is no question. The day for debate has gone. The incubator whether home make or purchased will do the work, but in engaging in the business on any extended scale the machine wanted will be the one most easily regulated, economically run, and promising best results.

An illustration is here given of the "Monarch," not because it is



MONARCH INCUBATOR.

the cheapest or necessarily the best, but simply and only because it is in quite general use, and gives good satisfaction. It is shown to illustrate the general idea of construction.

More of these incubators are in use in Maine than of all others combined, and they are proving successful. For this class of work buildings must be specially provided and there is here presented such as are necessary to carry on an extensive business. First of all there must be a suitable hatching room, one so located and protected that it will not be affected by outward changes in temperature and yet where complete ventilation may be secured. The difficulties attending artificial incubation necessitate that an even temperature be preserved in the room where the incubator is placed. The other buildings called for are the brooder houses.

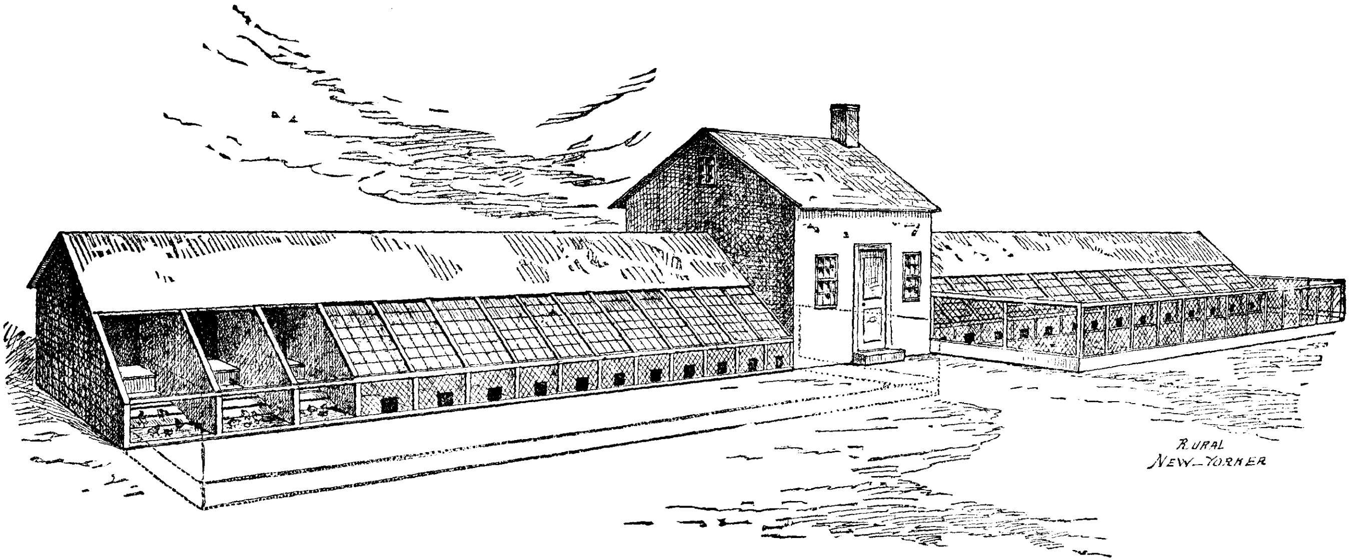


FIG. 1—A BROODER HOUSE WITH HEATING ROOM IN CENTER.

In figure 1 may be seen one of these with the heater house attached. These illustrations are not given as the best for the individual but simply to show the general working plan of the system. No one should embark in this work without first visiting several like establishments and examining carefully the location, construction of buildings and internal arrangement.

The house here shown is 140 feet long and 10 feet wide, and has a capacity for 3000 chicks.

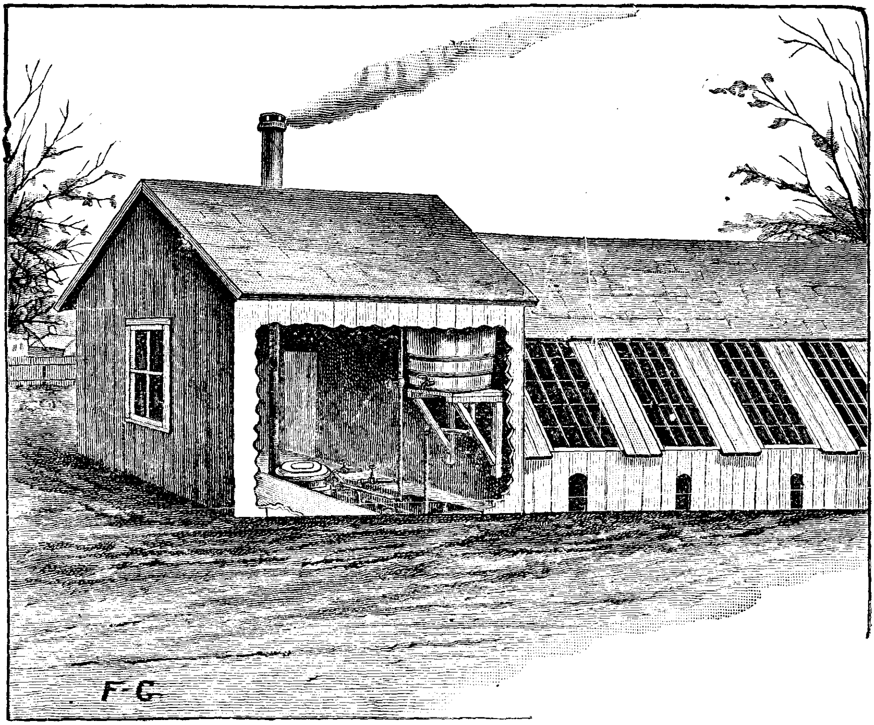
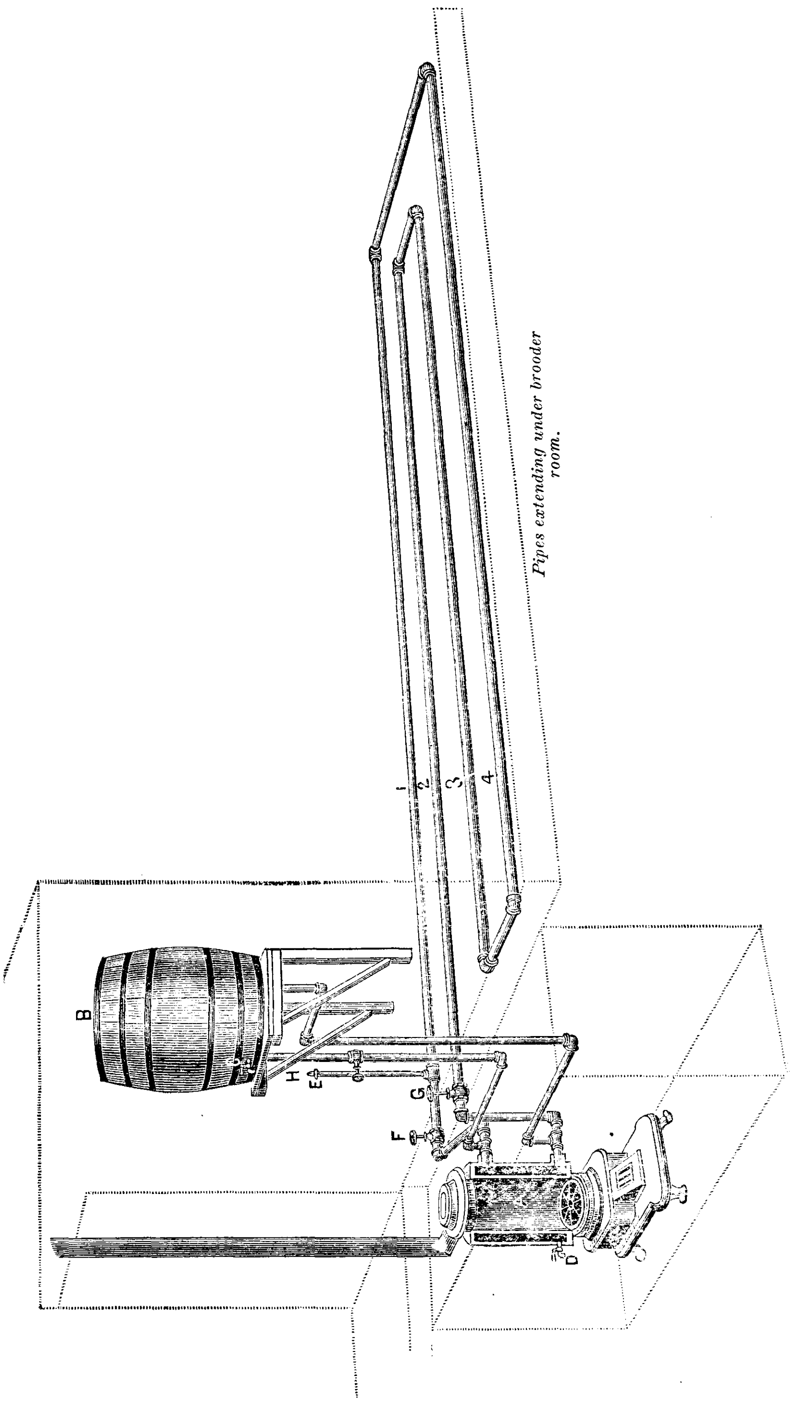


FIG. 2—HEATER ROOM.

In figure 2, one gets a good idea of the construction of the heater house, the location of the stove which must be below the pipes, also the position of the cold water tank.



Heating Room.

FIG. 3—SKELETON PLAN OF STOVE AND PIPES.

Figure 3 clearly shows the location and arrangement of the stoves and pipes In many cases only two pipes are used and the tank is set at the extreme end of the building, feeding in to the return pipes. The simplicity of the whole structure will at once be apparent.

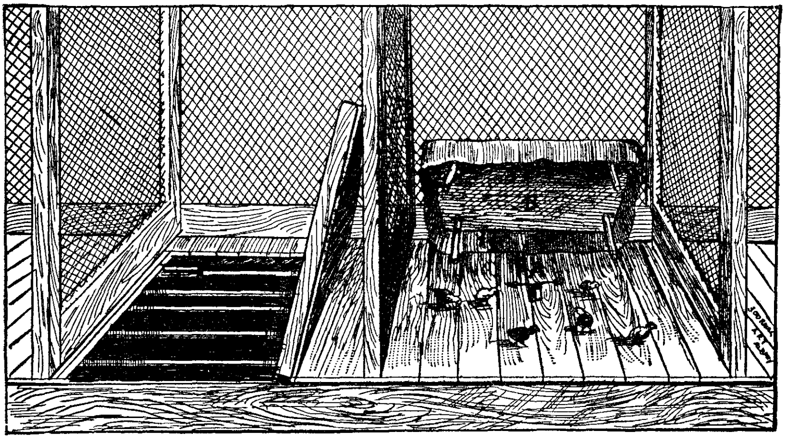


FIG. 4—SECTIONS OF BROODER APARTMENTS.

In figure 4, the whole system of arranging the pens and the construction of the mothers is clearly shown. This long building, ten feet wide, has a three foot walk at the rear leaving the pens seven feet deep. Partitions of fine wire netting are set up, dividing into pens five feet wide, and at the back side of these the pipes are extended either over or under the flooring where the chickens hover.

In this case they are underneath. The mothers are simply a miniature table with four corner posts, having felt or cloth tacked all around, and usually covered underneath with cotton wadding. The length of the posts or legs should correspond to the size of the chickens, so that when they run under the curtain they may be warmed and sheltered The heat is supplied by the jacket boiler, the hot water passing through two of the pipes to return again to the heater.

When the chicks appear they are placed in the pens nearest the stove, and as they mature, are gradually moved up the line until when eight or ten weeks old they pass on into the market as broilers and others take their place. Thus the crowding process is maintained throughout the season.

"The heat to the mothers comes from under the floor as already indicated, and is provided by using a boiler-stove (or stove with a water jacket). This stove is placed in a pit about three and one half feet deep and connected with a system of pipes. These pipes are of iron, of one and one-half inches inside diameter, and are laid the whole length of the building, first going down one side of the pipe box and coming up the next off side, turning them to go back again, and finally the fourth pipe is brought back alongside of the first one. To make it plain, it is only necesssary to say that the first and fourth pipes are side by side, and then the third and second, which brings the hottest and coldest pipes together. They are laid perfectly level, the first pipe being connected with the stove to receive the hot water, while the fourth pipe is the return pipe to the stove.

The pipe box is one yard wide and seven inches deep, the bottom being of boards or earth, as preferred, and the pipes are laid in the manner stated, on pieces of 2x3 scantling (or iron rods) to support them. The floor of the brooder covers the top of the pipe box. Through this floor is the two and one-half inch tube, which allows the warm air to come up into the mother. The tube is of wood, and about one inch in diameter. Bear in mind that no steam is used, the heat being derived from hot water flowing into the pipes. The pressure to the water is secured by placing a barrel on a platform and connecting the barrel by a pipe and elbow with the return pipe to the stove. As the barrel is higher than the pipes and stove, the water is forced to every portion of the pipes.

"The heated pipes in the pipe box warm the cold air (which comes into the pipe box from without by tin pipes, half an inch in diameter, which extend outside of the building) and this rises as it becomes warm, and passes out of the tube through the floor, where it strikes the bottom of the mother and diffuses over the chicks. The air coming from outside (and heated) is pure, and the warmth is therefore constant ventilation. As it diffuses under the mother and escapes, it assists also in warming the brooder house. The floors are all underlaid with half-inch mesh wire netting, as a precaution against the ingress of rats."

Chickens are easily educated. and by confining in snug quarters for a day or two soon learn where the warmth is to be found and hurry to its shelter when cold. Careful attention is given to the cleanliness of every part. Dry earth and fine gravel is used to cover the floor and this is removed at least twice a week. In no place can one find greater compensation for cleanliness than in this business of successful poultry growing.

It is comparatively an easy matter to hatch chickens by any method but in order to grow them rapidly and successfully skill and application are necessary. For want of these the poultry interests of the State suffer a heavy drain. Thousands of chickens are yearly hatched, which never come to maturity. While some of the largest breeders in the country still cling to the hen, after a faithful trial of artificial incubation and brooding, there is no question but others have secured a still greater per cent of profit by and through the advantages possible by the system here described. Looking carefully after cleanliness, ventilation and temperature a larger number are saved than would otherwise be possible, and under the forcing system here employed are put on the market at an earlier date and at heavier weight than would be if grown by the old system. This artificial system must increase because, by reason of western competition, in the fall months, eastern breeders will want to reach the market earlier than would be possible if we rely upon the hen to bring forth the broods. Not only the demands of the present but the probabilities of the future call for different methods in all lines of work, and especially in egg and poultry production. The superiority of the fresh products of New England over the cold-stored, western-grown stock must be emphasized and the best way to do this is to keep the markets supplied, the entire year, with poultry just suited to the most exacting demands. Here is a sure line of operations, but it is one demanding more constant and painstaking application, more careful study and the use of the incubator and a system of artificial brooding and growing.

In feeding these motherless little ones nothing should be given the first twenty-four hours, that time being required for them to consume the food absorbed from the yolk Warmth and rest are the essentials. Then commence to feed rolled oats or granulated oat meal, or bread or cracker crumbs moistened, not wet, in milk with bits of hard boiled eggs added. The tiny body cannot take care of and digest hearty food in any quantity and the one aim and object should be to promote steady growth. Then comes the baked bread made by mixing oats, ground, bran, middlings, corn meal and a very small quantity of meat scraps and linseed meal. This moistened with skimmed milk, and a little baking powder added, is thoroughly cooked, put away for twenty-four hours and then pounded or ground.

Bits of cabbage or apple, or the tender green shoots of rye or oats chopped fine will not only be relished but keep in healthy condition. Regularity in feeding cannot be emphasized too strongly as nature adapts the animal to its surroundings and if the hours of feeding be regular there will be no loss, while if irregular it will be impossible to preserve perfect health and secure rapid growth. The best breed for the broiler, a bird to weigh one and one-half to two pounds at eight or ten weeks, is the Plymouth Rocks or Wyandottes, or these crossed with Leghorns, using a Leghorn male. There is no hardier or more active chick hatched than the Leghorn and it grows very rapidly the first three months, the time in which broilers are perfected. The only change desired being a shorter leg and neck, the main points being a compact body, plump breast, short legs and as much fat as possible. Experienced breeders say that it costs five cents a pound to grow a chicken to dress four pounds. The better prices are secured in March, April and May, and chicks to weigh one and one-half pounds should be not over eight weeks old.

Strange as it may seem at first thought, it is a fact that hardly a successful grower of broilers on an extensive scale keeps a hen. This points to the division of trades, a fact to be emphasized. No man can secure the possible profit in artificial work of this kind unless he is able to give it his undivided attention, and no man can run his flocks who neglects them in the least. Here are two separate and distinct lines of work. In combining, the highest success in either cannot be expected. Either will consume one's entire time and call for the exercise of his undivided talents. This is intensive poultry culture, and here is where the money is to be coined in the future.

The entire cost of an outfit capable of taking care of 2,000 chicks, will not exceed $1,000, and will command the entire time of one man. This will cover everything ready for work. If the operator does his own labor, the expense will be materially reduced, while if hot water home-made incubators are used, another great reduction may be made. This estimate is for a complete equipment of some of the most approved incubators now on the market.

Beginners seldom succeed the first year, as there are many little details that depend on experience. Those engaged in broiler raising do nothing else at that time. They get up early, remain in the incubator-room and brooding-room all day and until late. One cannot raise broilers and engage in some other pursuit at the same time, nor is it an easy business for women or children. Like every other industry, it means work and careful attention, and hired labor cannot be depended on.

The one great obstacle to be met by the experienced breeder, is the difficulty of obtaining a supply of fertile eggs in December and until April. Those who do but a comparatively small business have time to look after their hens and keep them in good laying condition, but those who give their entire time to this special line must look elsewhere for their foundation stock—the eggs.

It is idle to expect to engage in artificial hatching and rearing and at the same time personally superintend other lines. The farmer with his many duties cannot give the time necessary to secure satisfactory results. This is especially a work for the specialist who can and will give his entire time to the production of the largest number possible, and doing this systematically there is no question but there is profit proportionate to the outlay of time and money.

In the consideration of this question another phase demands our attention, that of duck raising. If broilers can be grown at a cost of five cent a pound to weigh one and a half pounds at eight weeks, and to sell for forty cents a pound or more, during the earlier months, ducklings can also be grown to weigh four to four and a half pounds in the same time and at the same cost per pound. If these do not sell for as much there is still a larger margin of profit attending their culture.

The fact so often quoted that only a very few succeed in this line of woik, is no argument against the industry, but indicates how few there are who appreciate and persistently apply the principles underlying success. The general treatment and management of ducks is much the same as the chickens, and he who patiently seeks to enter into the knowledge of the details can find no better investment for capital or surer return for labor.

The field of artificial hatching and rearing is fruitful to the student and profitable to those who intelligently engage in it. The enthusiasm of the fever soon burns out and there comes the time when only the hard, prosaic facts of every-day work are to be found, and the danger is that unless one prepares for this emergency he will fall by the way.

Here may be read the explanation why so many rush in and so few remain. With all that may be said in favor of the general line of poultry breeding intensively applied, and the still greater possibilities of this special field of artificial operations the fact remains that only here and there can be found those who patiently continue their labors year after year.

The opportunities are many, the possibilities beyond any estimate attempted in this paper, and the future promises a steady and active demand. All that is needed is the willingness and patience to deal with little things, to search for hidden truths and to follow the chosen path with the same zeal and determination manifested by the successful man in any other vocation. There never can be an overproduction of the best; there can never come the time when a fair margin will not remain for him who produces at the lowest cost and at the proper time what the market demands. Because these things are so, there is urged a study of this problem of intensive poultry raising in its many phases.

The door to the future of this business opens towards more systematized methods. Flocks must be grown to produce eggs in winter. Buildings must be arranged and the food question studied with this in view. If there is any vacation let it be at the time when eggs are a drug in the market. Chickens must be matured earlier and put on the market during the summer or early fall months, and all this is possible by intensive methods without artificial means, and then beyond are all the possibilities of this larger field where by artificial hatching and brooding winter may be turned into summer, and the chickens and ducklings of August under old methods be ready for the spit in February under the new regime.

Here is a field for investigation and experimentation. It has been tried and not found wanting, and the results should be inviting to those who are looking for financial success where it can the readiest be secured. No section of country offers better attractions or more enduring results than the good old State of Maine, with all its natural advantages, with a rapidly increasing demand for these choicer products from the resorts springing up all along our sea coast and on our hillsides, there is every encouragement to engage in these special lines where, by intensive methods, success is certain and the future of the farms of Maine assured.

GROWING LAMBS FOR EARLY MARKET.

By E. F. Bowditch, Framingham, Mass.

I have been in the sheep business about ten years, beginning in a very small way and making up my mind I would raise lambs for the early market. It was a new business for me, and one I had to study, and I had some pretty expensive experience; but I have my flock now up to about five or six hundred breeding ewes, and I will give you a little sketch of how I work them.

I am breeding now one or two small flocks of thoroughbreds which of course I keep over. When I first began I bought my ewes thin in the spring, just after shearing time, and fed them quite highly. One object which I had in starting in the business was to improve my pastures. I bought a worn-out farm of about three hundred acres, which I think cut fifty tons of hay the first year. It does better now. The pastures were such as you can imagine would be on such a farm. I put the sheep into my poorest pastures and hurdled them every night, beginning on the poorest part of the land. The hurdles I used were sections of picket fence eight feet long, and fastened together with a pin, put together zigzag, like a Virginia fence. By shifting the hurdles after you have had your sheep in them two or three nights you give the land such a dressing that it doesn't forget it for years. It would seem at first to be a good deal of trouble to hurdle two or three hundred sheep; but by feeding a small amount of grain which immediately goes to help your top dressing on the pasture, you will find that the great trouble will be to keep the sheep out of the hurdles until you are ready to let them in. Once in a while in very rainy weather they hate to come out into the rain, because my hurdle is always in the open, and in that case you have to call them up with a dog, but as a rule a call by the shepherd brings them into the hurdle at once, and they are let out the first thing in the morning.

The great trouble in supplying the early market is that you cannot get your lambs early enough. I have had a great difficulty with that, and the last two years I have bred to some extent the Horned Dorset which breed any time of year, so to have your lambs any time you like. In England they have been breeding many years for the Christmas market, the lambs being dropped in October or early in November and they are plenty large enough for the Christmas market. They consider it a sad mistake to keep any animal out on frozen grass and I never found any economy in it. I always bring them into a pen as soon as the grass is actually frozen. The pens are as thoroughly ventilated as they can possible be. That is, they are always open. I have a double door, the upper half swinging in and the under half out, and either one or the other is open all through the winter. When it storms the lower one is shut. When the ewes are expected to lamb the doors are shut up during the night. A good many people have an idea that lambs have to be kept in a warm place, "hot house lambs" as they are called. But I find my lambs do better to turn them into an open pen as soon as they are twenty-four hours old, and they stand zero weather perfectly well. I know one year I had a great many lambs come all at once and was obliged to turn them when three hours old into a shed with the thermometer at zero, and they did perfectly well.

The sooner you can get your lambs to market the better you can sell them and the less risk you have. Therefore you want to feed your ewes as highly as you can to make them produce a full flow of milk. Any hot grain like cotton seed or corn meal before the ewes drop their lambs is apt to do harm; but if you feed hay or clover they will be kept in good condition. If you have to feed hay, feed with it a mixture of bran and oil meal. That I have found to work best. As soon as the lambs are a few days old they will begin to eat a little meal, and in one corner of the pen where they are kept I have a place fenced off so that only the lambs can get in, and there keep a little grain for them. The mixture I have found best for them has been one part of oil meal and two of corn meal. The amount they will eat is perfectly surprising. I found by actual measurement and weight that a lamb ate a quart of meal a day, which is more than you would dare to feed to an old sheep, and gained over a pound a day.

Question. At what age was that gain?

Mr. Bowditch. They would be about a month or six weeks' old. The object of forcing them of course is to get them heavy enough to sell in the market. The first year I began it took me from seventy to seventy-five days to get a lamb that would dress from twenty-five to twenty-eight pounds, and I have now got it down on the average to a lamb of over twenty-five pounds in six weeks. The whole thing is a system of forcing, and I have found by experience that if the ewes have to be forced too much a good many of them are apt to get trouble with their back ; so that after your ewe has raised her lamb she is generally in better condition than when she is barren, and if you have sold the lamb off her you can sell the ewe for more than you have paid for her, and in that way turn and buy again.

There is more money to be made in sheep at common farmer's prices than in any other branch of agriculture that I know of that is open to New England. All up through the Connecticut river valley in Massachusetts, in New Hampshire, and in this section there are hundreds and hundreds of low grade lambs that have no care at all taken of them except what they get in the pasture. Buyers are out after those lambs which have never been a cent of expense to the farmer. They buy them for three dollars and three and a half, as the standard price. When you can buy your ewes for three or four dollars and are pretty sure of getting a dollar and a half for the clip of wool on them, it is a very good interest on the investment.

Question. How do you prepare your ewes in the fall to secure early lambs? Does it not require preparation to get them to breed sufficiently early?

Mr. Bowditch. Ewes will usually breed early when they are fed well. If you can combine the two things you want to do by feeding your ewes better, you accomplish a double result—cause them to breed early and top dress your pasture at the same time; but you cannot be sure of having them come in when you want to. Lambs fetch the highest price in the market about this time. Washington's birthday is the old standard time, and sometimes it is just as it happens. If they have any big trade dinners or celebrities coming to town the hotels want a few lambs, but as a rule there is not much demand for them until late in February.

There is a fact that we do not look at as we ought. We complain that our pastures are not what they used to be, and they are grown up to bushes. I can assure you from my own experience that you can make sheep eat huckleberry bushes, though they don't like to do it. I changed the best huckleberry pasture in Middlesex county into a pretty fair pasture by making the sheep do that. You can keep your sheep as well as you want to and have them do that. The way I do it is to overstock the pasture and feed a little grain, and they must have some grass or other green herbage to fringe their stomachs and they will eat almost anything. In England they call their sheep "manure carriers," and they send them up into the hills and heathers, and all about, and bring them in at night and hurdle them and do their top dressing in that way. They hurdle every piece of land they want to plant and make their sheep do the manuring.

Question. What are your fences generally?

Mr. BOWDITCH. My fences on the farm are old tumble down stone walls. For sheep a few stone and barbed wire make a pretty good fence.

Question. Do they ever cut themselves in trying to jump over?

Mr. BOWDITCH. Yes, but they do not try it the second time. I always like to see them do it the first time. One barbed wire on the top of a fence will teach them to behave themselves.

Question. You spoke of Horned Dorsets for breeding purposes. What are you using for these early market lambs?

Mr. BOWDITCH. Almost all of them are Hampshire Downs. My rams are Hampshires. They are mostly grades that I raise for market. I spoke of being seventy-five days in getting a lamb ready for market. That was when I did not take pains enough in picking out my thoroughbred male. But the use of a large Hampshire ram has made a great difference.

Question How much wool does the Horned Dorset cut?

Mr. BOWDITCH. I cannot say from my own experience because when I made my first importation it was a year ago last July, and they were shorn in June and trimmed again when they were put on board in July. I sheared them in April so it was not much more than a fleece of nine months and a half, and that was between seven and eight pounds. But their record on the other side is nearly eleven pounds.

Question. What are the characteristics which you secure from using the Hampshire Down males?

Mr. BOWDITCH. You get a very large, square, weighty lamb with the black legs which the market prefers.

Question. How do the Hampshire Downs compare with the Shropshire sheep?

Mr. BOWDITCH. They are a very similar sort of sheep, if anything a trifle heavier in weight and a trifle more wool.

Question. What amount of grain do you feed to your sheep?

Mr. BOWDITCH. I feed them liberally upon grain, from a pint to a pint and a half of a mixture of bran and oil meal and corn meal when the ewe is suckling her lamb, and as soon as I wean the lamb I feed hay with a small feed of grain perhaps. If I have poor fodder I increase the grain so as to keep them in fair condition.

Question. Do you use the old or new process oil meal?

Mr. BOWDITCH. I feed the old process. That has about four per cent more of oil than the new process. The new process meal I think has been very much improved. I am just now trying an experiment with a couple tons of it.

Question. In forcing lambs how much of that do you feed?

Mr. BOWDITCH I would put about one-third of old process oil meal to two-thirds of corn meal for lambs. For the ewes I make a mixture of one part of old process oil meal and one of bran and one of corn meal. I have tried middlings, but not long enough to test them. My impression is that they are better for pigs than for sheep. Oats are first rate for lambs, but it is a great deal better to bruise them than to feed whole. If you try to feed them whole and the lamb is hungry, he will get so many in his mouth he cannot swallow them, and I have lost several from choking. But when bruised they are a first-rate food.

Question. What amount of clover hay, corn and oats would you recommend before ewes have dropped their lambs?

Mr. BOWDITCH. If I had good clover hay and my stock was in good condition I would not give them any grain until after they had lambed. From the time my ewes go to grass in the spring I feed just enough grain to keep them in proper condition. I always feed a little bit to get them in the habit of coming into the hurdles at night. But on a moderately short pasture, what we would call a pasture a little bit over stocked, a quarter or an eighth of a cents' worth of grain a day is enough.

Question. Then you don't resort to artificial processes to secure early breeding?

Mr. BOWDITCH. I am trying to, and I have had a great many theories, but they have all failed. I haven't been able to solve the problem. The same flock varies in different seasons and you cannot account for it.

Question. Could you use for your breeding purposes ewes you secured in Maine?

Mr. BOWDITCH. Those I had come from this way had too much coarse wool. I like a closer wool. The looser-wool breeds cannot stand the climate or the wet storms.

I have tried different mixtures of grain and since I have come down to a mixture of one-third oil meal and two-thirds of corn meal I haven't been able to discover that I have lost a lamb. I let the lambs have as much as they will eat of that. I have had lambs eat over a quart a day of it and gain over pound a day. I had a Horned Dorset that I fed on a mixture of bran, oats and a very little oil meal, and when 102 days old it weighed ninety-eight pounds. In forcing lambs my aim has been to have them gain a pound for every day they are alive. I have reached that point in individual cases. A lamb killed under six weeks old will shrink not over forty per cent perhaps, and sometimes even less than that, and when they grow older they will shrink sometimes more than half. When you turn your lambs to grass they naturally shrink. I stop killing the first week in May. The thoroughbred lambs I raise are not fed in this way. I purchase my ewe sheep in the spring when I make my flock good.

Question. Can you make your flock do as well the first year as you can after you have got them wonted to the farm?

Mr. BOWDITCH. I have had no trouble because I always have the bulk of my flock old sheep, and the new ones come in and get into the habit of behaving themselves as they go with the rest.

Question. About what weight of lamb do you dress?

Mr. BOWDITCH. They want them to dress from twenty-five to twenty-eight pounds. I killed one lamb twenty-nine days old that dressed twenty-three and a half pounds. The best thing I have done yet in the way of getting heavy lambs.

Question. Is the market well supplied or supplied according to its demands for this kind of lamb?

Mr. BOWDITCH. No. There is a limited demand very early in the season. There is an almost unlimited demand at seven and eight dollars. But the demand is greater from the first of March to the first of May.

Question. How many sheep do you keep in a flock?

Mr. BOWDITCH. In winter, for my own convenience and handling and sorting them over and catching the lambs, I divide them up into pens of about forty, and in summer they are all in one flock. I was told when I commenced the business that it would do very well to keep twenty or thirty together, but if more I should have trouble. I haven't had any trouble, and I have five hundred in a flock, and I don't know why I couldn't keep five thousand if I had room for them.

Question. Then it is more a question of supply of feed than field for exercise is it not?

Mr. BOWDITCH. I think so, because in England where they know more about it than we do, their sheep, in a good many parts of the country, are kept in hurdles and shifted about, and they are fed on turnips and all sorts of things, and hardly ever go into pasture.

Question. Do you use any artificial heat?

Mr. BOWDITCH. No. If you can keep it as warm as thirty-two degrees in the lamb pens you are perfectly safe. You do not need it warmer than that.

Question. Have you any particular way to secure sunshine?

Mr. BOWDITCH. Every animal needs the sun. They are only shut in at night when you expect lambs to rest; all the rest of the time, except in stormy weather, they are out in the field. Take the temperature at twenty below zero with a very comfortable, warm, well littered shed, and you will find nine-tenths of the sheep lying out on the ice in the sun from preference. I always attributed that to their lack of wit in getting in; but sheep know more than you think they do.

Question. In a fifty acre pasture how many sheep would you dare to carry, supplying the deficiency with concentrated food?

Mr. BOWDITCH. I have carried five hundred in a pasture of forty-four acres. After I get my crop of rowen I let them into a nine acre piece. That is the time they ate huckleberry bushes.

Question. Was there anything left alive in the pasture except the sheep?

Mr. BOWDITCH. No. I did not repeat that same process, but on that same pasture of forty-four acres I carried eighty of my best ewe lambs and twenty-three head of young Guernseys, and fed no grain to my lambs except enough to get them into the hurdles at night. I have brought up a good deal of my mowing land by top dressing. In case there is too much rowen to leave in your field and not enough to mow, move your hurdles in and hurdle the sheep, and in a few years you will find your crops increased.

AGRICULTURE AND ITS NEEDS.

By F. L. MANSFIELD, Member of Board, Knox County.

Agriculture the foundation of all pursuits, occupies an immense domain, wide as the earth, lasting as the ages, old as Adam, and of universal interest to every human being. People of every class are dependent on its success. It is the great moving power of human existence.

Washington said of agriculture, "It is the most healthful, the most useful and the noblest employment of man." Jefferson said "It is as profitable to be a farmer as a president." Since the day our forefathers laid low these wooded hills and vales to bare the land for vegetable growth agriculture has taken many advanced steps. Their attention was riveted on how to destroy the original forests and construct the farm buildings and necessary fences. They, from stern necessity, were obliged to crop the soil of its fertility without any returns to the land they worked.

All honor to that noble band of pioneers, with such a struggle for a mere existence as they made for themselves and families, with limited means, rude implements, and no communion but the solitude of the forest, whose industry and economy accomplished and bequeathed to their children such grand results. It would be a virtue in us, the successors to sunny hills and pleasant valleys, beautiful landscapes, pure running brooks and the perfumed breezes of as pure a clime as wafts over any State in the Union, to appreciate such a sturdy inheritance.

Since that day times have changed A new condition of things is brought about, and he who would prosper must through intelligence and foresight adapt himself to methods that will bring success to his occupation, while he who fails to adapt himself to this condition is destined to failure and disappointment. To-day successful farming must be the result of thought and study. The farmer who is trained for his calling has many advantages over the one who is not. A high state of agricultural improvement in any community will not be attained by practice alone. A knowledge of the principles upon which its correct practice can be based is as indispensable to successful agriculture, as in the profession of medicine, surgery, music or any profession based upon scientific principles.

Agriculture is to rise to a higher school, and science is to be the teacher. Education should no longer mean the distinct professions. To be a successful farmer demands a discipline and an education even more varied than other professions or occupations.

It seems to be quite generally admitted that a necessity for agricultural education exists, that the future generation, more especially the young men, should have the means of acquiring a knowledge of the principles which underlie the processes of agriculture, instead of wearing out a life of ceaseless toil, only to discover what "might have been." Said a farmer to me lately, a man of great energy, who had spent a life in unremitting labor, "If I had taken a little time to study and improve my mind by reading agricultural books and papers instead of adhering to the blind practice of our fathers how much greater success, how much more happiness, I should have enjoyed." More light must be diffused through the means of an agricultural press. No farmer of large or small means should be without a live agricultural paper. It is not only a great help as to methods and practices of a business needing to be fostered, but it influences the mind to think, and increases an interest for knowledge and improvement. It is an influence for good in the home. It is an important accessory in laying the foundation of earthly hopes and prospects, creating an interested necessity for knowledge. The mission of a paper is to be an informant, an educator, an aid to the reader. The State taxes a man who has no children to give his neighbors' sons schooling, both special and general—to educate him. How many there are who have no children, who have paid a tax for many years for just that purpose, and has done it willingly, feeling that the prosperity of a people and a State required it. And if a State lays a tax on such citizens, its welfare must depend upon the intelligence of its citizens. As a means to increase intelligence the agricultural paper is an important factor. Then why not introduce such a paper into such homes as are unable to procure it as an educator at the expense of the State?

There seems to be a large public sentiment at the present time in favor of the introduction of the elements of agricultural science into our common schools as a study. Of course there is a diversity of opinion in regard to this, but this is certain, that the future prosperity of agriculture demands that farmers provide the best possible educational advantages for their children. We look for the further preparation of our children for the responsibilities of life to our common schools and agricultural colleges. If farmers would have their children occupy an advanced position in life, they must insist upon a course of study adapted to the wants of agriculture. The elements of chemistry, geology, botany and physics are intimately connected with the farmer's daily life, and should receive attention in our district schools. The agricultural college was an outgrowth of a pressing need for liberally educated farmers. We are assured that it is filling a useful place, but we are equally assured that it does not meet the full demands of educated labor. The encouragement of such a study in our schools will be an important auxiliary as a means to advance agricultural education. It will double the importance of the science and lift it to the more honorable place which it deserves throughout the country. It will be the best means by which there can be an advance in agricultural education so as to be of greater use to the people. We are aware of the difficulties to be overcome in the establishment of such an introduction, at least in its commencement.

The idea is advanced by some that the contemplated work would have no teachers fitted or prepared, that they would need to pass through an agricultural college to fit them for such work, or that a preparation would necessarily be largely from self teaching, and that if these things could be so easily learned by the common school teacher, they can just as well be learned by the scholar who intends to become a farmer.

A sufficient answer to this would be, if the scholars can learn the one study so easily, so might they learn all studies without a teacher. Again nearly all our common school teachers are from the Normal schools, but certainly they do need to pass through an agricultural college, if they have graduated without a knowledge of the principles of the heretofore mentioned studies; and with the contemplated text-book as a guide teachers certainly will be just as able to instruct in these studies as in any others.

Agriculture and chemistry are taught in the common schools of Scotland, and they have an advanced agriculture. Why not an education to fit the farmer for his profession as well as to fit for any other?

From a brief consideration of the helpfulness to agricultural pursuits, the expense sinks materially when compared with the difference between a perfect and very imperfect system of agriculture. Wealth is the most abundant where there is the greatest amount of general information. The benefits resulting from the acquisition of theoretical knowledge are not generally measured in dollars and cents, yet they have a pecuniary value. Scientific knowledge for a young man may be a source of pleasure to him—nay, will be in later years and perhaps prevent him from dissipation, for "idleness is the father of discontent." Then is not the possession above the value of dollars to the rising generation and to the State? Can it be otherwise than financially desirable to educate the scholars in the general principles of the natural sciences?

The tillers of the soil should study the physical character of agriculture. They need to understand the laws by which water is moved through the earth, the laws governing the requirements of plants, the laws of heat and light. They should know something of geology. Geology diffuses much scientific information and encourages the study of the works of nature. It teaches the young farmer that all soils are a decomposition of the earth's crust and that some soils are richer in the elements of plant food than others.

It furnishes data from which to judge of the character of the soil. It furnishes a basis for intelligent agricultural operations. By its aid different soils may be classified according to their relative values. Geology aids the agricultural interest by pointing out deposits of natural manures, also what materials ought to be added to soils to make them more productive. Much better add Geology to the common school studies and throw away Algebra if we cannot have both. As much might be said of the other mentioned studies in their treatment. Of this study, Algebra, what need has the common farmer?

Now, will any intelligent farmer say that he believes from past experiences that even a limited additional knowledge in agricultural science introduced into our common schools will not be the means of enlarging and honoring the occupation of farming, and thus create a better interest in agricultural pursuits and be a means of retaining our own children at home to develop the great natural resources of the State.

The great hope of agriculture is its ennoblement. To make farming noble we should love it; and to love it is to know it. Our calling is what we make it. Observation and investigation make labor a pleasure. Taking all things into consideration, the probabilities of health, length of days, freedom from the anxious cares of business, domestic happiness, and the joys of home, with the promise of seed time and harvest, is not its pursuit more desirable than any other?

That the farmer of to-day is much discouraged over the present out-look it is no use denying. That there are many discouraging features to rural life is admitted, so it is in all callings or professions. Shall we sit idly down and decry the situation or shall we write progress on our fence posts, renew our exertions, seek new methods by which to advance, closely study and take a more determined view of the situation? Is farming a success or a failure? In the minds of some there may exist doubts as regards financial adv.ncement through profitable cultivation of the soil.

But I submit that thought and intelligent application of labor will bring as remunerative results as at any time in the history of the State. I believe it to be a fact that farm property brings a larger income on the investment in proportion to labor expended, than any other kind of property or business.

We ought to feel and take more pride in our profession, in our farms and homes. They should be the ideal homes and moral schools of the nation. Instead of that degraded feeling so frequently pervading the atmosphere of the farmer, there should be a feeling of respectability and independence. "Hayseed" and "Fresh" are no longer a stigma. Look at the great men of our nation, our rulers, our scientific men. Were they not farmers? I am told the entire number of naturalists in the United States were reared from the farm.

It is the farmer's duty to interest and attract his children in the co-partnership of the farm. They should be taught all labor is honorable and that there is dignity in labor; they should be taught practical lessons in feeding and caring for stock; their minds should be moulded intelligently. being early interested in books and papers relative to the farm. Some paper and some stock in their name will make them thoughtful. They should be consulted in regard to farm matters. The home should be made attractive and they should become interested in it. Then our farms and homes will stay occupied and our children will be illustrations of contentment. The day should no longer dawn upon the idea that if farmers' boys are smart they should leave the farm and engage in a more honorable calling. It is an evil that so large a majority of farmers' boys and girls should leave the influences of home and scenes of their childhood for an uncertain life in the city. Careful training and the right methods of government would have kept them at home.

Many of our young men have left the parental roof because of the exactions in the way of privileges and pleasures. It is natural for the young to seek amusement and recreation. Wisdom and forethought on the part of parents would allow their children opportunities for healthy amusement. "All work and no play makes Jack a dull boy." The occupation and the home should be so pleasant and interesting that they will have no desire to leave it to seek other fields. Fretting and fuming have driven more young men from the home than any one thing. Children should be treated as equals, taken into confidence and interested in the business. Young men think they have a hard time on the farm. They do not have the leisure they would like, but if they should change to city employments they would learn a needed lesson. They would learn "all things are not what they seem," and the leisure they so much desired, is still in the distance.

The importance of the grange can not be over-estimated. It should become the farmers' school-room. Great benefit is to be derived by farmers in attending its meetings. Besides the pleasure and privilege of attending various questions relating to the farm and household may be brought up, theories and experiences compared and discussed, so the young farmer may reap the benefit of life's experiences of the older, become benefited by the valuable hints and suggestions. Practical lessons may be learned. Each member becomes an instructor in lifting each other to a higher plane of thought and action.

Much valuable knowledge may be gleaned by essays and selections, by an interchange of thought. The nobler qualities of human nature are unfolded and self reliance is gained. At the same time it is an educator of our youth, and if they are led to become interested. just so far they become satisfied with their surroundings and that *unrest* is *eliminated*, and they learn to look upon their occupation as the noblest of earth, to realize its dignity and usefulness. Farmers' girls are apt to think that farmers' wives are not respected and they regard farm life as one of drudgery and unrespectability. But the fact exists and our great writers voice it that home life on the farm is the pleasantest of any on earth. Here they gain a true idea of the beauties of rural life. Another important feature is that the grange admits women on an equal, thus commanding more respect and higher regard, and the meetings become more elevated through her presence. Another advantage is its social features. It overcomes the lack of social intercourse. Warm friendships are formed and we have a more extended acquaintance. It aims to make the daily life of its members better and happier as well as to improve the character and increase the intelligence. The grange is a potent factor in uniting the farmers in bonds of union, protection and forbearance and in building up their condition below mediocrity, for whom there is no royal road to wealth nor mystic process by which to multiply dollars. The grange is making phenomenal progress in the condition of its members, morally and intellectually. I hope the farmers will see the necessity of joining this organization.

Every association which has for its object the protection and advancement of the interests of those engaged in tilling the soil should receive the hearty support of all. Too long have the farmers been the butt of political scheme and the prey of gigantic fraud. This should no longer be submitted to. Let us give our allegiance and vote only for those public representatives who will advance our interests.

The last census gave as a grand total of all persons engaged in the various occupations as some rising seventeen millions, all persons engaged in agriculture seven and a half millions, manufactures and mining less than four millions, leaving five and a half millions for various occupations. Also the estimated value of all property, personal and real, in the United States as forty-three thousand millions, while it gave the estimated value of farms at ten thousand millions, (some less than a quarter of the whole value) also the capital invested in manufactures nearly twenty-eight hundred millions only. The total presidential vote for 1880 was a little over nine millions. Now the seven and a half millions engaged in agriculture being largely voters surely proves the fact that more than one-half of that vote was cast by farmers. This shows that the agricultural industry of our country is of vastly more importance than any other. It employs more than double the number of persons than any other industry, double the capital, more than double the power, if they will use it, to direct legislation, instead of being dominated over by others. In us is vested the power to elect or defeat. The time for party division among farmers has passed. To-day all thinkers should vote for their own interest regardless of party lines. Farmers are too apt to get into a rut and think there is no way of getting out.

Farmers everywhere should wake up to the importance of this matter. They are too apt to stay at home and work hard early and late and when election comes go to the polls and vote for a lawyer or somebody else who cares nothing for their interest, but who is probably elected in the interest of some "trust" or monopoly that is extorting money from the pockets of farmers themselves. Farmers should study their interests closer. When they come to a full realization of their rights and privileges there will be more of them found in Congress and in the State legislatures. It is time that farmers got over the notion that it does not pay to bother with politics.

Farmers should realize their responsibility to the nation and future generations. Farmers should organize. Almost every interest is organized; labor that is other than farm labor is organized; railroad industries and manufactures. If any scheme detrimental to a certain line of manufacturing is proposed for consideration in any branch of the government, state or nation, the men who are interested rise in mass regardless of party and protest against it. And they usually succeed in having things about as they want them. "In union is strength" and in organization power. If farmers as business men would combine regardless of party for the better protection of their business the result would be highly beneficial.

The unjust taxation of real estate caused by the fact that so much personal property in towns and cities wholly escapes taxation is one of the crying evils that most directly affects farmers. In not a few States they are taking hold of the matter in earnest. It is a reform that is urgently needed and farmers' organizations can well undertake it. It is semi-political in its nature. It is a job the Maine Board of Agriculture and the State Grange have already tackled.

The valuation commission now in session, assured the Board of Agriculture who appeared before them at the annual meeting, that everything in their power should be done toward relieving the farms of their unjust taxation. This is encouraging.

There should be a relief from the double tax system or to that class of farmers whose capital is limited and who do not fully own their farms, but are embarrassed by both taxation and interest in form of capital secured by mortgage. This should be brought about by legislative enactment. And I would like to suggest also the idea that many of our abandoned farms and homes might be repeopled if for a limited number of years they should be relieved from taxation provided their owners show a certain amount of improvement. Ireland owes her present condition to the fact that her land is owned by a few rich men ; prosperous France to the fact that the land is owned by the peasantry who till their own soil. If we are interested in the future of a state we must be interested in the retaining and upbuilding of the small farms of Maine. Away with tenantry and landlordism now gaining a foothold in this boasted free land of ours ! If we would remain independent we must create a reform. If we love these beautiful hills and valleys, if we love these homes of our birth, every feature of which is dear to the heart, we must needs be frugal and industrious, and awake to our surroundings. The teeming millions are to be fed.

"The king may rule o'er land and sea
 The lord may live right royally;
The soldier ride in pomp and pride,
 The sailor roam o'er oceans wide;
But this or that, whate'er befall,
 The farmer, he must feed them all.

The writer thinks, the poet sings,
 The craftsman fashions wondrous things,
The doctor heals, the lawyer pleads,
 The miner follows precious leads;
But this or that, whate'er befall,
 The farmer, he must feed them all.

The merchant he may buy or sell,
 The teacher do his duty well;
And men may toil through busy days,
 Or men may toil through pleasant ways,
Beggar or king, whate'er befall,
 The farmer, he must feed them all.

The farmer's trade is one of worth;
 He's partner with the sky and earth,
And partner with the sun and rain,
 And no man loses for his gain,
And if men rise or if they fall,
 The farmer, he must feed them all.

The farmer dares his mind to speak;
 He has no gift or place to seek,
To no man living need he bow,
 For he who walks behind the plow
Is his own man, whate'er befall,
 Beggar or king, he feeds them all."

A STUDY OF THE MAIZE PLANT.

[Copied from New York State Experiment Station Report 1889, Dr. Peter Collier, Director.

In 1888 some attention was given at this Station to investigating the increase and chemical changes which take place in the maize plant during its period of growth, and it was decided to continue the investigations through 1889.

The three questions presenting themselves most forcibly for study were:

1. What is the best variety of corn to grow for the silo?
2. What is the best method of planting?
3. What is the proper stage of maturity for cutting corn for the silo?

In the past a larger amount of work has been done at this Station in the growing of maize for forage and other experimental purposes, and much of this data is in a line to aid in answering the questions we have already outlined.

Before coming to examine the results of the present season we may review the work already done at the station. In 1884* several trials with varieties are recorded, and we first note the difference between hill and drill for a Flint variety. Hills, forty-four by twenty-two inches; drills, forty-four inches, about twelve kernels to foot:

	Yield of forage.	Amount water per acre.	Dry matter.
	Tons	Tons	Tons
Flint corn, in hills	16 39	13.04	3.35
Flint corn, in drills	10.01	8.07	1.94

The results are in accordance with the general belief that corn so thickly planted, as in the drills above, gives smaller amount of dry matter than when planted at greater distance.

It is interesting to note the actual yield per acre of the several chemical constituents for thick planting and thin planting, as in the hills and drills just recorded:

*Third Annual Report New York Station, p. 102.

	Yield per Acre in Pounds.	
	In hills.	In drills.
Ash	237.85	136.58
Albuminoids	559.45	308.07
Crude fiber	1,564.45	1,019.66
Nitrogen-free extract	4,159.38	2,294.24
Fat	174.87	121.44

In 1884 corn for forage was planted thick, and the varieties we are about to consider were planted in drills forty-four inches apart, and about twelve kernels to the foot except the pop variety, and this was planted in drills twenty-two inches apart. Below we give the yield of green forage, the amount of water and of dry matter all expressed in tons, per acre:

	Forage per acre.	Water per acre.	Dry matter per acre.
Minnesota Dent	10.57	8.69	1.88
Evergreen Sweet	7.95	6.40	1.55
Waushakum Flint	10.01	8.07	1.94
New England Pop	11.06	9.67	1.39

The yield per acre for both green forage and dry matter was very low, but to what extent this is due to thick planting we can not fairly say. In 1885 several varieties of corn were planted in drill, about twelve kernels to the foot, and the distance between drills was varied, some plats being forty-four inches others twenty-two inches apart, and below we tabulate the results for the green forage, amount of water and dry matter expressed in tons per acre:

Variety.	Forage per acre.	Water per acre.	Dry matter per acre.
White Flint, drills 44 inches	23.26	20.20	3.06
Orange County Flint, drills 22 inches	27.37	19.36	8.01
Queen of Prairie Dent, drills 44 inches	18.13	15.25	2.88
Long Island White Dent, drills 22 inches	17.00	14.34	2.66
Sweet corn, mixed, drills 44 inches	20.33	17.46	2.87
Pop corn, mixed, drills 44 inches	15.94	13.06	2.88
Pop corn, White Pearl, drills 44 inches	15.30	12.69	2.61
Pop corn, White Pearl, drills 22 inches	19.00	15.53	3.47

In 1886* four varieties of corn were tested in two series of plats, twenty kernels to the foot were planted in drills. In series 1, drills forty-four inches apart; series 2, drills thirty inches apart.

For this year we have only the yield of green forage in tons, per acre, as follows:

	Series I.	Series II.
Waushakum	11.19	19.05
Yankee Dent	12.88	18.21
Stowell's Evergreen, sweet	9.99	13.06
Pearl Pop	11.74	11.51
Mixture of all	15.08	14.61

It is noticeable that the yield per acre of green forage was greater for the thick seeding for each variety except the pop.

The average for four-year trials is summarized† as follows, regardless of variety:

AVERAGE TONS OF GREEN FORAGE PER ACRE.

Flint corn	15.88
Dent corn	14.95
Sweet corn	12.83
Pop corn	12.63

*Fifth Annual Report New York Station, p. 46.

†Fifth Annual Report New York Station, p. 47.

From the trials as summarized, it appears that the Flint corns give, under the method of thick seeding, the greatest amount of green forage per acre, and four years' trials should give a fair test including as they do, several well-know varieties.

The corns were cut, as a rule, at the stage when the pollen was falling.

The question we now have to consider, is, whether the method of planting in drills with the stalks so close, twelve or more to the foot, was the most favorable for the production of the greatest amount of forage. The Flint corn, planted in hills and drills, indicates that the corn in drills was too thick for best growth. The trials in the following year on this point are conflicting, but we do not have the same two varieties for comparison, hence must look elsewhere for our answer. In 1886 we have direct comparison for twenty kernels to the foot in drills forty-four inches apart and drills thirty inches apart. With Flint, Dent and sweet corn, the results for total yielded of green forage is decidedly in favor of thick seeding, as already shown in series 1 and 2. We can not say, however, that a greater yield of dry matter would have been secured with four or six kernels to the foot.

Like results have been obtained with planting amber cane for forage, as shown below:

	Forage per acre.	Water per acre.	Dry matter per acre.
Early Amber Cane, drills 44 inches—tons...........	23.84	20.33	3.51
Early Amber Cane, drills 44 inches—tons...........	23.75	20.15	3.60
Early Amber Cane, drills 22 inches—tons...........	27.41	23.18	4.23
Early Amber Cane, drills 22 inches—tons...........	25.20	21.02	4.18

In dry matter we see a decided increase by thicker seeding and we have confirmed the general results obtained with corn.

As these plats growing amber cane were in comparison with the corn plats in 1885, we see the relative yield of corn and amber cane as forage crops; corn averaging 3.55 tons of dry matter per acre and amber cane 3.88 tons. There seems to be no question then but what the greatest amount of green forage and dry matter has been produced at this Station by thick seeding. Whether by thin seeding, as in the case of hill and drill trials, a greater yield would have been secured may be questioned. Under what conditions the greatest amount of digestible matter would be secured remains for further investigation.

The next point we come to consider is, "What is the amount of increase in the maize plant as it approaches maturity?" As a first step in this direction we can have no better data than is found in the experiment by Dr. Babcock.*

In a plat of flint corn, Waushakum corn, Babcock selected thirty stalks on August eighteenth, each bearing two ears and as much alike in general appearance as could be determined by a superficial examination. At this date the kernels of corn were just beginning to swell, and beginning at this date analyses were made at intervals of one week to September twenty-third. Five stalks were selected at each cutting and measurements, analyses, etc., made of each individual stalk.

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*Second Annual Report, 1883, p. 153.

Rearranging the table to serve our purpose we have the following:

Date of Sampling.	Height of stalk—feet.	Weight of Stalk—Grams		Per cent water.	Per cent dry substance.	Ash.	Albuminoids, Nx 6.25.	Crude fiber	Nitrogen-free extract.	Fat, ether extract.
		Fresh.	Dry.							
August 18:										
Stalk 1....	6.25	777.0	98.5	87.32	12.68	4.87	9.81	25.70	57.30	2.32
Stalk 2....	7.80	953.0	132.4	86.11	13.89	5.03	10.06	27.14	55.42	2.35
Stalk 3....	7.00	911.0	135.5	85.12	14.88	4.50	11.19	28.24	53.84	2.23
Stalk 4....	7.10	896.0	126.2	85.91	14.09	5.00	10.12	30.15	52.39	2.34
Stalk 5....	6.60	1,014.0	142.0	85.99	14.01	4.41	10.31	25.97	57.19	2.12
Average.....	6.95	910.0	126.9	86.05	13.95	4.76	10.30	27.44	55.23	2.27
August 25:										
Stalk 1....	6.50	1,265.0	177.3	85.99	14.01	5.01	12.19	27.95	52.97	1.88
Stalk 2....	6.75	847.0	134.0	84.18	15.82	4.73	10.94	28.32	53.97	2.04
Stalk 3 ...	6.90	864.0	150.3	82.60	17.40	3.98	11.06	25.31	57.60	2.05
Stalk 4 ...	7.60	1,032.0	153.0	84.20	15.80	4.22	10.19	28.09	55.67	1.83
Stalk 5....	7.00	912.0	137.0	84.94	15.06	4.38	12.25	26.66	54.64	2.07
Average.....	6.95	984.0	151.3	84.38	15 62	4.46	11.32	27.27	54.98	1.97
September 1:										
Stalk 1....	6.90	986.0	177.7	81.98	18.02	4.31	10.44	25.95	57.36	1.94
Stalk 2....	5.75	684.0	149.0	78.16	21.84	4.37	10.84	22.34	60.21	2.14
Stalk 3....	6.60	1,325.0	226.3	82.92	17.08	5.03	12.13	20.06	60.77	2.01
Stalk 4....	7.50	1,028.0	159.0	84.53	15.47	3.76	9.81	28.73	55.91	1.79
Stalk 5 ...	7.80	1,060.0	196.3	81.48	18.52	4.25	9.25	25.74	58.74	2.02
Average.....	6.91	1,017.0	181.7	81.81	18.19	4.34	10.51	24.56	58.58	1.98
September 8:										
Stalk 1 ...	7.33	988.0	224.0	77.33	22.67	3.79	9.56	21.67	62.96	2.02
Stalk 2....	7.00	1,185.0	279.5	76.41	23.59	3.69	9.44	19.54	64.68	2.65
Stalk 3....	7.00	1,004.0	229.5	77.14	22.86	3.93	9.94	20.14	63.55	2.44
Stalk 4....	7.10	1,182.0	252.0	78.68	21.32	4.10	9.50	18.55	65.58	2.27
Stalk 5....	7.82	1,016.0	232.0	77.16	22.84	3.87	10.13	19.19	63.94	2.87
Average.....	7.25	1,075.0	243.8	77 34	22 66	3.88	9.71	19 82	64.14	2.45
September 15:										
Stalk 1....	7.00	948.0	245.0	74.15	25.85	3.41	8 44	19 17	66.28	2.70
Stalk 2....	7.00	742.5	191.0	74.28	25.72	3.05	8.75	19.16	66.67	2.37
Stalk 3....	6.25	811.0	201.0	75.21	24.79	4.78	11.13	16.41	64.66	3.02
Stalk 4	7.42	977.0	257.0	73.69	26.31	3.44	9.63	20.35	63.84	2.74
Stalk 5	8.00	1,282.0	285.5	77.73	22.27	3.23	9.56	21.07	63.98	2.16
Average.....	7 13	952 1	235.9	75.01	24.99	3.58	9.50	19.25	65.07	2.60
September 23:										
Stalk 1 ..	7.90	960.0	298.5	68.91	31.09	3.05	7.94	20.88	65.66	2.47
Stalk 2....	6.42	1,134.0	359.0	68.34	31.66	2.95	9.19	17.19	67.50	3.17
Stalk 3....	7.33	1,276.0	395.0	69.04	30.96	2.77	9.81	16.49	67.68	3.25
Stalk 4....	6.33	845.0	271.0	67.93	32.07	3.19	9.31	25.42	59.11	2.97
Stalk 5....	7.60	1,203.0	310.0	74.14	25.86	2.97	8.50	20.85	64.82	2.86
Average......	7.12	1,084.0	326.7	69.67	30.33	2.98	8 95	20.17	64.96	2.94

The table presented is interesting not cnly in showing the relative increase in the stalks, but also the variation in the chemical composition of individual stalks.

From the averages given in the last table we may construct another table giving the actual amounts for the several periods from formation of kernel up to full maturity. Such a table is presented below:

Average for	Dry substance.	Ash.	Albuminoids.	Crude fibre	Nitrogen-free extract.	Fat.
	Grams	Grams.	Grams.	Grams.	Grams.	Grams
August 18...	126.9	7.04	13.07	34.82	70.08	2.88
August 25...	151.3	6.74	17.12	41.25	83.18	2.98
September 1,	181.7	7.88	19.09	44.62	106.44	3.59
September 8,	243.8	9.45	23.67	48.32	156 37	5.97
Sept 15.....	235.9	8 44	22.41	45.41	153.54	6.13
Sept. 23.....	326.7	9.73	29.23	65.89	212.22	9.60

The above table is interesting in showing the gradual increase, with the exception of the five stalks cut September fifteenth which did not prove to be an average lot, and illustrates the great difficulty of selecting or in sampling corn so as to fairly represent the entire crop.

It was intended in this connection to have considered the work already done at other stations, but the great mass of accumulated data renders it impossible to do anything like justice and keep within the limits of the present article. The whole should be thoroughly digested and published as a monograph.

EXPERIMENTAL WORK OF 1888.

Briefly reviewing the woik of 1888,* we have the following summary:

	Corn Per Acre	
	Pounds	Tons.
September 11	25,326	12.66
September 29	25,011	12.50

*Bulletin No. 16, New York Agricultural Experiment Station.

The total yield per acre of the chemical components was as follows:

Per Acre.	Sept. 11.	Sept. 29.	Increase.
Water, lbs.	20,322	19,351	
Dry matter, lbs.	5,004	5,660	
Ash, lbs.	215	237	
Albuminoids, lbs.	525	512	
Crude fiber, lbs.	1,443	1,650	
Nitrogen-free extract, lbs.	2,696	3,109	
Fat, lbs	125	188	
Total nitrogen, lbs.	84.07	80.94	
Albuminoid nitrogen, lbs.	50.04	66.79	
Amide nitrogen, lbs.	34.03	14.15	
Glucose, lbs.	580.46	751.49	171.03
Sucrose, lbs.	390.31	633.92	243 61
Starch, lbs.	908.72	1,077.10	168.38
			583.02

The variety of corn was B. & W. and September eleventh, the date of first cutting ranged from full silk to watery stage of kernels; September twenty-ninth from watery stage to full milk.

EXPERIMENTS IN 1889.

The present season our experiments have been restricted to the one question, "What is the best stage for cutting corn for the silo?" The chemical work, to determine the changes in the corn at the several stages of growth, has been quite complete. For the purpose of our experiment King Philip corn was selected. In the latter part of July, in a field of some twelve acres, one acre was selected that to all appearances was as nearly uniform in growth as possible to select and measured off. The plot included forty rows and these were divided into five sets, one-fifth acre each. This gave eight rows to each fifth acre, and, in order that any inequality in the land or growth of the corn might be counterbalanced so far as possible, it was decided at each cutting of the corn to take rows from each plot.

The corn, as fast as cut, was piled upon a wagon, drawn to the barn, weighed and immediately run through the ensilage cutter and eight samples selected from the mass for water determination and analysis. Five cuttings were made and the dates and stage of growth are shown below:

Date of cutting.	Stage of growth.
July 30	Full tasseled.
August 9	Full silked.
August 21	Kernels watery to full milk.
September 7	Kernels glazing.
September 23	Ripe.

The yield per acre and the per cent of water for each period were as follows:

	Pounds per acre.	Per cent water.
July 30	18,045	91.05
August 9	25,745	88.05
August 21	32,000	85.76
September 7	32,295	77.70
September 27	28,460	72.18

The greatest weight per acre of green matter was at period of watery stage of kernel to full milk but the largest per cent of water as would be expected was at the first cutting, when 9.02 tons per acre were cut and of this amount 8.21 tons was water 0.81 tons of dry matter and in this connection the words of Professor Robertson at an institute in Wisconsin seem fully justified. In speaking of corn so planted as to be cut for forage at this stage of growth he said: "Fodder corn sown broadcast does not meet the needs of milking cows. Such a fodder is mainly a device of a thoughtless farmer to fool his cows into believing that they have been fed when they have only been filled up." A cow of 1,000 pounds live weight in order to get the amount of dry matter called for by the German standards would have to eat per day 300 pounds of corn forage such as we just been considering. At the second cutting we have 11.33 tons of water and 1.54 tons of dry matter in the 12.87 tons of forage. At full maturity we have an average crop of 14.23 tons with less water than at the period of tasseling and nearly five times as much dry matter.

	Corn, tons per acre.	Tons water per acre.	Tons dry matter per acre.
July 30	9.02	8.21	.81
August 9	12.87	11.33	1.54
August 21	16.30	13.97	2.33
September 7	16.14	12.51	3.63
September 23	14.23	10.27	3.96

The composition of the dry matter for each period shows percentagely a gradual decrease for all the components except nitrogen-free extract, which rises from forty to nearly sixty-one per cent. The per cent of nitrogen steadily diminishes through the series, while the sugars rise and fall. The starch falls slightly in per cent

	July 30.	Aug. 9.	Aug. 21.	Sept. 7.	Sept. 23.
Ash	8.58	6.54	5.00	4.20	4.60
Albuminoids	14.81	14.19	10.31	8.94	8.56
Crude fiber	31.76	28.36	27.18	24.38	21.90
Nitrogen-free extract	40.39	45.46	52.58	58.87	60.97
Fat	4.46	5.45	4.93	3.61	3.97

through the first three periods, and then increases rapidly until maturity.

Per Cent in Dry Substance.

	Total nitrogen.	Albuminoid nitrogen.	Amide nitrogen.	Glucose.	Sucrose.	Starch.
July 30	2.37	1.69	.68	3.60	.56	17.55
August 9	2.27	1.45	.82	9.76	3.60	15.96
August 21	1.65	1.30	.35	14.32	2.80	15.20
September 7	1.43	1.09	.34	10.00	1.32	24.09
September 23	1.37	1.15	.22	6.80	1.88	36.02

It is interesting to note the differences in percentage composition with each stage of growth of the corn, but it is only when we consider the total yield per acre that we are able to fully understand the increase which has taken place in the crop itself.

CHEMICAL CHANGES IN THE CROP.

The total yield per acre at the date of last cutting was not so large as at the time of the two previous cuttings, but the dry matter steadily increased. From the date of full tasseling until ripe the dry matter increased 4.8 times or from 1,619 pounds to 7,918 pounds per acre. From full silking until ripe the increase in dry matter was 2.5 times. Last year in our experiments we found no increase in albuminoids with B. & W. corn between the periods of full silk and watery stage of kernels. We note that while in this experiment for the same period of growth there was some increase in albuminoids, yet it was much less than for the previous or following period.

Per Acre.	Tasseled. July 30.	Silked August 9.	Milk August 21.	Glazed Sept 7.	Ripe Sept. 23.
	Pounds	Pounds	Pounds.	Pounds.	Pounds.
Yield per acre	18,045.00	25,745.00	32,600.00	32,295.00	28,460.00
Water per acre	16,426.00	22,666.00	27,957.00	25,093.00	20,542.00
Dry matter per acre	1,619.00	3,078.00	4,643 00	7,202.00	7,918.00
Ash	138.91	201.30	232.15	302.48	364.23
Albuminoids	239.77	436.76	478.69	643.86	677.78
Crude fiber	514.19	872.93	1,261.97	1,755.85	1,734.04
Nitrogen-free extract	653.91	1,399.26	2,441.29	4,239.82	4,827.60
Fat	72.20	167.75	228.90	259.99	314.34

CHEMICAL CHANGES IN THE ALBUMINOIDS.

It is interesting to note the changes taking place in the albuminoids during the period of growth. It is noticeable that there are two periods of smallest gain in total nitrogen.

Pounds of Nitrogen per Acre.

		Total nitrogen.	Albuminoid nitrogen.	Amide nitrogen.
July 30.........	Tasseled.......	38.37	27.36	11.01
August 9........	Silked	69.87	44.63	25.24
August 21.......	Kernels in milk	77.61	66.36	17.25
September 7.....	Corn glazed...............	102.99	78.50	24.49
September 23....	Corn ripe	108.47	91.06	17.41

And there are also the periods of minimum amide nitrogen. Thus it appears that between periods of silking and corn in milk there is small gain in nitrogen, and this corroborates the work of last season with B. & W. corn. At this stage of growth the amide nitrogen is largely transformed into albuminoid nitrogen. Following the period just mentioned, corn in milk, there is a large increase in nitrogen, and the amide nitrogen increases in greater proportion than does the albuminoid nitrogen. It is at this period of growth that it is essential that there be present in the soil nitrogen in a form available as plant food During the ripening stage there is little increase of total nitrogen, but the amide nitrogen is transformed into albuminoid nitrogen.

NITROGEN-FREE EXTRACT.

It is in the nitrogen-free extract or carbohydrates that the greatest increase has taken place, and to learn what is the nature of this increase was the object of our further investigation.

Amount per Acre for Different Stages of Growth.

		Glucose.	Sucrose	Starch.
		Pounds	Pounds.	Pounds.
July 30.	Tasseled....... .	58.28	9.06	122.23
August 9.............	Silked	300.41	110.80	491.25
August 21............	In milk...........	664.98	129.00	706.74
September 7	Glazed	720.20	95.06	1,734.96
September 23	Ripe	538.42	118.86	2,852.86

The total starch per acre increased more than twenty-three times between tasseling of corn and harvesting, a period of fifty-five days. From the stage of glazing of corn until full ripening the increase in dry matter was 716 pounds, the increase in nitrogen-free extract, 587 pounds, while the increase of sugar and starch was 989 pounds, or greater by 273 pounds than the entire gain in crop. That is, much of the nitrogen-free extract which at period of glazing of corn was in the transitory state had been translocated and transformed into sugars and starch.

The conclusions reached last year with B. & W. corn are in the main borne out by the present season's investigation, and the results of two years' work given in a short summary are as follows:

CONCLUSIONS.

1. That the greatest weight of green fodder is between the period of full silking and milky stage of kernel.
2. That the total weight diminished after this date but the total dry matter increased.
3. That as the corn approaches maturity the per cent of amide nitrogen diminishes, while the albuminoid nitrogen increases, thus seemingly increasing the feeding value of the crop.
4. That the sugars and starch increase rapidly during the latter period of growth and maturing of the corn plant, and that these are the most valuable portion of the nitrogen-free extract.
5. That between the period of glazing and full ripening of corn there was a large increase in amount of sugar and starch.
6. That for the greatest amount of nutriment, considered from a chemical standpoint, corn should not be cut before it has well ripened.
7. That the B. & W. corn can not, in ordinary culture, be matured in this latitude.

DIGESTIBLE MATTER.

Artificial digestion serves to give us a pretty definite knowledge of the digestibility of the albuminoids of foods and by this means we find that for the several cuttings we have:

	Total albuminoids.	Albuminoids digestible.
Tasseled, pounds	239.77	117.37
Silked, "	436.76	205.79
In milk, "	478.69	207.03
Glazed, "	643.86	315.42
Ripe, "	677.78	326.21

An inspection of the above table shows two periods of rapid increase in digestible albuminoids. These figures correspond with the periods of similar increase in total albuminoids. Between the period of the corn silking and the kernels in milk there is almost no increase in albuminoids, and the same is true between the glazing and ripening period of the corn although a rapid increase of starch is made.

GREEN GRASS vs. DRIED GRASS.

By H. P. ARMSBY AND WM. H. CALDWELL.

[Copied from Pennsylvania Experiment Station Report, 1888.]

There is a prevalent impression among farmers that drying diminishes very materially both the digestibility and feeding value of grass or clover. This impression arises very naturally from the comparison, which is forced upon every farmer, of the relative value of dry hay and pasture. While upon good pasture animals will thrive and produce abundantly of either milk or meat, the same animals when fed upon hay fail to yield anything like the same return.

When, however, exact digestion experiments came to be made, it was found that simple drying had practically no effect upon the digestibility of grass or clover. It is hardly necessary here to cite examples of this. The experiment has been repeated so often that every one conversant with the subject has been forced to admit that the simple drying of fodder without loss does not decrease its digestibility. It is still claimed, however, that while the dried material may be just as digestible as the green, the digested matter has not the same nutritive value. The ardent advocates of ensilage especially have claimed a greater nutritive value for this feed on account of its succulence, and have claimed that in the process of drying the nutrients of green food undergo a process of dehydration which renders them less easily digestible and less valuable, and in this connection they lay considerable stress upon the difference between hay and grass, noted above, and which is familiar to every one, as a further example of the value of succulence.

While numerous comparative digestion experiments have been made on green and dried fodder, there have not been made, so far as I know, any exact experiments designed to test the truth of this general impression of the greater nutritive value of green as compared with dried material. The experiments described on the following pages were designed as a beginning in this direction. Owing to the great amount of labor and time requisite for the proper carrying out of such an experiment it was found impossible to use more than one animal. A larger number would doubtless have added to the value of the experiment, but the results are presented here for what they are worth.

PLAN OF THE EXPERIMENT.

The animal used was a five-year-old Guernsey-Jersey cow. She dropped her second calf on April 2d, 1888. The week previous to entering upon the experiment her average daily yield of milk was twenty-nine pounds and three ounces. On May 11, 1888, she was fed ten pounds of the green grass, and the quantity of grass increased and that of dried fodder decreased until May 27th, when she was fed exclusively green grass, of which she received a full ration of eighty pounds. The experiment proper began on the afternoon of May 29th, and was conducted as follows: On the afternoon of each day there was cut on the college campus somewhat more than 165 pounds of grass. The grass was raked up carefully as fast as cut, placed in a cart and kept covered to prevent wilting, and taken to the barn as soon as the whole quantity had been cut. There a sample of five pounds was first taken for chemical analysis; then eighty pounds were weighed out for the animal, about half being given to it the same night, and the remainder kept covered in as cool a place as possible, and used for the next morning's feed. Finally a second portion of eighty pounds was weighed out and spread on a large sheet to dry. It was at first attempted to dry this grass in the sun, but this was found to progress so slowly that as a substitute a staging was built over the boiler of the Mechanic

Arts' shop, and the sheet containing each day's grass was spread out upon this and allowed to lie usually for nearly twenty-four hours. When thoroughly dried the whole amount for one day was carefully transferred to a cloth bag, tied up securely and set aside. This routine was gone through with daily throughout the first period of eighteen days. During the last five days of this period the digestibility of the grass was determined in the method described below. The weight of the cow and the amount of water drunk daily were determined; the cow was not allowed to run in the yard, but kept in the stable all the time. In the second period of the experiment, also extending over eighteen days, the dried grass from the previous period was fed, the grass dried on the first day of the first period being fed on the first day of the second period and so on throughout. The digestibility of the dried grass was determined during the last five days of the period, and the weights of animal and water drunk were taken as before. Throughout the experiment the animal was milked twice daily. Each milking was weighed and a sample of the night's and next morning's milk was taken daily for analysis. The feed given was eaten clean except on five days of the green grass feeding. Four of the days were in the first half of the period, and all five of them in what may be called the preliminary feeding; that is, there were no uneaten residues during the digestion period. After making allowance for these uneaten residues, we find the amount of fresh grass actually eaten per day in period I, to have been:

First half	79 05	pounds
Second half	79.75	"
Whole	79.40	"

It should be observed that in an experiment conducted in this way practically all the errors of experiment are likely to diminish rather than to increase the comparative value of the dried grass. The green grass was weighed out and fed directly with practically no chance for loss. The dried grass on the contrary had been handled considerably, and since it was not weighed after drying any accidental loss during the drying and necessary handling would diminish the amount of food eaten in the second period, and so tend to cut down the milk yield. It is believed, however, that no material loss of fodder occurred during the experiment.

COMPOSITION AND DIGESTIBILITY.

The following table shows the proportion of water and dry matter, and the percentage composition of dry matter of the grass that was used in the preliminary feeding and in the digestion period, and that left uneaten:

Composition of Grass.

	Preliminary feeding.	Digestion period.	Uneaten residues.
Water	73.21	75.77	58.61
Dry matter	26.79	24.23	41.39
	100.00	100.00	100.00
In 100 parts of dry matter:			
Ash	10.31	10.92	10.47
Albuminoids	13.44	11.74	13.25
Non-albuminoids	6.29	3.43	4.68
Crude fiber	24.33	27.92	24.92
Nitrogen-free extract	41.12	41.73	41.62
Fat	4.51	4.26	5.06
	100.00	100.00	100.00

It will be observed that the grass used in the preliminary feeding was of a rather better quality than that used in the actual digestion period, since it contained considerable more protein and considerably less crude fiber. It is altogether probable that there was a difference in the digestibility corresponding to this difference in composition, and that more food was actually digested from the grass during the first part of the experiment than the figures to be presented later appear to show. On the other hand, however, this difference affects both periods of the experiment equally, since grass of the same quality was fed at a corresponding time in each period. By this method of conducting the experiment, therefore, we eliminate from the comparison of the nutritive effect, any error due to the varying composition of the grass on different days.

As noted above, the digestibility of the fodder was determined in both periods. The general method of conducting a digestion experiment is easily understood. A carefully weighed quantity of food of known composition is fed. This being known, we can calculate how much of each crude nutrient is eaten. After the feeding has been continued for a sufficient length of time so that all residues of previous fodders have been eliminated from the animal, the dung is collected carefully for several days, weighed and analyzed. From the data thus obtained, we can compute how much of each crude nutrient passes through the animal undigested. The difference between this amount and the amount eaten shows the amount digested. Much care is requisite in the details of such an experiment, but the general principle is easily comprehended from the above statement.

Without occupying space with the detailed figures of the digestion experiment, its general results are presented in the table below, which shows the percentage digestibility of the fodder. By this is meant that for example in period I, 68.7 per cent of all the dry matter which the animal ate was digested and did not appear in the excreta; that of the total amount of protein contained in the feed of the first period, 65.5 per cent was digested and so on with the other ingredients.

Percentage Digestibility.

Period	Fodder.	Dry matter.	Ash.	Total protein	Albuminoids.	Crude fiber.	N.-free extract.	Fat.
I.........	Green grass,	68.7	49.7	65.5	55.5	74.3	72.5	54.7
II.......	Dried grass,	71.3	55.5	71.5	63.2	76.7	72.9	60.1

The results just given show an apparently greater digestibility for the dried than for the green grass. A portion of this difference may arise from the method in which the experiment was conducted as will appear from the following considerations. If any of the grass was lost during the process of drying, the amount of material actually fed in the second period was less than that in the first period. In the computations as to the digestibility, however, it is assumed that the same amount of material was fed in the two periods. If this is not the case, the amount excreted in the dung in the second period, as actually determined, being deducted from a greater amount than was actually fed, will show a corresponding greater digestibility. It is reasonably certain, however that not all the difference in the two sets of figures is due to this cause. In order to produce the observed difference in the digestibility of the dry matter, it would have been necessary that fully 20 per cent of the grass should have been lost on drying. It is impossible that any such loss as this can have taken place, and most of the difference must be explained in some other way. On the other hand it is difficult to imagine that the drying can have actually increased the digestibility, and I am inclined to consider the observed difference as simply accidental and most probably due to variations in the amount of dung excreted. The results at any rate, agree with those of other experimenters in showing no loss of digestibility as the result of drying.

NUTRITIVE EFFECT.

The nutritive effect of the feeding is to be measured by the gain or loss in weight of the animal and by the milk yield.

Live Weight—The average live weight of the animals in the first and second period is presented in the following table which contains also the average amount of water drunk per day and the average stall temperature:

	Average live weight.	Average water drunk	Average stall temperature.
Period I. Green Grass.			
First half	763 lbs.	67.5 lbs	67.9 deg. Fahr.
Second half	783 "	54.2 "	71.8 " "
Whole	773 lbs.	60.9 lbs.	69.9 deg. Fahr.
Period II. Dried Grass			
First half	728 lbs.	106.1 lbs.	78.1 deg. Fahr.
Second half	742 "	106.9 "	68.4 " "
Whole	735 lbs	106.5 lbs	73.30 deg. Fahr

In order to show better the variations of live weight the weights from day to day have been represented on the accompanying diagram, in which the heavy line rises or falls as the weight increased or decreased. It is evident from the figures for the daily weighings and from an inspection of the diagram that while the weight of the animal was decidedly less in the second period, on the dried grass, than in the first period, the falling off of weight in passing from the one period to the other was a sudden one. Within three or four days after the dried grass feeding was begun, the weight practically reached its minimum and thereafter increased rather than decreased. If the apparent loss of weight in the second period had been due to deficient nutrition, we should expect that the falling off would be gradual. The fact that it was not indicates pretty conclusively that the loss was not due to actual decrease in the weight of the tissues of the animals, but to a decrease in the contents of the stomach and intestines due to the change of food. This appears so plain from the diagram that I believe we are safe in assuming that the green grass showed no material superiority over the dried grass, so far as the maintenance of the animal was concerned.

Quality of Milk—The average percentage composition of the milk produced in each half of each period is shown below:

Percentage Composition of Milk.

	Total solids.	Fat.	Protein (Nx6.25).
Period I. Green Grass.			
First half	12.84	4.10	2.76
Second half	12.29	4.19	2.80
Whole	12.57	4.14	2.78
Period II. Dried Grass.			
First half	12.07	4.17	2.65
Second half	12.27	4.27	2.58
Whole	12.17	4.21	2.62

The table shows slight changes in the composition of the milk, but they are rather favorable than otherwise to the dried grass. The percentage of solids decreases somewhat regularly until the second half of the dried grass period when it again rises. The fat shows an increase, although a somewhat irregular one throughout the experiment, and the protein a decrease after the first half of the first period. On the whole the differences are so small as to be of little significance.

Quantity of Milk—The table below shows the average daily yield of milk in each half of each period, and also the average yield per day of total solid matter, of fat and of protein, calculated from the composition of the milk as just given.

Average Daily Yield.

	Fresh milk.	Total solids.	Fat.	Protein (Nx6.25).
Period I — Green Grass.	Lbs.	Lbs.	Lbs.	Lbs.
First half	26.17	3 36	1.07	0.72
Second half	25.85	3.18	1.08	0.72
Wh le	26.01	3.27	1.08	0.72
Period II.—Dried Grass.				
First half	25.27	3.05	1.05	0.67
Second half	25.27	3.10	1.08	0.65
Whole	25.27	3.07	1.06	0.66

The quantity of fresh milk produced per day decreases in general throughout the first period and the first half of the second period. During the second half of the dried grass feeding this falling off is arrested although no increase is produced. It is well known, however, that the proportion of water in milk may vary more or less from day to day, and hence the amount of total solid matter produced per day is a more accurate measure of the effect of the food than the amount of fresh milk. Taking the solids as our basis of comparison we find that between the first half and the second half of the first period the daily yield decreased .18 pounds; between the second half of the green grass period and the first half of the dried grass period it fell off .13 pounds, while between the first half and the second half of the dried grass period we note an *increase* of .05 pounds. The daily yield of fat is a matter of some interest since it furnishes us an approximate measure of the amount of butter which the milk might have produced. As will be seen, the yield of fat is very nearly uniform throughout the experiment, there being but a slight falling off in the first half of the dried grass period. The yield of protein is less in the second period than in the first. On the whole the figures appear to show a slight increase in the milk production in the last half of the dried grass period, although the differences are small. If they are to be accepted as significant we may say that the nutritive effect of the dried grass was slightly greater than that of green grass. It is to be remembered, however, that a little of the green grass was left uneaten in the first period while the dried grass in the second period was eaten clean so that the cow really received a trifle more food in the second eriod than in the first. Taking this into account, a fair calculation from the above results would appear to be that the green grass and the dried grass were substantially equal in nutritive effect. It was not possible in this experiment to determine the actual yield of butter from the milk. The amount of fat contained in the milk may, of course, be taken as an approximate measure of this, but, as will be shown below, this measure is not an exact one. The churnability of milk, that is the proportion of its total fat, which can be recovered in butter may vary considerably, it would appear, under the influences of the food eaten. Further mention on this point will be made in connection with the experiment about to be described.

Experiment at the Agricultural Experiment Station of the University of Wisconsin.

During the summer of 1887 the writer carried out an experiment very similar to the one just described, at the above institution, with which he was then connected. In this experiment the grass used was considerably more mature, being cut when some nine or ten inches high. No determinations were made of the digestibility of the grass, but, on the other hand, the amount of butter produced from the milk of the cow was determined and its quality passed upon by an expert. An unfortunate mistake also diminished somewhat the value of the experiment. It was the intention to make grass the sole feed of the cow, but by a misunderstanding of orders the cow was fed wheat bran by measure like the rest of the herd. When the mistake was discovered about the end of the first period the man was directed to measure out the customary amount of bran and place it on the scales. This was repeated three times and, the three weighings agreeing closely, their average was taken to represent the amount of bran which had been fed, and throughout the rest of the experiment this amount was weighed out daily to the cow. The amount of bran fed per day was 5.5 pounds. The cow used in the experiment was a grade Jersey which had previously been used in the experiments on milk production described in the report of the Wisconsin Station for 1887. She was kept in the barn during the day, but was allowed to run in the yard during the night. She could not have found there, however, any material amount of food. The trial feeding began May 26. The actual experiment began June 2, the green grass period ending June

15 and the dried grass period June 29. The composition of the grass used was as follows:

Water	76.28
Dry matter	23 72
	100.00

In 100 parts of dry matter:

Ash	6 94
Protein	14.47
Crude fiber	29.20
Nitrogen-free extract	46.14
Fat	3.25
	100.00

The bran was not analyzed, since the amount fed was made as nearly as possible the same throughout both periods.

NUTRITIVE EFFECT.

Live Weight—The live weight of the animal was taken daily. The average of the daily weighings was as follows:

Period I. Green grass:

First half	885 pounds.
Second half	908 "

Period II. Dried grass:

First half	929 "
Second half	937 "

There was a steady increase in the weight of the animal, slightly less rapid in the second period than in the first, but with not enough difference between the two to indicate anything like deficient nutrition.

Quality of Milk—The composition of the milk in the several periods was as follows:

Average Percentage Composition of Milk.

	Total solids.	Fat.
Period I. Green Grass.		
First half	14.13	5.15
Second half	14.62	5.64
Whole	14.36	5.40
Period II Dried Grass.		
First half	14.15	5.79
Second half	14.36	5.44
Whole	14.26	5.61

The figures vary somewhat, but so irregularly that they do not indicate any distinct effect of the variations in food on the composition of the milk. The average of the second period is nearly or quite as good as that of the first.

Quantity of Milk—The quantity of milk produced is shown below :

Average Daily Yield—Pounds.

	Milk.	Tot. solids.	Fat.
Period I. Green Grass.			
First half	17.32	2.45	0.89
Second half	16.64	2.43	0.94
Whole	16.98	2.44	0.92
Period II. Dried Grass.			
First half	17.17	2.43	0.99
Second half	18.45	2.65	1.00
Whole	17.81	2.54	1.00

There was a slight falling off in the yield as between the first and second halves of the first period, except in the case of the fat. With these exceptions there was an increase of yield as the experiment progressed. It is remarkable that this experiment, like the one previously described, seems to show a slight gain as the result of drying, but even though the two experiments concur in this respect, I believe we are warranted in assuming this slight gain to be accidental and not due to the feeding. It is certainly difficult to conceive how drying the fodder should improve its quality, and in any case the two experiments afford insufficient data for such a conclusion. Both experiments coincide, however, in failing to show any loss as the result of drying. If there were any such marked difference between green and dried fodder as is sometimes claimed, it seems hardly possible that it should have failed to show itself in two experiments conducted on the whole as carefully as these.

Yield of Butter—In this experiment each milking was, after being sampled, placed in a small Cooley can, and the cream produced, after proper ripening, was churned every three days. The butter was salted as usual, one ounce to the pound, but not colored. After weighing, a sample of about a pound was packed in a tin box, which was placed inside a wooden box. surrounded by grass, and shipped at once by express to a butter dealer in Chicago for rating according to the established scale of points. The following table shows the the average yield of butter, and gives also the weight of pure fat contained in this butter. In this way, by taking the amount of fat in the butter as the basis of comparison, we may eliminate any errors due the varying amounts of water, salt, caseine, etc., contained in the commercial butter.

Average Daily Yield of Butter--Pounds.

	Fresh butter.	Butter fat.
Period I. Green Grass.		
First six days	0 88	0.72
Last seven days	1.06	0.86
Whole	0.99	0.79
Period II. Dried Grass.		
First six days	0.94	0.79
Last nine days	0.99	0.82
Whole	0.97	0.81

The yield of butter is practically the same in the two periods, or if we make allowance for the slight variations in composition by making the yield of butter fat the basis of comparison shows a slight gain in the second period. It should be noted, however, that this slight gain in the second period is considerably less than corresponds to the increased amount of fat in the milk produced, as shown by the previous table.

Churnability of Milk Fat—The fact just mentioned leads naturally to a consideration of the relation between the total fat contained in the milk and the amount of butter which can be made from it. Not all the fat of the milk can be converted into butter. A small portion of it in any case remains in the skim milk, and another, usually somewhat larger, portion in the buttermilk. It appears from numerous experiments that the food of the animal may influence to a considerable extent the proportion of the total fat of the milk, which can be recovered in the butter. It is plain, then, that if any particular food or method of feeding has the effect of causing the milk to churn better, or, in other words, enable us to get out of the milk a larger proportion of the fat which it contains, that food or that method of feeding is of special value to the buttermaker even though it does not produce any greater total amount of fat in the milk. The subject of the influence of feed on the churnability of milk has been comparatively little studied, but a few recent experiments go to show that the use of green succulent food enables us to separate the butter more completely from the milk.

Alvord* gives the following results of trials made at Houghton farm. The first table below shows the total amount of fat in the milk, the amount of fat in the butter obtained by churning the same milk, and finally the percentage of the total amount of fat in the milk which was recovered by the churn. The results show the average product of the same lot of cows fed first on hay and grain in April, second on ensilage and grain in March, and third on good pasturage in May. The second table gives similar data for a single cow "selected for the apparent uniformity of her product, and of her health, appetite and general condition." In the table as given the amount of butter fat obtained has been substituted for that of the butter obtained as given in the original paper, it being assumed that the butter contained eighty-five per cent of fat. While it is not likely that this was exactly true, it is hardly possible that the variations in the composition of the butter could account for the differences observed.

Trial with Herd.

Found in 100 lbs. of milk.	Dry-fed hay and grain in April.	Fed corn ensilage and grain in March.	On good pasturage alone in May.
Actual fat in milk	5.12 pounds.	4.37 pounds.	4.13 pounds.
Butter fat obtained.......	4.21 pounds.	3.71 pounds.	3.58 pounds.
Per cent. of fat churned out,	82.17 per cent.	84.80 per cent	86.64 per cent.

*Society for Promotion of Agricultural Science, 1883-1884, pages 23-24.

Trial with Single Cow.

Found in 100 Lbs. of Milk.	Fed hay and grain in March	Fed corn ensilage and grain in March	Fed corn ensilage alone in April.	Fed on grass alone pasturage in May
Actual fat in milk...	4.76 pounds.	4.42 pounds	3.93 pounds.	4.64 pounds.
Butter fat obtained..	3.60 "	3.73 "	3.36 "	4.04 "
Per cent of fat churn'd out...............	75.53 p'r cent.	84.43 p'r cent	85.43 p'r cent.	87.02 per cent.

Alvord's conclusion from the above results is that "the greater the proportion of succulent food, the more completely the churn will do its work." Experiments by Sturtevant,* in which the total fat of the milk was compared with that obtained by churning on a small scale, show very considerable variations in the churnability of the milk on different feeds, but the feeding periods were too short to allow any very definite conclusions to be drawn as to the exact effect of the feed in this respect. It is worthy of note, however, that with one exception the ensilage period gave the highest churnability. In our own experiment the proportion of the total fat which was recovered in the butter was as follows:

Period I—First half ..	80 95	Period II—First half ..	79 23
Second half..	91 18	Second half..	81.45
Whole	86.64	Whole	80.65

Here we have a difference of six per cent in the churnability of the milk, or if we compare the second halves of the two periods, a difference of nearly ten per cent in favor of the green grass.

In experiments upon the comparative value of corn fodder and ensilage, Woll† found that during the period in which ensilage was fed, the percentage of fat obtained in the butter was 12.60 per cent greater than the average of the two periods in which corn fodder was fed. His results were as follows:

	Butter fat.	Milk fat.	Churned out.
Period I....................	11.59 lbs.	13.12 lbs.	88.35 per cent
Period II....................	11.05 "	11.61 "	95.15 "
Period III....................	9.50 "	12.38 "	76.74 "

*Report New York Agricultural Experiment Station, 1883 1885.

†Agricultural Experiment Station, University of Wisconsin, Fifth report, page 52.

It would seem from these results to be highly probable that green succulent food does improve the churning qualities ot milk, and that if in the experiment described above, butter had been made from the milk, there would have been a gain in the first period as compared with the second.

Quality of Butter. As noted above, samples of the butter from each churning were sent to a Chicago dealer for rating. The samples sent him were designated by number only, and he had no knowledge of the nature of the experiment in progress. The following is his letter, including his report on the samples:

"Please find enclosed score of the samples of butter sent me. You will see that I have made the score 50 points. The flavor, I presume is what you most wanted. The examination made yesterday was made without any reference to the former score, and, of course, I have allowed a little in flavor for the stock being old.

I was quite surprised to find Nos. 4, 5 and 6 very rank in flavor. The number one was quite oily. The others were about as ordinary butter is after being held.

This butter was put on a shelf on the side of my ice-box in my refrigerator, and I do not think the temperature varies much from 55, and I was surprised that the lots which I have named should get so badly off in flavor. I had my butter man make the score at the same time without knowing what the other man put down, and we run very close on points, and I have averaged them so I think they will be about right. There is none of it as high in flavor as some of the fine creameries which we receive, but I suppose it could not be done in making such small lots.

Yours truly,

A. H. BARBER."

The results on the fresh butter were as follows:

Green Grass Period.

No of sample	Milk of	Churned.	Flavor 30	Grain 10.	Color 5	Salt 5.	Total 50.
1	June 3, 4, 5	June 6	20	10	4	5	39
2	June 6, 7, 8	June 9	12	8	5	4	29
3	June 9, 10, 11	June 14	22	9	4½	4¼	40
4	June 12, 13, 14, 15	June 17	20	8	4½	4½	37
	Average		18.5	8.75	4.5	4.5	36.25

Dried Grass Period.

No. of sample.	Milk of	Churned.	Flavor 30.	Grain 10.	Color 5.	Salt 5.	Total 50.
5..........	June 16, 17, 18.........	June 20...	18	7	4	3	32
6..	June 19, 20, 21.........	June 23...	14	8	3½	4	29½
7....... ..	June 22, 23, 24.........	June 27...	16	10	5	4	35
8..........	June 25, 26, 27.........	June 30...	21	10	5	5	41
9..........	June 28, 29, 30.........	July 2 ...	20	10	3½	4	37½
	Average....... ...	....	17.8	9	4.2	4	35.0

On August 4 a second examination of the samples was made, they having meanwhile been kept in the ice-box, with the following results:

Green Grass Period.

1..........	June 3, 4, 5........ ...	June 6 ...	10	10	5	5	30.0
2.	June 6, 7, 8	June 9....	15	10	4	4	33.5
3..........	June 9, 10, 11..........	June 14...	8	10	5½	4	27.0
4..	June 12, 13, 14, 15	June 17...	5	10	5	5	25.0
	Average..........	....	9.5	10	4.9	4.5	28.9

Dried Grass Period.

5...	June 16, 17, 18.........	June 20. .	5	7	4	3	19.0
6..........	June 19, 20, 21.........	June 23...	5	8	4	4	21.0
7..........	June 22, 23, 24.........	June 27...	10	10	5	4	29.0
8..........	June 25, 26, 27...... ...	June 30...	12	10	5	4½	31.5
9..........	June 28, 29, 30.........	July 2....	16	10	4	4	34.0
	Average..........	....	9.6	9.0	4.4	3.9	26.9

Nos. 4, 5 and 6, rancid; No. 1, oily.

It will be seen that the differences between the two classes of samples were comparatively small, and, on the average, showed that the chief difference between the two was in the flavor, though even there the difference does not amount to a whole point. If we allow any significance to this slight difference, the general result of the comparison is that the butter from the green grass was slightly better at first than that from the dried grass, but did not keep quite as well. It appears doubtful, however, if these small differences have any significance whatever. It will be observed that the quality of none of the samples was very high. This was probably due, as Mr. Barber's letter suggests, to the fact that the butter was made in small lots, and therefore not under the most favorable conditions, and to the further fact that the single cow used had been in milk about seven months.

CONCLUSIONS.

The experiments described above, taken in connection with what is already known on the subject, lead to the conclusion that the simple drying of grass without loss does not diminish either its digestibility or its nutritive value, as a food for milch cows, with the single exception that dried food appears to influence unfavorably the churning qualities of the milk. In this connection, some explanation seems to be called for of the great difference between grass and hay, which was alluded to in the introduction to this article, the more so as a good deal of confusion appears to exist upon this point even in the minds of those tolerably well informed on such subjects. Pasture grass is better than hay, first because it is cut earlier, and is therefore of a better quality *per se.* It is a perfectly well established fact that the earlier grass is cut the greater is its percentage of protein, and the less its percentage of crude fiber, both of which circumstances give greater value to the young grass. As an example of this, we may cite analyses of hay cut at three different times from the same meadow.*

Composition.

Cut.	Protein, per cent.	Crude fiber, per cent.	Fat, per cent.	Nitrogen-free extract, per cent	Ash, per cent.
May 13, 1877	18.97	24.70	3.42	43.91	9.50
June 9, 1877.....	11.16	34.88	2.74	43.27	7.95
July 26, 1877	8.46	38.15	2.71	33.34	7.34

*Landw. Jahrb. 8, I Supplement, 54.

ABSTRACT OF REPORT

OF

Cattle Commissioners,

1889.

F. O. BEAL, PRESIDENT. W. W. HARRIS, SECRETARY.

G. H. BAILEY, VETERINARIAN.

To His Excellency, the Governor of Maine:

In presenting our annual report for 1889, we have thought best, in view of frequent inquiries as to the application of the present law as compared with that "approved March 17th, 1887," to publish the present amended law in full for the benefit of all concerned. In our annual report of 1888, we recommended to the Governor and Council that certain changes in the law of 1887 were in our opinion not only desirable, but if not modified or amended, were liable to entail much unnecessary expense upon the State in disposing of cases in the future, to which our attention might be called. The committee by whom the present bill was referred to the Senate and House of Representatives, reported in favor of all the changes we at that time recommended, although the new bill did not become a law in season to avert the payment by the State of a large amount of money in the case of the herd of Hereford cattle destroyed at

Kennebunk in January, before the amended bill was passed in March, 1889.

We copy from report of 1888, pages 24 and 25: "The new cattle bill passed at the close of the last session of the legislature, in 1887, entitled 'An Act to extirpate contagious diseases among cattle,' should, in the opinion of our Board, be so changed or modified as not to give in certain sections of the law, especial prominence to the disease known as tuberculosis, to which the public mind had at that time been pointedly directed in consequence of the unprecedented outbreak of the disease at the State College farm at Orono. At the time the report of the Orono cases was published (although the entire herd had then been disposed of and destroyed), there were still outstanding quite a number of young animals (mostly bulls) that had been sold from time to time from the college herd, that by order of the Committee of Investigation, were afterwards inspected, and being found in almost every instance thoroughly diseased, were also destroyed, so that we are now able to report the State free from any suspicious cases that trace directly to the college herd, with possibly the exception of a single bull in the town of Lee, that was out of one of the worst diseased and condemned cows at Orono.

In view of this fact we have to recommend that there be left out of section 1, chapter 138, the words 'especially tuberculosis,' and out of sections 2, 5, 6 and 7, such portions as recommended the 'quarantine and destruction of such animals as have been exposed to the disease known as tuberculosis, but not themselves actually diseased,' as being contrary to all well recognized authorities and precedents in dealing with and disposing of cases of tuberculosis among cattle. It has been repeatedly proven in this State that some one or more cases may be found present in a large herd, (which being destroyed) no other cases ever afterwards developed, and the three cases destroyed the present year show conclusively that although summered and wintered with other cattle, no suspicious cases remain in the herds from which they came, while should a single case of contagious pleuro-pneumonia be discovered in a herd of cattle, the only rational means to insure its extermination would not only be to destroy such an animal, but all others that had been herded with it. The frightfully contagious nature of this disease, and its treacherous and fatal character, have long since proved that to be the most economical and only certain manner of extermination.

In several instances in the past our Board have been notified of supposed cases of contagious pleuro-pneumonia, and it should perhaps, be stated in this connection that an animal affected with common lung fever or pneumonia presents appearances so nearly identical with those of the contagious form, that it is often impossible to distinguish them as different while the animal is living, but that by a post-mortem it at once becomes apparent. Up to the present time, however, no case of contagious pleuro-pneumonia has ever made its appearance in this State, and it is believed that if the same watchful care and prudent legislation be exercised and continued in the future as in the past, this dread disease will never make its appearance in Maine."

We reproduce the recommendations as made in 1888, which show that the facts then existing are reflected in our present report, that whenever we have been called to inspect a herd of cattle in this State, and have found one or more cases of tuberculosis, they have been disposed of, and we have never afterwards had occasion to revisit the same herds to inspect or dispose of other animals.

The first case called to the attention of the Cattle Commissioners the present year was on January 7th, when an inspection was ordered of the herd of Hereford and Jersey cattle belonging to Hartley Lord, Esq., of Kennebunk. This is the herd already referred to, where we were met upon the very threshold of the new year with just such a case as we had anticipated and attempted to guard against in our recommendations to the legislature of 1887, and where a special appropriation was asked for and obtained to pay for the entire herd, which was condemned under the old law.

Mr. Lord's herd consisted of seventeen animals (all thoroughbreds), fifteen of which were Herefords and two Jerseys, five of the number being calves, and at our first visit a yearling heifer was condemned and destroyed, the post-mortem disclosing the fact that a portion of the right lung, together with the bronchial lymphatic glands were affected with tubercular deposit.

Our next visit to Mr. Lord's herd was on January 10th, when we condemned and destroyed a registered Hereford cow, found to be clearly affected with tuberculosis.

January 26th. The "full board" met at Mr. Lord's farm to decide what disposition should be made of the balance of the animals, the owner having demanded, under the Contagious Act of 1887, that he be paid "three-fourths of their value as determined

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upon the basis of health before infection, and the full appraised value in case of animals exposed to either of such diseases, but not themselves actually diseased, out of any moneys appropriated by the legislature for that purpose; provided, however, that they shall not pay more than two hundred dollars for an animal with pedigree recorded or recordable in the recognized herd books of the breed in which the animal destroyed shall belong, nor more than one hundred dollars for an animal which has no pedigree." The Commissioners, finding they had no alternative but to appraise and condemn the entire herd, "under section 2, chapter 138, defining the powers and duties of said Commissioners," appraised the herd at seventeen hundred dollars, and the legislature then in session made an especial appropriation in payment of the award.

January 12th. The Commissioners inspected the herd of Addison True of Mechanic Falls, and condemned a grade Jersey cow, appraisal $25.00.

January 23d. An inspection was ordered at the farm of C. B. Dunn, East New Sharon, where a grade cow was found diseased and was condemned and appraised at $25.00.

February 2d. An inspection was ordered at Charles M. Haynes' stable at Bucksport, but no contagious disease was found.

March 14th. A case of glanders was reported at Milo, at the stable of William Mayo, which proved to be chronic catarrh.

March 16th. An inspection was held of the cattle belonging to Henry Merrill of Garland, and a grade Jersey cow found to be badly diseased; appraisal, $25.00.

March 21st. An ox belonging to Sprague Keene of Harrison, was found badly affected with tuberculosis and condemned; appraisal, $35 00.

March 23d. An inspection was ordered in a "lumber camp" at Danforth, Washington county, for supposed glanders, which proved to be a case of chronic catarrh.

March 25th. Inspected the herd of Nelson Harmon, of Scarboro' Beach, who had lost several calves. A post-mortem revealed the fact that they had died of impaction of the third stomach. No appraisal.

March 26th. Inspected the herd of Leonard Stevens, South Windham, and condemned a Jersey cow found badly diseased with tuberculosis; appraisal, $25.00.

March 29th. Inspected the cattle of George W. Knight, of South Waterboro', and found a "grade Jersey cow" diseased; appraisal, $16.00.

April 6th. Inspected cattle of James I. Payne of Standish, but found no contagious disease.

April 9th. A reported case of glanders, at Unity, was found upon inspection to be chronic catarrh.

April 10th. Inspection was ordered at farm of F. F. Irish of Buckfield, but no contagious disease was discovered.

April 12th. The "Mayor of Calais" reported a case of glanders at Red Beach, which proved to be chronic catarrh, but the following day, April 13th, a case of glanders was found in the stable of Frederick J. Young, at Calais, and condemned. Appraisal, $40.00.

April 30th. A case of glanders was reported at the stable of Frank G. Connor at Richmond, which proved to be catarrh.

May 3d. A case of tuberculosis was reported upon the farm of Henry Smith of Troy, which proved to be emphysema.

May 6th. Inspection was ordered of cattle at farm of E. J. Waterhouse of Groveville, but no contagious disease was found to exist.

May 13th. The cattle of Charles W. Smith of South Orrington were inspected, but no tuberculosis found.

May 18th. A post-mortem was held upon a cow that had died under suspicious circumstances upon the farm of James L. Carter of Scarboro'. No contagious disease.

May 27th. The herd of cattle belonging to Levi Jordan of East Raymond, was inspected and a grade Jersey heifer found affected with tuberculosis. Appraisal, $25.00.

May 22d, May 26th, May 27th, June 4th, June 27th and September 21st, the Commissioners visited the premises of C. E. Winslow at Falmouth, to inspect upon the dates above set forth, a large herd of milch cows, reported to be affected with some contagious disease, and as these cases have proved to be of especial interest through various post-mortems that have been had from time to time since the first inspection was ordered, they will be taken up at the close of this annual report, and the various visits and post-mortems described in detail.

June 3d. A case of glanders was reported at the stable of Jacob Levi at Portland, and a chestnut gelding found badly affected with the disease. He was condemned and appraised at $100.00.

June 8th. The Society for the Prevention of Cruelty to Animals reported a case of glanders at Cumberland Mills, which proved upon inspection to be chronic catarrh.

June 11th. An inspection was ordered of the cattle of Frank Hart of Howard, and a Jersey cow was quarantined.

June 14th. A case of tuberculosis was discovered in a Holstein bull, belonging to George W. Reed of South Orrington, and he was condemned and destroyed. Appraisal, $40.00.

June 15th. Inspection ordered of herd of cattle belonging to A. S. Forbes of Brooks, but no contagious disease discovered.

June 17th. A herd of cattle were inspected at Bowery Beach, but no contagious disease was found to exist.

June 18th. The herd of cattle of Wm. H. Cole of Paris, was inspected, and an ox found badly affected with tuberculosis and condemned. Appraisal, $50.00.

June 19th. Inspection ordered of the cattle of Herbert J. Holt, of North Norway, but no contagion found.

June 21st. A post-mortem was held at Burnham, upon an ox that had died upon the farm of John Sayward, when the ox was found to have died of "congestion of the lungs."

June 24th. An inspection was ordered of the cattle of Messrs. Bonney and Jewell at Mechanic Falls, but no contagious disease was found to exist.

July 15th. The herd of Albert A. Young of Auburn was inspected, and a registered Holstein cow found badly affected with tuberculosis. She was condemned and appraised at $100.

July 18th. A case of glanders was reported at Hampden, which proved to be a case of chronic catarrh.

July 26th. The herd of cattle of J. W. Powers of Brewer, was inspected, which resulted in finding a case of emphysema.

July 29th. A case of glanders was reported at Gray, at the stables of John Merrill, which proved to be catarrh.

July 30th. The cattle of Mr. Bemis of Hermon, were inspected, but no contagious disease was discovered.

July 31st. The Commissioners visited Danforth, Washington county, and found a case of glanders in a mare and colt belonging to White Brothers, which were condemned and appraised at $90, and the same day condemned a horse belonging to George O. Frye of Brookton, which was appraised at $60.

August 1st. Inspected the cattle of Robert P. Smart of Monroe, and found several head of young cattle affected with emphysema.

August 7th. Inspected the herd of Mr. Chapin of Hermon, but found no contagious disease among his cattle.

August 13th. Visited the farm of Hiram Towle of Belgrade Mills, and found a case of tuberculosis in a grade cow. Appraised $35.

August 19th. A case of glanders was reported by Mr. Luce of Hermon, where two horses were found to be affected with lymphangitis. No appraisal.

August 24th. Inspection was ordered of the cattle of Staples & Berry at North Auburn, but no contagious disease was found.

September 12th. A case of glanders was reported by the selectmen of Porter, at the stables of David S. Hurd, which proved to be catarrh.

September 13th. A post-mortem and inspection was held at Lewiston, upon the premises of John Bolton. No contagious disease was discovered.

September 28th. Inspection was ordered at the farm of George W. Stone of Lewiston, but no contagion was found among his cattle.

October 7th. A case of glanders was reported at Eddington, at the stables of E. G. Hepworth. The horse was condemned and appraised at $100.

October 9th. The cattle of J. M. Knight of Otisfield, were inspected, but no contagious disease was found.

October 11th. The "Board of Health" of Leeds reported a case of glanders, which proved upon examination to be chronic catarrh.

October 15th. Inspection was ordered of the cattle of Llewellyn Norton of Farmington, but no contagious disease was found.

October 16th. Inspection was ordered upon the farm of Mrs. J. Hood of Wayne, but no cases of tuberculosis were found.

October 17th. A bad case of tuberculosis was discovered in a Jersey cow belonging to Frank Warren of Livermore Falls, which was condemned and appraised at $25.

October 23d. Commissioners Beal and Bailey visited the premises of S. S. McCallough of Hermon, and found an advanced case of tuberculosis in a Jersey cow that had for a long time been furnishing the milk for a family of small children. The cow was condemned and appraised at $28.

October 25th. Commissioners Harris and Bailey visited the farm of Rev. Samuel Poindexter at Shapleigh, who had lost several head of cattle, and reported others sick with the same symptoms. A post-mortem on an ox that had recently died disclosed the fact that it was a case of poisoning, and the history of the previous cases all go to confirm the same diagnosis. No appraisal.

November 4th. A case of "glanders and farcy" was reported by O. M. Cummings of Norway. Diagnosis confirmed; appraisal $100.

November 5th. The cattle of W. G. Everett of South Paris were inspected, but no contagious disease was found to exist.

November 12th. The cattle of William Harlow of Turner Center were inspected, and a Holstein heifer found to be affected with tuberculosis. She was condemned and appraised at $15.00.

November 13th. Visited the premises of A. H. Pratt at "North Turner Bridge," and condemned a yearling registered Holstein bull, the animal being appraised at $35.00 This bull was the produce of the Holstein cow already described as belonging to A. A Young of Auburn, which was condemned last July, and found to be a very bad case of tuberculosis; and this bull was disposed of in pursuance of the well settled policy of this State, to follow up and destroy the produce of tuberculous cows.

November 23d. Two cases of glanders were reported in the camp of George W. Day at Presque Isle, Aroostook county, but upon inspection were found to be bad cases of catarrh.

November 26d. A case of glanders was reported at Wytopitlock, Washington county, which also proved to be chronic catarrh.

November 30th. An inspection was ordered of the cattle belonging to N. Q Pope of Poland. A Holstein cow which had been brought into this State from New York last August, was found to be affected with tuberculosis, and condemned, although no compensation could be awarded to the owner, as section 2 of the present law provides "that in no case shall compensation be allowed for an animal destroyed under the provisions of this Act, which may have contracted the disease in a foreign country, or on the high seas, or that may have been brought into this State within one year previous to such animal's showing evidence of such disease."

December 6th. Inspection was ordered upon a Jersey cow, the property of Joseph A. Lamb of Lewiston, and found to be an advanced case of tuberculosis. Appraised at $30.00. The above cow had dropped a bull calf the previous year, which was then in the possession of a gentleman at South Turner, who upon learning the facts in relation to his dam, promptly ordered the animal destroyed.

The same day a bad case of "glanders and farcy" was discovered at the stable of Dr. L. A. Bourque of Lewiston, and was destroyed. Appraisal, $100.00.

December 7th. A case of glanders was reported at the stable of David Cram at Litchfield Plains, which proved to be a case of *pupura hœmorrhagica.*

December 13th. A case was reported at North Greene, said to be an advanced case of tuberculosis, but which proved to be non-contagious emphysema. The cow was the property of S. M. Rose, and there was no appraisal.

December 23d. Inspection was held at Bethel in the herd of L. A. Hall, but no contagious disease was found.

December 26th. The selectmen of South Litchfield requested an inspection of the herd of Granville A Palmer of that town, and two grade Jersey cows were found to be affected with tuberculosis, and were condemned after having been appraised, one at $20 and the other at $18.

The last case of the year reported was supposed glanders, in a mare at Bingham, but which proved to be catarrh, and the attention of all parties interested is again directed to pages 17, 18, 19 and 20 of our report of 1888, in which the symptoms of glanders and farcy are so clearly given that if these are carefully compared with supposed cases as they arise, it would save our Board much trouble and expense in going long distances to render decisions, in which the owners themselves ought to be able to determine whether they have glanders or catarrh.

Emphysema among cattle also seems to be on the increase in this State, and a large majority of the herds visited the past year have disclosed such cases, which are entirely non-contagious. This condition of emphysema, which is analogous to "heaves in horses," has been found to exist in a large number of cases where tuberculosis was suspected. Any considerable pressure or violent concussion of the lung may produce a laceration of that viscus and give occasion to the infiltration of air into the areolar texture, called "interlobular pulmonary emphysema," or we may have excessive dilation of the air cells, some of which ultimately break and give rise to irregular vesicles at the surface of the lung, known as "vesicular emphysema." The inspiratory efforts are increased and somewhat suppressed, while the expiration, which is more frequently audible, is prolonged, laborious and wheezing. These symptoms, together with the accompanying cough, often confuse an owner, and your Commissioners believe that much of this trouble is caused by over-feeding bulky and innutritious food, causing extreme pressure of the lungs and its consequent results.

In summing up the business of the year, aside from Mr. Lord's herd at Kennebunk for which a special appropriation was ordered, seventy-two cases were reported in 1889, scattered from the New Hampshire line to the St. Johns river; fifty-five herds of cattle were inspected and seventeen stables and "lumber camps" were visited; seventeen cows, two bulls, and two oxen were condemned at an appraisal of $702.00 and seven horses were condemned at an appraisal of $590.00, making a total of $1,292.00. At the close of the year, we are able to report that all the expenses of the Commission, as well as payment for horses and cattle destroyed, have been kept within the appropriation, and a check of $241.43 has been returned to the State by the Treasurer of our Commission.

A summary of the whole number of cases reported to the Commissioners in 1888, was found to number fifty-three, embracing cities and towns distributed from the sea-board at Portland, to the backwoods of Maine. Eighteen herds of cattle were inspected, and thirty-five stables and "lumber camps." Two head of cattle were condemned and destroyed at an expense of $85.84, and nineteen horses were also condemned and destroyed at an expense of $1,300.50 making a total of $1,386.34 as compared with 1887, forty-eight herd of cattle were inspected, and thirteen head of cattle were destroyed at an expense of $309.75, while eleven horses were destroyed (seven of them being traced to one lumber camp) at an expense of $626.50, making a total of $936.25.

It will be observed that the number of horses destroyed for glanders has materially decreased from last season, which is no doubt owing to the salutary change in the law of 1887, which now provides, that "no compensation shall be allowed for an animal destroyed under the provisions of the present act, that may have been brought into the State within one year previous to such animal's showing evidence of such disease," while the Massachusetts authorities in 1889 destroyed fifty-seven horses, just fifty more than were condemned in this State.

ANNUAL REPORT

OF THE

Maine State College Agricultural Experiment Station.

1889.

MAINE STATE COLLEGE.

AGRICULTURAL EXPERIMENT STATION.

STATION COUNCIL.

STATION OFFICERS.

REPORT.

NOTE—Part I. of the Station Report, devoted exclusively to the Inspection of Fertilizers, and a report of analyses made, is omitted in this connection.

Z. A. GILBERT,
Secretary Board of Agriculture.

CATTLE FOODS.

ANALYSES OF HAYS FROM VARIOUS GRASSES.

For several years samples have been collected of the various grasses and other fodder plants growing on the College Farm, which have been analyzed, and some have been submitted to digestion tests. This work has been continued with additional samples collected in 1888. The analyses of six hays from five different species of grasses and one clover are given below, all from the crop of 1888.

The samples were all cut during the first few days of July while the plants were in full bloom, and were carefully dried and stored, so that the analyses represent the hays in their best possible condition.

The terms used in stating the analysis of a fodder, such as "*protein*," "*fiber*," etc., are explained in the report of this station for 1888, pages 83–85, and in the same connection are given on pages 81–83 some general considerations bearing upon the value and need of a wider knowledge of the composition of our fodder plants.

Table of Fodder Analyses.

Station number.	Description of Samples—Crop of 1888.	In 100 Parts of Air-Dry Substance. Water—per cent.	Ash—per cent.	Protein Nx6 25--per cent.	Fiber—per cent.	Nitrogen-free extractive matter—per cent.	Fat—per cent.	In 100 Parts of Water-Free Substance. Ash—per cent.	Protein Nx6 25--per cent.	Fiber—per cent.	Nitrogen-free extractive matter—per cent..	Fat—per cent.
LXXXVI ..	Timothy* *Phleum pratense* In early bloom	8.29	4.77	8.75	26.77	47.64	3.78	5.21	9.54	29.19	51.94	4.12
LXXXVII,	Timothy† " 10 days past bloom	7.97	3.67	7.00	26.82	51.08	3.46	3.99	7.60	29.14	55.51	3.76
LXXXVIII	Wild oat grass, *Danthonia spicata*. In full bloom.....	8.29	4.23	8.75	27.80	47.66	3.27	4.61	9.54	30.23	52.07	3.55
LXXXIX ..	Red Top, *Agrostis vulgaris*. In full bloom...........	8.11	4.10	8.50	26.60	49.09	3.60	4.46	9.25	28.94	53.43	3.92
XCVI	Blue Joint, *Calamagrostis Canadensis*. In bloom.....	6.80	5.32	9.50	33.85	42.16	2.37	5.70	10.19	36.32	45.25	2.54
XCVII.....	Witch grass, *Triticum repens*. In full bloom	6.45	5.25	7.31	28.73	49.52	2.74	5.61	7.81	30.71	52.94	2.93
XC........	Alsike clover, *Trifolium hybridum*. In full bloom....	8.45	6.54	12.50	28.00	40.63	3.88	7.14	13.65	30.58	44.39	4.24

*Yield per acre of dry hay, 3,233 lbs.

†Yield per acre of dry hay.

The relative composition of the various hays can be more accurately shown by comparing the averages of the analyses for several years.

Average Composition of Hays from Various Grasses Cut on same Farm

	In 100 Parts Water-Free Substance.				
	Ash.	Protein.	Fiber.	Nitrogen from extractive matter.	Fat.
Timothy hay, '84, from general lot of hay*,	4.49	7.86	34.36	50.65	2.64
Timothy hay, " " " " " *,	4.00	7.10	34.50	52.07	2.33
Timothy hay, '85, in bloom*	6.47	7 67	38.50	43.70	3.66
Timothy hay, '86, two weeks past bloom, average two analyses†	4.03	6.21	32.07	54.61	3.08
Timothy hay, '87, in full bloom‡	4.58	8.18	32.66	50.98	3.60
Timothy hay, '87, somewhat past bloom‡	5 17	7.84	32.10	51.30	3.59
Timothy hay, '88, in early bloom	5.21	9.54	29.19	51.94	4.12
Timothy hay, '88, ten days past bloom	3.99	7.60	29.14	55 51	3.76
Red Top hay, '87, in full bloom§	5.06	9.69	30.98	50.64	3.63
Red Top hay, '88, " "	4.46	9.25	28.94	53.43	3.92
Witch grass hay, '85, in bloom*	6.79	9.33	36.88	43.86	3.14
Witch grass hay, '87, " ‡	5.41	9.53	38.07	43.21	3.78
Witch grass hay, '88, "	5.61	7.81	30.71	52.94	2.93
Wild oat grass hay, '87, in bloom‡	3.81	7.49	34.10	51.74	2.86
Wild oat grass hay,' 88, "	4.61	9.54	30.23	52.07	3.55
Blue Joint hay, '86, in bloom*	5.88	12.00	39.88	38.54	3.70
Blue Joint hay, '87, " ‡	5.97	10 06	36.22	44.66	3.09
Blue Joint hay, '88, "	5.70	10.19	36.32	45.25	2.54
Timothy hay, average 3 years, in bloom,	5.42	8.46	33.45	48.88	3.79
Red Top hay, " 2 " "	4.76	9.47	29.96	52 03	3.78
Witch grass hay, " 3 " "	5.94	8.89	35.22	46.67	3.28
Wild oat grass hay, " 2 " "	4.21	8.51	32.16	51.91	3.21
Blue Joint hay, " 3 " "	5.85	10.75	37.47	42.82	3.11

*Report Maine Experiment Station, 1885 6, page 51.

†Ibid, 1886-7, page 68.

‡Ibid, 1888, page 86.

A study of the above figures reveals the following facts:

(1) The same species of grass may vary greatly in composition from year to year, even in the same locality, and at the same stage of growth as, for instance, in the case of the Timothy and Witch Grass.

(2) The upland species of grass, so far examined at the same stage of growth do not differ in composition in a marked manner, except that Witch Grass appears to contain a rather large relative percentage of fiber. The Red Top compares very favorably with the other grasses. The texture, composition and digestibility (see later) of this grass commend it as one that should more frequently find a place in seed mixtures for permanent grass lands. Blue

Joint, probably the most valuable of lowland grasses, contains a comparatively larger average percentage of nitrogenous material, but is relatively woody. At the same time, if cut in bloom, or soon after, instead of being allowed to stand until so late, it makes a valuable fodder, and one that is superior to the poorer grades of hay from upland grasses.

DIGESTIBILITY OF HAYS FROM GRASSES AND OTHER FODDER PLANTS.

The hays cut in 1888 on the College Farm the analyses of which are given on page 4, were submitted to digestion tests, that is, the actual amount of available nutritive material contained in them has been determined by experiments with animals.

The principles and methods involved in a digestion experiment are explained on pages 90–92 of the Station Report for 1888, and are briefly summarized below:

(1) Only that portion of the food which is dissolved by the juices of the stomach and intestines and taken into the blood, is available for use in sustaining life or producing growth.

(2) The solid excrement or dung is the undissolved or unused portion of the food, therefore;

(3) The difference between what the animal takes in as food and excretes in the feces constitutes the dissolved, digested or useful portion.

A digestion experiment, then, consists simply in feeding an animal a known and uniform daily ration, determining at the same time the composition of the food and the weight and composition of the solid excrement. This has been done by the Station in 1888–9 with quite a number of cattle foods, sheep being used as the experimental animals. Repeated observations have shown that the various classes of ruminants are practically alike as to the manner and extent of their digestive processes, so that what is true for sheep would be true for cows and oxen. (For fuller details of methods used in the digestion experiments see Station Report for 1888, pp. 91–92.)

The data needed for the calculation of the coefficients or percentages of digestibility are the following:

(1) Composition of food.

(2) Composition of feces.

(3) Weights of food eaten and feces excreted.

The composition of the foods is already given on page 4. The other data can be found in the two following tables:

Composition of Feces.

Station number.	From Fodder.	Fresh Feces. Water—per cent.	Dry substance—per cent.	In 100 Parts Water-Free Substance. Ash—per cent.	Protein—per cent.	Fiber—per cent.	Nitrogen-free s'bst'nce-p'r ct.	Fat—per cent.
LXXXVI,	Timothy, early cut, sheep 1....	56.04	43.96	6.54	9.66	31.87	47.56	4.37
"	" " " 2 .	61.46	38.54	7.10	10.16	30.47	47.67	4.60
LXXXVII	Timothy, late cut, " 1....	79.05	20.95	7.10	9.69	32.32	47.13	3.76
"	" " " 2....	64.77	35.23	5.78	8.63	32.93	48.90	3.76
LXXXVIII	Wild cat grass, " 3. ..							
"	" " " 4....	61.10	38.90	6.95	9.64	28.06	51.19	4.16
LXXXIX .	Red top, " 1....	47.60	52.40	7.59	8.97	29.31	49.56	4.57
"	" " 2....	60.00	40 00	7.89	9.33	29.25	49.25	4. 28
XCVI.....	Blue joint, " 3....	56.38	43.62	8.84	9.60	32.78	44.75	4.03
"	" " 4....	67.42	32.58	9.75	9.73	31.12	45.69	3.71
XCVII....	Witch grass, " 1....	72.55	27.45	9.56	10.58	33.40	42.81	3.65
"	" " 2....	67.55	32.45	7.91	8.99	35.30	44.35	3.45
XC........	Alsike clover, " 3....	70.57	29.43	9.20	11.48	36.80	38.27	4.25
"	" " 4....	76.25	23.75	9.42	11.80	35.44	39.69	3.65

Weights of Food Eaten and Feces Excreted.

		Total Food Consumed in Five Days. Air dry grams.	Water-free grams.	Total Feces Excreted in Five Days Fresh grams.	Water-free grams.
LXXXVI..	Timothy, early cut, sheep 1............	3500	3209.8	2933	1289.3
"	" " " 2............	3500	3209.8	3251	1252.9
LXXXVII,	Timothy, late cut, " 1.............	3500	3221.	5985	1253.9
"	" " " 2.............	3500	3221.	4060	1430.7
LXXXVIII	Wild oat grass, " 3.............	3500	3209.8	3995	
"	" " " 4.............	3500	3209.8	2615	1017.5
LXXXIX..	Red top, " 1.............	3500	3216.	2377	1245.6
"	" " 2............	3500	3216.	3035	1213.8
XCVI......	Blue joint, " 3.............	2100*	1957.2	1321*	576.3
"	" " 4.............	2100*	1957.2	2000*	651.6
XCVII	Witch grass, " 1............	2100*	1964.6	2667*	732.2
"	" " 2.............	2100*	1964.6	2296*	745.2
XC........	Alsike clover, " 3.............	3500	3204.3	4233	1245.9
"	" " 4.............	3500	3204.3	4813	1142.9

*For only three days.

The next table gives the coefficients or percentages of digestibility of the several hays. This table also shows somewhat in detail the figures and method involved in the calculation from the data of the two previous tables.

Digestibility of Various Hays.

	Dry substance.	Organic matter.	Ash.	Protein N x 6.25.	Fiber.	Nitrogen-free extractive matter.	Fat.
LXXXVI, TIMOTHY HAY, early cut,							
Sheep 1.							
Fed in five days	3209.8	3042.6	167.23	306.21	936.94	1667.17	132.25
Excreted in feces in five days,	1289.3	1205.0	84.32	124.54	410.90	613.19	56.34
Digested	1920.5	1837.6	82.91	181.67	526.04	1053.98	75.90
Per cent. digested............	59.83	60.37	49.57	59.33	56.14	63.23	57.39
Sheep 2.							
Fed in five days	3209.8	3042.6	167.23	306.21	936.94	1667.17	132.24
Excreted in feces in five days,	1252.9	1163.9	88.96	127.30	381.78	597.30	57.64
Digested....................	1956.9	1878.7	78.27	178.91	555.16	1069.87	74.60
Per cent. digested............	60.96	61.75	46.80	58.43	59.25	64.17	56.41
Average per cent. digested by two animals	60.40	61.06	48.18	58.88	57.69	63.70	56.90
LXXXVII, TIMOTHY HAY, late cut,							
Sheep 1.							
Fed in five days	3221.	3092.5	128.52	244.80	938.60	1787.98	121.11
Excreted in feces in five days,	1253.9	1164.9	89.02	121.50	405.20	590.92	47.14
Digested....................	1967.1	1927.6	39.50	123.35	33.40	1197.06	73.97
Per cent. digested............	61.07	62.33	30.73	50.36	56.83	66.95	61.07
Sheep 2.							
Fed in five days	3221.	3092.5	128.52	244.80	938.60	1787.98	121.11
Excreted in feces in five days.	1430.7	1348.0	82.70	123.48	471.16	699.66	53.80
Digested....................	1790.3	1744.5	45.82	121.32	467.44	1088.32	67.30
Per cent. digested ...	55.58	56.41	35.66	49.56	49.80	60.87	55.57
Average per cent. digested by two animals	58.32	59.37	33.20	49.96	53.31	63.91	58.32
LXXXVIII, WILD OAT GRASS.							
Sheep 3.							
Fed in five days	3209.8	3061.8	147.97	306.21	970.32	1671.34	113.95
Excreted in feces in five days,	1017.5	946.8	70.72	98.10	285.54	520.90	42.34
Digested....................	2192.3	2115.0	77.25	208.11	684.78	1150.44	71.61
Per cent. digested............	68.30	69.07	52.20	67.96	70.57	68.84	62.84
LXXXIX, RED TOP							
Sheep 1.							
Fed in five days	3216.1	3072.7	143.44	297.49	930.74	1718.36	126.07
Excreted in feces in five days,	1245.6	1151.1	94.54	111.72	365.08	617.4	56.92
Digested....................	1970.5	1921.6	48.90	185.77	565.66	1100.96	69.15
Per cent digested............	61.27	62.31	34.09	62.44	60.77	64.07	54.85
Sheep 2.							
Fed in five days	3216.1	3072.7	143.44	297.49	930.74	1718.36	126.07
Excreted in feces in five days,	1213.8	1118.	95.76	113.24	355.04	597.80	51.96
Digested....................	2002.3	1954.7	47.68	184.25	575.70	1120.56	74.11
Per cent. digested............	62.26	63.61	33.24	61.93	61.85	65.21	58.78
Average per cent. digested by two animals..............	61.76	62.96	33.66	62.18	61.31	64.64	56.81

Digestibility of Various Hays—Concluded.

	Dry substance.	Organic matter.	Ash.	Protein Nx6 25.	Fiber.	Nitrogen-free extractive matter.	Fat.
XCVI BLUE JOINT.							
Sheep 3.							
Fed in three days	1957.2	1845.6	111.56	199.44	710.86	885.63	49.71
Excreted in feces in three days	576.3	525.4	50 94	55.32	188.91	257.89	23.22
Digested	1380.9	1320.2	60.62	144.12	521.95	627.74	26.49
Per cent. digested	70.55	71.53	54.34	72.26	73.43	70.88	53.29
Sheep 4.							
Fed in three days	1957.2	1845.6	111.56	199.44	710.86	885.63	49.71
Excreted in feces in three days	651.6	588.1	63.53	63.40	202.78	297.72	24.17
Digested	1305.6	1257.5	48.03	136.04	508.08	587.91	25.54
Per cent. digested	66.70	68.13	43.05	68.21	71.47	66.38	51.38
Average per cent. digested by two animals	68.6	69.8	48.70	70.23	72.45	68.63	52.33
XCVII WITCH GRASS.							
Sheep 1.							
Fed in three days	1964.6	1854.4	110.2	153.44	603.33	1040.06	57.56
Excreted in feces in three days	732.2	662.2	70.	77.47	244.55	313.45	26.72
Digested	1232.4	1192.2	40.2	75.97	358.78	726.61	30.84
Per cent. digested	62.73	64.29	36.47	49.51	59.46	69.86	53.58
Sheep 2.							
Fed in three days	1964.6	1854.4	110.20	153.44	603.33	1040.06	57.56
Excreted in feces in three days	745.2	686.1	58.94	66.99	263.06	330.50	25.71
Digested	1219.4	1168.3	51.26	86.45	340.27	709.56	31.85
Per cent. digested	62.07	63.00	46.51	56.34	56.39	68.22	55.33
Average per cent. digested by two animals	62.40	63.64	41.49	52.92	57.92	69.04	54.45
XC ALSIKE CLOVER.							
Sheep 3.							
Fed in five days	3204.3	2975.5	228.79	437.39	979.87	1422.39	135.86
Excreted in feces in five days	1245.9	1131.3	114.62	143.02	458.46	476.76	52.94
Digested	1958.4	1844.2	114.17	294.37	521.41	945.63	82.92
Per cent. digested	61.12	61.98	49.90	67.30	53.21	66.48	61.03
Sheep 4.							
Fed in five days	3204.3	2975.5	228.79	437.39	979.87	1422.39	135.86
Excreted in feces in five days	1142.9	1035.2	107.66	134.86	405.	453.58	41.72
Digested	2061.4	1940.3	121.13	302.53	574.87	968.81	94.14
Per cent. digested	64.33	65.20	52.94	69.16	58.67	68.11	69.29
Average per cent. digested by two animals	62.72	63.59	51.42	68.23	55.94	67.29	65.16

In order to facilitate a comparison of these coefficients of digestibility they are summarized below.

	Dry substance.	Organic matter.	Ash.	Protein Nx6.25.	Fiber.	Nitrogen-free extractive matter.	Fat.
Timothy hay, early cut	60.40	61.06	48.18	58.88	57.69	63.70	56.90
Timothy hay, late cut..	58.32	59.37	33.20	49.96	53.31	63.91	58.32
Wild oat grass	68.30	69.07	52.20	67.96	70.57	68.84	62.84
Red Top	61.76	62.96	33.66	62.18	61.31	64.64	56.81
Blue Joint	68.60	69.80	48.70	70.23	72.45	68.63	52.33
Witch grass	62.40	63.64	41.49	52.92	57.92	69.04	54.45
Alsike clover..............	62.72	63.59	51.42	68.23	55.94	67.29	61.16

It is but fair to remark that the collection of the feces from the Blue Joint and Witch Grass for so short a time as three days, renders the coefficients for those days less reliable than in the other cases.

COMPOSITION, DIGESTIBILITY AND YIELD OF EARLY-CUT AND LATE-CUT TIMOTHY.

In the summer of 1888, a very uniform field of Timothy grass was divided into six plots, each plot being 236 feet long and 47 feet wide. Plots 1, 3 and 5 were cut July 9th while the Timothy was in early bloom, and plots 2, 3 and 6 were cut July 24th, fifteen days later. In both cases the grass was carefully cured, and the two cuttings were stored separately so that the hay could be re-weighed, which was done on November 28th. About a hundred pounds of each lot of hay was finely chopped for use in the determination of their composition and digestibility.

The composition of these two hays has already been given, but is re-stated below for the purpose of comparison.

	Ash—per cent.	Protein—per cent	Fiber—per cent.	Nitrogen-free extractive matter—per cent.	Fat—per cent.
Timothy, cut July 9th	5.21	9.54	29.19	51.94	4.12
Timothy cut July 24th..........	3.99	7.60	29.14	55.51	3.76
Difference	1.22	1.94	.05	—3.57	.36

The digestibility of the hays is also compared in the next table, the figures given being the percentages of digestibility.

	Dry substance	Organic matter.	Ash.	Protein—per cent.	Fiber.	Nitrogen-free extractive matter.	Fat.
Timothy, cut July 9th......	60.40	61.06	48.18	58.88	58.69	63.70	56.90
Timothy, cut July 24th	58.32	59.37	32.20	49.96	53.31	63.91	58.32

The following figures show the weights of hay from the two cuttings.

	Lot cut July 9th.	Lot cut July 24th.
Weight when put in barn..................	2815 pounds.	2790 pounds.
Weight on November 28th..................	2470 "	2420 "
Loss by drying in barn....................	345 pounds.	370 pounds.
Per cent loss in barn	12.2 per cent.	13.3 per cent.
Yield dry hay per acre	3233 pounds.	3168 pounds.

The especial uniformity of the grass on this experimental field warrants the belief that the above figures represent very fairly the relative yield of hay from early-cut and late-cut grass under the existing conditions. The grass in this field had been attacked for several years by an insect, the larva of which feeds on the inner portion of the culm (stalk) and causes the death of the upper portion of the plant.

Probably one-fifth of the grass plants on this field was thus affected in 1888, and the above results indicate that longer standing gave a decreased rather than the usual increased yield. On the other hand, the season was such as to promote an undergrowth of short grass, so that the hay harvested late in July does not seem to differ much in composition, digestibility or yield from the former cutting, although in all respects there is a small balance in favor of the early cut hay.

THE COMPOSITION AND YIELD OF FODDER FROM THREE VARIETIES OF CORN, AND THE DIGESTIBILITY OF THE SAME BOTH AS DRIED FODDER AND AS ENSILAGE.

The corn plant is an important source of cattle food. This is especially true now that this crop is so largely grown to be converted into ensilage, and now that we have come to more fully appreciate and more economically use, by means of the silo, what is left after removing the ears either for the sweet corn factory or for the ripe grain.

The matter of the relative yield of food from several varieties of corn when grown to be packed in the silo, is often discussed, as for instance, southern ensilage corn, common field corn, or sweet corn. How does the actual amount of nutritive material produced by these varieties under like conditions, compare?

With a view to obtaining an answer to this question, an experiment was undertaken in the summer of 1888, after the following plan:

Two acres of land, a fine loam, which had been in grass for several years was manured with 600 pounds of superphosphate per acre, drilled in with the seed. This, with the decaying sod, furnished the crop a fair amount of food.

This area was divided into twelve plots of equal size. On plots 1, 4, 7 and 10 was planted Southern Ensilage Corn; on plots 2, 5, 8 and 11 Common Field Corn, and on plots 3, 6, 9 and 12, Sweet Corn. The corn was planted in drills by the use of the Eclipse Corn Planter. The least quantity of seed that it was found possible to drill in with this machine, and at the same time secure uniformity, was more than desired, and the plots were somewhat too heavily seeded, though not greatly so.

The corn was planted on May 30th and 31st, and the fodder was cut September 8th to 12th. The crop was well cultivated by both machine and hand work.

Three reasons exist why the results obtained in this experiment are less satisfactory than they otherwise would have been, viz:

The season of 1888 was unfavorable to the early maturity of the corn plant, being exceptionally wet, and although one hundred days elapsed between the planting and the harvesting, the crop was less mature than was necessary for the largest production. In the case of the field corn, a good many ears were fully developed, in sweet corn a few, and in the southern corn the formation of ears had not begun.

Again the field corn and sweet corn were attacked when a few inches high, and somewhat thinned by a cut worm. It is a question whether this thinning actually diminished the yield of fodder, but it disturbed to some extent the uniformity of conditions under which the three varieties grew. It is worthy of note that the cut worm entirely avoided the southern corn, but was found on every plot of the other two varieties.

To complete the list of calamities, the corn was frost bitten a few nights before it was harvested, though not severely. This latter misfortune could in no way materially effect the accuracy of the data as to the yield and composition of dry matter, but may be supposed to have had an influence on the palatableness of the fodder, and thus interfere with the success of an experiment involving digestion and feeding experiments. But notwithstanding these unfavorable conditions, it was decided to continue the experiment as planned, because a study of unsatisfactory results is often instructive, and in the case under consideration it is certainly worth while to know just how far short of success this crop of somewhat immature frost bitten fodder came. It is sometimes asserted that failures teach more than successes. Besides the original inquiries involved in the experiment, the adverse conditions mentioned above raise the additional inquiry as to the real quality for ensilage and feeding possessed by such material as the experiment furnished. A study was made of the following points:

(1) Yield of green fodder and dry matter.
(2) Composition of the fodder.
(3) Digestibility of the fodder.
(4) Actual effect of the fodder when fed as ensilage.

Yield of fodder. The fodder was hauled to the barn directly after cutting and was weighed before being chopped to pack in the silo. The yields of green fodder and dry substance are given in the tables below, as also are the total yield, and calculated rate of yield per acre. The yields of dry matter are calculated by means of analytical data to be found later.

Yield of Fodder Corn.

	Southern Corn.			Field Corn.			Sweet Corn.		
	Plot.	Weight green, in pounds.	Weight water-free substance, in pounds.	Plot	Weight green, in pounds.	Weight water-free substance, in pounds	Plot.	Weight green, in pounds.	Weight water-free substance, in pounds.
	1	4,450	547.3	2	2,325	404.5	3	1,995	269.3
	4	4,565	561.5	5	2,495	434.1	6	2,495	336.8
	7	3,925	482.8	8	2,140	362.4	9	2,160	291.6
	10	4,590	564.6	11	2,515	437.6	12	2,820	380.7
	Total	17,530	2,156.2		9,475	1,638.6		9,470	1,278.4
Rate of yield per acre,		26,295	3,234.3		14,212	2,457.9		14,205	1,917.6

No one of the varieties of corn yielded largely, and under the existing conditions this was not to be expected. In fact the experiment was planned with reference to a comparison of yield and not to secure a maximum crop.

The growth of dry matter, as well as of green fodder seems to have been much larger with the southern ensilage corn. Would this have been true under more favorable conditions? A future experiment must more definitely answer this question.

One fact is plainly seen, however, which is, that 36,475 pounds of green fodder contained only 5,073 pounds of dry matter, and 31,402 pounds of water, or in other words, over eighteen tons of green material grown on two acres, furnished only two and one-half tons of dry substance. This is less dry matter per acre than is furnished by the average grass crop on very many of our well tilled Maine hay farms, and in the case of the hay fifteen tons of water are not present to be lifted several times. There would be no reason for mentioning the poor economy of this crop were it not for the fact that many such crops of corn fodder have been grown and may still be grown in Maine on land of moderate fertility, and from late planted seed. More liberal manuring and greater maturity are essential conditions of success in the growth of the corn plant for the silo.

But the *amount* of dry matter is not the only factor involved in the consideration of nutritive value. The southern corn was harvested, as must always be the case in Maine, in a much more immature condition than the other two varieties. This fact must effect the composition of the fodder, and the question arises: May not the smaller amount of dry matter in the more mature field corn have as great or greater value than the larger amount in the southern corn? Again, what is the quality of the dry matter in fodder corn of this sort? An answer to these questions must come from a knowledge of the composition and digestibility of the different varieties.

Composition of the fodder corn. When the plots of corn were cut samples were selected from quite a number of places in each plot and a few hundred pounds of each variety of fodder was weighed, and then stored in a place and manner favorable to drying. Late in November the three lots of partially dried fodder were finely chopped in a hay cutter, and were then spread out for additional drying. On December 6th, the chopped fodder was weighed, samples weighed out for analysis, and that used in the digestion experiments, which were then begun, was weighed into paper bags. The samples for analysis were dried still more until in a condition for grinding, and then re-weighed. The several weighings are recorded below:

	First Drying.		Second Drying.	
	Green corn stored—lbs.	Partially dried fodder obtained—lbs.	Partially dried fodder taken—grams.	Air-dry fodder obtained—grams.
Southern corn	450	94.5	800	513
Field corn	400	129.0	800	478
Sweet corn	400	110.0	800	435

The air dry fodder as analyzed, contained moisture as follows: Southern corn, 8.91 per cent, field corn, 9.75 per cent, sweet corn, 9.64 per cent.

From the data now given, it is possible to calculate the composition of the green fodder, and also of the water-free substance.

Composition of Fodder Corn.

Station number.	Kind of Corn.	In 100 Parts Green Fodder.							In 100 Parts Water-Free Substance.				
		Water—per cent.	Dry substance—per cent.	Ash—per cent.	Protein Nx6.25—per cent.	Fiber—per cent.	Nitrogen-free extractive matter—per cent	Fat—per cent	Ash—per cent.	Protein Nx6 25—per cent.	Fiber—per cent.	Nitrogen-free extractive matter—per cent.	Fat—per cent.
LXXXIII,	Southern,	87.70	12.3	.87	1.49	3.95	5.67	.32	7.11	12.14	32.09	46.09	2.57
LXXXIV..	Field	82.60	17.4	1.35	2.30	5.04	8.32	.39	7.79	13.22	8.95	47.80	2.24
LXXXV ..	Sweet....	86.40	13.5	.73	1.72	4.10	6.58	.37	5.45	12.73	30.35	48.74	2.73

The figures show that the southern corn fodder contained the most water, and the field corn the least. The composition of the dry matter seems not to differ in a marked manner, in the three cases, the proportion of protein to carbohydrate material being nearly the same, though the smaller varieties contained a somewhat larger proportion of protein, the field corn leading in this respect as in the amount of dry matter.

It is interesting to note how the composition of these fodders compares with the composition of the seventy-five samples of green corn fodder that had been analyzed in this country up to 1888. This average is:

Water.	Dry substance.	Ash.	Protein.	Fiber.	Nitrogen-free extractive matter	Fat.	
78.74	21.26	1.08	1.80	4.99	12.94	.45	.... Average
92.90	7.10	-	.70	1.90	3.20	.10	.... Minimum
51.50	48.50	-	3.00	11.4	22.10	1.80	.................Maximum

While these fodders did not prove to be quite up to the average quality, they are much better than the poorest that have been analyzed.

The composition of the partially dried fodder when chopped late in November, can also be determined from the analyses and weighings.

This fodder had been stored for nearly two months, spread out in a thin layer in a dry place, and the fact that it still retained from 40 to 50 per cent. of water shows how slowly such material dries, and how large is the proportion of water that we may expect to find in any corn fodder or stover consisting of the uncut stalks.

Composition of Partially Dried Corn Fodder.

	Water.	Dry substance.	Ash.	Protein Nx6 25.	Fiber.	Nitrogen-free extractive matter.	Fat.
Southern corn fodder............	41.5	58.5	4.16	7.10	18.77	26 97	1.50
Field corn fodder...............	46.0	54.0	4.20	7.14	15.63	25.82	1.21
Sweet corn fodder...............	50.9	49.1	2.67	6.25	14.90	23.93	1.34

Digestibility of the fodder corn. The digestibility of these three varieties of fodder corn was determined by experiments with sheep, the plan followed being the same as that described in connection with former experiments. The usual data are given below:

Composition of Feces.

From	Fresh feces.		In 100 parts water-free feces.				
	Water—per cent.	Water free substance—per cent.	Ash—per cent.	Protein Nx6.25—per cent.	Fiber—per cent.	Nitrogen-free extractive matter—per cent.	Fat—per cent.
LXXXIII, Southern Corn Fodder, Sheep 1	73.16	26.84	14.38	15.49	21.48	46.21	2.44
LXXXIII, Southern Corn Fodder, Sheep 2	64.47	35.53	12.14	13.66	24.95	47.10	2.15
LXXXIV, Field Corn Fodder, Sheep 3	61.58	38.42	14.67	16.01	19.12	47.90	2.30
LXXXIV, Field Corn Fodder, Sheep 4	71.04	28.96	14.49	16.30	20.07	47.18	1.96
LXXXV, Sweet Corn Fodder, Sheep 3	58.06	41.94	10.49	15.08	23.04	49.03	2.36
LXXXV, Sweet Corn Fodder, Sheep 4	55.75	44.25	10.86	11.71	23.18	52.06	2.19

Weights of Food Eaten and Feces Excreted.

		Total food eaten in five days.		Total feces excreted in five days.	
		Partially air-dry—grams.	Water-free—grams.	Fresh—grams.	Water-free—grams.
LXXXIII ..	Southern Corn Fodder, Sheep 1...	4000	2336.4	2925.	784.9
" ..	" " " 2...	4000	2336.4	2395.	851.
LXXXIV....	Field Corn Fodder, " 3...	4000	2156.9	1735.	666.6
" ...	" " " 4...	4000	2156.9	2140.	619.8
LXXXV....	Sweet Corn Fodder, " 3...	4000	1965.3	1794.	752.5
"	" " " 4...	4000	1965.3	1771.	783.6

Digestibility of Corn Fodder.

	Dry substance.	Organic matter.	Ash.	Protein Nx6.25.	Fiber.	Nitrogen free extractive matter.	Fat.
LXXXIII, SOUTHERN CORN FODDER							
Sheep 1.							
Fed in five days	2336.4	2170.3	166.12	283.94	749.75	1076.85	60.05
Excreted in feces in five days	784.9	672.0	112.86	121.56	168.58	362.16	19.14
Digested	1541.5	1498.3	53.26	162.38	581.17	714.19	40.91
Per cent. digested	65.98	69.04	32.06	57.18	77.51	66.32	68.12
Sheep 2.							
Fed in five days	2336.4	2170.3	166.12	283.94	749.75	1076.85	60.05
Excreted in feces in five days	851.	753.7	103.32	116.24	212.32	400.82	18.30
Digested	1485.4	1416.6	62.80	167.70	537.43	676.03	41.75
Per cent. digested	63.57	65.27	37.80	59.06	71.68	62.77	69.52
Avg. per cent. digested by 2 animals	64.77	67.15	34.93	58.12	74.59	64.54	68.82
LXXXIV, FIELD CORN FODDER.							
Sheep 3.							
Fed in five days	2156.9	1988.9	168.02	285.14	624.42	1030.99	48.31
Excreted in feces in five days	666.6	568.8	97.80	106.72	127.46	319.30	15.34
Digested	1490.3	1420.1	70.22	178.42	496.96	711.69	32.97
Per cent. digested	69.09	71.40	41.79	62.57	79.58	69.02	68.25
Sheep 4							
Fed in five days	2156.9	1988.9	168.02	285.14	624.42	1030.99	48.31
Excreted in feces in five days	619.8	530.8	89.80	101.02	124.40	292.42	12.14
Digested	1537.1	1458.1	78.22	184.12	500.02	738.57	36.17
Per cent digested	71.26	73.31	46.55	64.57	80.07	71.63	74.87
Avg. per cent digested by 2 animals	70.17	72.35	44.17	63.57	79.82	70.32	71.56
LXXXV, SWEET CORN FODDER.							
Sheep 3							
Fed in five days	1965.3	1858.2	107.11	250.18	596.47	957.89	53.65
Excreted in feces in five days	752.5	673.6	78.92	113.46	173.36	368.90	17.76
Digested	1212.8	1184.6	28.19	136.72	423.11	588.99	35.89
Per cent digested	61.71	63.75	26.32	54.65	70.93	61.48	66.89
Sheep 4.							
Fed in five days	1965.3	1858.2	107.11	250.18	596.47	957.89	53.65
Excreted in feces in five days	783.6	698.5	85.10	91.76	181.64	407.94	17.16
Digested	1181.7	1159.7	22.01	158.42	414.83	549.95	36.49
Per cent. digested	60.12	62.40	20.54	63.32	69.54	57.41	68.01
Avg. per cent. digested by 2 animals	60.91	63.07	23.43	58.98	70.23	59.44	67.45

Composition and digestibility of the ensilage from the three varieties of corn. Each variety of fodder corn used in this experiment was cut and packed in the silo separately. The green fodder was hauled to the barn as soon as cut and immediately chopped and packed. The fodder cutter used was the Lion Fodder Cutter, No. 2, manufactured by Hank & Comstock, Mechanicsburg, Pa., which not only cuts the fodder to any desired length, but also crushes the coarse pieces of stalk.

The silo was not opened until late in February, and the contents were found to be in good condition, save the usual layer of poor material at the surface. The ensilage was of fair quality, and was certainly greedily eaten, especially by the cows.

While each kind of ensilage was being eaten, samples were selected daily during two weeks for use in digestion experiments with sheep, as well as for analysis. It is not claimed that the analyses fairly represent the entire contents of the silo, but only that part used in the digestion experiments, which, however, could not be greatly different from the whole mass of material. The analyses of the ensilage follow:

Composition of Ensilage.

Station number.		In 100 Parts Fresh Ensilage.							In 100 Parts Water-Free Substance.				
		Water.	Dry substance.	Ash	Protein Nx6 25.	Fiber.	Nitrogen-free extractive matter	Fat.	Ash.	Protein Nx6.25.	Fiber.	Nitrogen-free extractive matter.	Fat.
XCIX,	South'n corn ensilage..	82.22	17.78	1.05	1.82	5.70	8.70	0.51	5.94	10.22	32.05	48.93	2.86
XCIV,	Field corn ensilage..	83.08	16.92	0.86	2.[illegible]0	4.34	8.75	0.99	5.08	11.81	25.65	51.63	5.83
XCV..	Sweet corn ensilage .	83.49	16.51	0.87	1.97	4.07	8.60	1.00	5.26	11.94	24.63	52.10	6.07

The further data necessary to the calculation of the digestibility are given below. The experiments furnishing this data were continued for twelve days, the feces being collected during the last five:

Composition of Feces.

From	Water.	Dry substance.	In 100 parts water-free substance. Ash.	Protein.	Fiber.	Nitrogen-free extractive matter.	Fat
XCIX, Southern Corn Ensilage, Sheep 3...	66.16	33.84	14.10	14.60	22.31	46.00	2.99
XCIX, Southern Corn Ensilage, Sheep 4...	68.32	31.68	13.44	15.05	23.24	45.61	2.66
XCIV, Field Corn Ensilage, Sheep 3,	78.81	21.19	14.35	20.20	20.58	41.57	3.30
" " " " 4,	62.84	37.16	14.26	15.65	20.30	46.58	3.21
XCV, Sweet Corn Ensilage, " 1,	59.83	40.17	10.85	16.92	23.25	45.77	3.21
" " " " 2,	74.28	25.72	11.63	17 62	21.2[illegible]	46.40	3.07

Weights of Food Eaten and Feces Excreted.

		Food Eaten in Five Days. Fresh—grams.	Water-free—grams	Feces Excreted in Five Days. Fresh—grams.	Water-free—grams.
XCIX,	Southern corn ensilage, sheep 3.......	7500	1333.5	1345	455.1
"	" " " " 4.......	7500	1333.5	1658	525.4
XCIV,	Field corn " " 3.......	7500	1279.	1817	385.1
"	" " " " 4.......	7500	1279.	1092	405.8
XCV..	Sweet corn " " 1.......	7500	1238 2	1030	413.8
"	" " " " 2.......	7500	1238.2	1462	376

Digestibility of Ensilage.

	Dry substance.	Organic matter.	Ash.	Protien Nx6 25.	Fiber.	Nitrogen-free extractive matter.	Fat.
XCIX, SOUTHERN CORN ENSILAGE.							
Sheep 3.							
Fed in five days	1333.5	1254.3	79.23	136.32	427.51	652.68	38.15
Excreted in feces in five days	455.1	390.9	64.16	66.44	101.52	209.30	13.60
Digested	878.4	863.4	15.07	69.88	325.99	443.38	24.55
Per cent. digested	65.87	68.75	19.02	51.26	76.25	67.93	64.35
Sheep 4.							
Fed in five days	1333.5	1254.3	79.23	136.32	427.51	652.68	38.15
Excreted in feces in five days	525.4	454.4	70.62	79.08	122.10	239.64	12.88
Digested	808.1	799.9	8.61	57.24	305.40	413.04	25.27
Per cent. digested	60.59	63.77	10.87	41.98	71.45	63.29	66.24
Average per cent. digested by two animals	63.23	66.26	14.94	46.62	73.85	65.61	65.30
XCIV, FIELD CORN ENSILAGE.							
Sheep 3.							
Fed in five days	1279.	1214.5	64.46	149.86	325.47	655.13	73.98
Excreted in feces in five days	385.1	329.8	55.26	77.79	79.25	160.09	12.71
Digested	893.9	884.7	9.20	72.07	246.22	495.04	61.27
Per cent. digested	69.89	72.84	14.27	48.09	75.65	75.56	82.82
Sheep 4.							
Fed in five days	279.	1214.5	64.46	149.86	325.47	655.13	73.98
Excreted in feces in five days	405.8	347.9	57.86	63.50	82.38	189.02	13.02
Digested	873.2	866.6	6.60	86.36	243.09	466.11	60.96
Per cent. digested	68.27	71.35	10.24	57.62	74.68	71.15	82.40
Average per cent. digested by two animals	69.08	72.09	12.25	52.85	75.16	73.35	82.61
XCV, SWEET CORN ENSILAGE.							
Sheep 1							
Fed in five days	1238.2	1173.1	65.12	147.82	304.92	645.98	75.15
Excreted in feces in five days	413.8	368.9	44.90	69.96	96.20	189.40	13.28
Digested	824.4	804.2	20.22	77.86	208.72	456 58	61.87
Per cent. digested	66.58	68.55	31.05	52.67	68.44	70.68	82.33
Sheep 2.							
Fed in five days	1238.2	1173.1	65.12	147.82	304.92	645.98	75.15
Excreted in feces in five days	376.	332.3	43.72	66.26	80.00	174.46	11.54
Digested	862.2	840.8	21.40	81.56	224.92	471.52	63.61
Per cent. digested	69.63	71.67	32.86	55.17	73.76	72.99	84.64
Average per cent. digested by two animals	68.10	70.11	31.95	54.01	71.10	71.83	83.48

The digestibility of these varieties of corn having been determined both as fodder and as ensilage, it is now possible to compare the figures obtained. It is interesting to note whether ensilage is greatly more or less digestible than the original material converted into dried fodder.

Comparison of Digestibility of Corn Fodder and Ensilage.

	Dry substance.	Organic matter.	Ash.	Protein Nx6.25.	Fiber.	Nitrogen-free extractive matter.	Fat.
SOUTHERN CORN.							
As fodder	64.77	67.15	34.93	58.12	74.59	64.54	68.82
As ensilage........	63.23	66.26	14.94	46.62	73.85	65.61	65.30
Difference	+1.54	+.89	+19.99	+11.50	+.74	—1.07	+3.52
FIELD CORN.							
As fodder..........	70.17	72.35	44.17	63.57	79.82	70.32	71.56
As ensilage........	69.08	72.09	12.25	52.85	75.16	73.35	82.61
Difference	+1.09	+.26	+31.92	+10.72	+4.66	—3.03	—11.05
SWEET CORN.							
As fodder	60.91	63.07	23.43	58.98	70.23	59.44	67.45
As ensilage........	68.10	70.11	31.95	54.01	71.10	71.83	83.48
Difference...... ...	—7.19	—7.04	—8.52	+4.97	—.87	—12.39	—16.03

These figures from actual trials furnish no evidence that the fermentation which a fodder undergoes in the silo greatly affects its digestibility, and they accord with the results of previous tests.

In view of the unanimity of testimony in this point, there seems to be no reason for perpetuating the statement through our agricultural papers. that ensilage is more digestible than the original material when dried. In fact, there is good reason for believing that if a fodder can be so quickly and perfectly dried that it suffers no change in composition, its percentage of digestibility will be greater than that of the ensilage made from it, because the fermentation in the silo destroys some of the soluble and perfectly digestible compounds in the fodder.

In practice, however, fodder is not generally dried without loss similar to that which takes place in the silo, and so in discussing the advantages of the silo, the matter of a greater or less digestibility does not seem likely to furnish an argument either pro or con.

Summary. The previously described results of a somewhat careful study of the composition and digestibility of inmature fodder corn, harvested under unfavorable conditions, make a very good showing for the nutritive value of whatever of dry substance the fodder contained. It can by no means be said that such material is worthless, but it is fairer to claim that its dry matter has a greater feeding value, pound for pound, than that of much hay that is fed. Immaturity implies a low nutritive value, only so far as it is an indication of the presence of a very large percentage of water. June pasture grass is made up of immature plants but who does not know that its dry substance is very nutritious?

The indictment against the crops of fodder corn obtained in this experiment is the small amount of dry matter harvested. The appearance of the plots of southern corn, especially, indicated a crop by no means small, and the scales made a showing of over thirteen tons of green material per acre, but the close inspection of the laboratory shows that this large bulk of fodder yielded less than one and two-thirds tons of actual food substance.

Any crop, so bulky and so largely water, such as roots and fodder corn, is likely to be deceptive as to its real food value.

(1) The dry substance in 100 pounds of the somewhat immature green fodder from three varieties of corn varied from 12.3 pounds to 17.4 pounds.

(2) The dry substance in 37,475 pounds of green fodder was 5,073 pounds. Of the southern corn 26,295 pounds contained only 3,234 pounds of dry matter.

(3) The dry substance of these fodders was found to have a composition and high relative rate of digestibility that indicate good nutritive quality.

(4) The digestion experiments do not show a superior digestibility for the ensilage over the dried fodder.

COMPOSITION AND VALUE OF VARIOUS COMMERCIAL FEEDING STUFFS.

J. M. BARTLETT.

The idea of collecting and analyzing a few samples of the feeding stuffs offered for sale in our markets was suggested to the writer by frequent inquiries from the farmers as to the relative value of the various milling products and other concentrated cattle foods now sold by dealers.

Three samples of nearly every food were taken in as many different towns, in order to obtain some idea of the amount of variation in the composition of the same brands. The detailed analyses showing the composition of the samples collected are given in tabular form on page 27. Further on is shown the amounts of digestible nutrients calculated from the average of the analyses of each food, and these figures possibly may be of some service to the intelligent farmer in buying and feeding economically. In the report of this Station for 1888, page 108, can be found the method for calculating rations, and on the following pages, feeding standards, composition of American fodders, their digestibility, etc., that farmers can make use of in making up rations.

It is undoubtedly true that the intelligent buyer can materially lessen the cost of feeding his animals by studying the composition of the foods offered for sale, and buying those which will furnish the nutrients he especially needs, at the lowest price. For instance it will be seen below that a little more digestible protein, fat and carbohydrates can be obtained from fifty pounds of wheat bran and fifty pounds middlings than from one hundred pounds of oats. The bran and middlings at present prices, would cost about $1.00, while the oats would cost about $1.25. Again if one has a fodder rich in carbohydrates and wishes to buy protein to make a proper ration, it could be much more cheaply obtained in cottonseed or gluten meal, or any food rich in protein, than in corn meal which is poor in protein, providing the large amount of carbohydrates the corn contains is not needed.

The reverse would also be true if one wished to buy carbohydrates, they could be more cheaply purchased in corn meal than in cottonseed meal or gluten meal. It is not possible for us to say which foods are always most economical, because prices fluctuate so that what would be true to-day might not be true three months hence, but the buyer must ascertain his needs, study the composition of the foods in the market, and their prices, and use his own judgment in purchasing.

Composition of Commercial Feeding Stuffs.

Laboratory number.		Water—per cent.	Dry substance—per cent.	Ash—per cent.	Protein Nx6.25—per cent.	Fiber—per cent	Nitrogen-free extractive matter—per cent.	Fat—per cent.	P'r ct. protein digestible in pepsin solution.
LVI.....	White Wheat Bran.......	12.07	87.93	6.27	16.56	8.53	52.35	4.22	86.03
LVII....	" "	11.50	88.50	6.27	16.81	7.55	53.30	4.57	86.25
LVIII...	" "	10.80	89.20	6.22	17.69	7.48	53.96	3.85	81.98
	Average..................	11.46	88.54	6.25	17.02	7.85	53.20	4.22	84.75
LIX.....	Red Wheat Bran	12.50	87.50	6.40	16.94	6.35	53.56	4.25	81.55
LX......	" "	11.05	88.95	6.55	16.81	7.50	53.11	4.98	82.16
LXI.....	" "	11.05	88.95	6.25	16.38	10.15	50.54	5.63	84.74
	Average..................	11.54	88.46	6.40	16.71	8.00	52.40	4.95	82.81
LXII....	Wheat Middlings	12.15	87.85	3.58	19.13	4.00	55.49	5.65	90.52
LXIII...	" "	11.60	88.40	3.10	16.81	4.45	60.54	3.50	90.34
LXIV...	" "	11.00	89.00	3.42	18.93	3.20	58.59	4.86	91.75
LXV	" "	11.87	88.13	5.10	18.31	6.36	53.19	5.17	87.03
	Average	11.66	88.34	3.80	18.29	5.50	56.95	4.79	89.91
LXVI...	Wheat Middlings (fancy)	11.00	89.00	1.45	17.75	2.90	63.12	3.78	91.20
LXVII..	" " "	10.45	89.55	1.62	14.19	4.51	65.86	3.37	89.43
LXVIII,	" " "	10.65	89.35	2.80	13.75	3.72	64.91	4.17	90.67
	Average..	10.70	89.30	1.95	15.23	3.71	64.65	3.77	90.43
LXIX...	Feed Flour	9.90	90.10	2.75	20.87	3.66	57.98	4.80	95.01
LXX	" "	11.30	88.70	.95	20.	1.64	61.66	4.72	94.56
	Average..................	10.90	89.40	1.85	20.43	2.65	59.82	4.75	94.78
LXXI ..	Corn Meal............ ...	12.27	87.73	1.26	10.00	2.72	69.74	3.81	82.50
LXXII .	" "	11.69	88.31	1.02	9.94	2.42	71.06	3.87	83.02
LXXX...	" "	12.50	87.50	1.14	10.00	1.80	70.29	4.27	83.13
	Average..................	12.16	87.84	1.14	9.98	3.98	70.36	2.31	82.88
LXXIII,	Ground Oats.............	11.48	88.52	2.87	12.52	9.23	60.36	4.00	87.05
LXXXI,	" "	11.14	88.86	3.21	13.56	8.57	58.38	5.14	91.24
	Average..................	11.31	88.69	3.04	13.64	8.90	59.37	4.57	89.14
LXXIV..	Cotton Seed Meal	7.11	92.89	6.89	44.38	6.40	21.53	13.69	87.89
LXXVII,	" "	7.94	92.06	6.23	44.75	3.44	18.74	18.90	91.34
LXXVIII	" "	7.52	92.48	5.38	49.18	5.75	21.52	10.65	89.33
	Average.................	7.53	92.47	6.16	46.10	5.20	20.59	14.41	89.52
LXXV...	Linseed Meal	8.58	91.42	5.26	38.12	8.28	32.27	7.49	92.13
LXXVI..	" "	8.91	91.09	4.72	37.88	7.39	22.15	18.95	98.58
	Average	8.75	91.25	4.99	38.00	7.[illegible]	[illegible]7.21	13.22	95.35

DIGESTIBLE NUTRIENTS IN ONE HUNDRED POUNDS.

Red Wheat Bran.

Protein	12.37	pounds
Fat	4.11	"
Carbohydrates	35.11	"

White Wheat Bran.

Protein	12.59	pounds
Fat	3.49	"
Carbohydrates	35.64	"

Red Wheat Middlings.

Protein	14.84	pounds
Fat	4.45	"
Carbohydrates	46.28	"

Fancy Middlings.

Protein	12.03	pounds
Fat	3.20	"
Carbohydrates	53.64	"

The coefficients used in calculating the digestible nutrients in the bran and middlings were obtained by experiments with animals, recently made at this Station. They are for

	Protein—per cent.	Carbohydrates—per cent.	Fat—per cent.
Bran	74	67	83
Middlings	79	83	85

Feed Flour.

Protein	16.15	pounds
Fat	4.07	"
Carbohydrates	49.65	"

We were somewhat surprised to find the feed flour so rich in protein, which seems to indicate that gluten meal or some other highly nitrogenous material was mixed with it. The coefficients for middlings were used in calculating the digestible matter.

Corn Meal.

Protein	8.48	pounds
Fat	3.02	"
Carbohydrates	66.14	"

Ground Oats.

Protein	10.04	pounds
Fat	3.75	"
Carbohydrates	43.93	"

Cottonseed Meal.

Protein	40.57	pounds
Fat	12.25	"
Carbohydrates	19.56	"

Linseed Meal.

Protein	32.68	pounds
Fat	12.03	"
Carbohydrates	21.77	"

THE COMPARATIVE DIGESTIBILITY OF WHEAT BRAN AND WHEAT MIDDLINGS.

The wheat bran (shorts,) which is at the present time one of our most important commercial cattle foods, is quite different mechanically and chemically, we may believe, from that produced by the earlier processes of milling, being coarser and more nitrogenous. The mechanical difference is apparent to the eye, while the change in composition is seen by comparing earlier analyses with those given in this report. The average content of protein in eight samples of bran analyzed by Storer and Johnson* previous to 1877, is given below in comparison with the average of the samples collected last winter by this Station.

	Range of per cent. of protein.	Average per cent. of protein.
Storer & Johnson, eight analyses,	11.13 to 13.91	12.87
This Station, six analyses,	16 38 to 17.69	16.89

Armsby† has previously called attention to the difference between roller bran and that produced in former years.

The only digestion experiments with wheat bran which are recorded were made in Germany, and there seems to be no evidence than the experimental food was similar to our roller bran. In fact, there is every reason to believe that the majority of the German tests were made with quite different material. The digestibility of middlings does not seem to have been determined anywhere, at least the German tables of digestion coefficients make no mention of this feeding stuff, though it is possible that the term bran (Kleie) has been applied to material which in this country would be called middlings. It seems reasonably certain, however, that there is here recorded the first determination and comparison of the digestibility of American roller bran and middlings.

Plan of Experiment. The animals used were wethers, as in former experiments, and the general method of procedure was the same as heretofore observed. The determination of the digestibility of a grain or other concentrated food by ruminants requires a modification of the plan followed in the case of a hay, for the reason that a sheep cannot well be fed on bran alone, or corn alone. It seems to be necessary to feed a fodder such as hay with the concentrated

*See Bulletin I, Bussey Institute, and Report of Connecticut Agricultural Experiment Station, 1877.

†See Report of Wisconsin Experiment Station, 1885, p. 86.

food to be tested, the digestibility of this hay having been determined by previous experiments with the same animals. In this case Red Top hay was fed with both the middlings and bran. The daily rations were as follows:

Sheep 1 and 2 { 400 grs. Red Top Hay. 400 grs. middlings.

Sheep 3 and 4 { 400 grs. Red Top Hay. 400 grs. bran.

When the digestion experiment previously recorded was begun a much larger lot of Red Top hay was cut and mixed than was used in that experiment, and this surplus was again sampled and weighed out for use in the middlings and bran experiment. A quantity of middlings was thoroughly mixed, from which the rations were weighed and samples taken. The bran was similarly treated.

Analytical data. The analyses of the second sample of Red Top and of the middlings and bran gave the following figures:

	In 100 parts air-dry substance.						In 100 parts water-free substance.				
	Water—per cent.	Ash—per cent.	Protein—per cent.	Fiber—per cent.	Nitrogen-free extractive matter—per cent.	Fat—per cent.	Ash—per cent.	Protein—per cent.	Fiber—per cent.	Nitrogen-free extractive matter—per cent.	Fat—per cent.
XCIII, Red Top Hay,	10.07	4.50	8.18	25.73	48.17	3.35	5.00	9.09	28.61	53.57	3.73
XCII, Fancy Middlings	11.13	3 04	20.06	5 73	57.03	4 01	3.42	22.57	5.32	64.18	4.51
XCI, Bran..........	11.55	6.03	16.56	8 06	53.31	4 41	6.84	18.72	9.11	60.28	5.05

The necessary analyses of the feces were also made.

Composition of the Feces.

From.	Water.	Dry substance.	Ash.	Protein.	Fiber.	Nitrogen-free extractive matter.	Fat.
Red Top and Middlings, Sheep 1............	70.8	29.2	10.20	12.62	25.97	47.66	3.55
" " " " 2............	70.7	29.3	10.11	13.20	25.76	47.26	3.67
Red Top and Bran, " 3............	75.1	24.9	12.34	11.02	25.09	48.38	3.17
" " " 4............	71.3	28.7	12.49	9.96	25.86	48.57	3.12

Weights of Food Eaten and Feces Excreted.

	Total Food Eaten in Five Days.		Total Feces Excreted in Fve Days.	
	Air-dry—grams.	Water-free—grams.	Fresh—grams.	Water-free—grams.
EXPERIMENT WITH WHEAT MIDDLINGS.				
Sheep 1. XCIII, Red Top....................	2000	1798.6	4021	1176.2
Sheep 1. XCII, Wheat Middlings................	2000	1777.4		
Sheep 2. " " "	"	"	3730	1094.6
EXPERIMENT WITH WHEAT BRAN.				
Sheep 3. XCIII, Red Top....................	2000	1798.6	5865	1459.6
Sheep 3. XCI, Wheat Bran....................	2000	1769		
Sheep 4. " "			4780	1373.6

Digestibility of Wheat Middlings and Wheat Bran.

	Dry substance	Organic matter.	Ash.	Protein Nx6.25.	Fiber.	Nitrogen-free extractive matter.	Fat.
XCII, WHEAT MIDDLINGS.							
Sheep 1.							
Fed in hay in five days	1798.6	1708 7	89 93	163.49	514.58	963.51	67.08
Fed in middlings in five days......	1777 4	1716.7	60.68	401.16	94 56	1140.74	80.16
Total fed	3576.0	3425.4	150 61	564.65	609.14	2104.25	147.24
Excreted in feces in five days......	1176.2	1056.2	119.98	148 44	305.46	560.58	41.76
Total digested..................	2399.8	2369.2	30.63	416 21	303.68	1543 67	105.48
Digested from hay...............	1109.7	1079.4	30.27	101.65	315.49	622.81	38.09
Digested from middlings..........	1290.1	1289.8	.36	314.46	-	920.86	67.39
Per cent digested from middlings,	72.6	75.1	-	78.4	-	80.7	84.1
Sheep 2							
Total fed...	3576.0	3425.4	150 61	564.65	609.14	2104.25	147.24
Excreted in feces	1094.6	984.0	110.66	144.48	281.96	507.30	40.16
Total digested	2481.4	2441.4	39.95	420.17	327.18	1586.95	107.08
Digested from hay.	1109.7	1079.4	30.27	101.65	315.49	622.81	38.09
Digested from middlings	1371.7	1362.0	9.68	318.52	11.69	964.14	68.99
Per cent. digested from middlings,	77.2	79.3	-	79.4	-	84.5	86.1
Average per cent. digested by two animals.....................	74.9	77 2	-	78.9	-	82 6	85.1
XCI, WHEAT BRAN.							
Sheep 3.							
Fed in hay in five days..........	1798.6	1708.7	89.93	163.49	514.58	963.51	67.08
Fed in bran in five days..........	1769.0	1648.	121.	331.16	161.16	1066.35	89.33
Total fed..	3567.6	3356.7	210.93	494.65	675.74	2029.86	156 41
Excreted in dung in five days.....	1459.6	1279 5	180.12	160.84	366.22	706.16	46.26
Total digested	2108.	2077.2	30.81	333 81	309.52	1323 70	110.15
Digested from hay	1109.7	1079.4	30.27	101.65	315.49	622.81	38.09
Digested from bran..............	998.3	997.8	.54	232.16	-	700.89	72.06
Per cent. digested from bran......	56.4	60.5	-	70.1	-	65.7	80.7
Sheep 4.							
Total fed	3567.6	3356 7	210.93	494.65	675.74	2029.86	156.41
Excreted in feces	1373 6	1202.	171.56	136.82	355.22	667.14	42.86
Total digested..................	2194.0	2154.7	39.37	357 83	320.52	1362 72	113.55
Digested from hay	1109.7	1079.4	30.27	101.65	315.49	622.81	8.09
Digested from bran	1084 3	1075.3	9.10	256.18	5.03	739.91	75.46
Per cent. digested from bran	61.3	65.2	-	77.3	-	69.4	84.5
Average per cent. digested by two animals....................	58.8	62.8	-	73.7	-	67.5	82.6

There appears to be a marked difference in the digestibility of middlings and roller bran, as shown by the results of this experiment. A direct comparison of the two sets of figures is interesting.

	Coefficients of Digestibility.				
	Dry substance.	Organic matter.	Protein.	Nitrogen-free extractive matter.	Fat.
Fancy Middlings	74.9	77.2	78.9	82.6	85.1
Roller Bran	58.8	62.8	73.7	67.5	82.6
Difference	16.1	14.4	5.2	15.1	2.5

RESULT OF EXPERIMENT.

(1) This roller bran appears to have been slightly less digestible than the Alsike clover or early-cut Timothy hay.

(2) In this experiment the digestible organic nutritive material in a fine sample of middlings and in roller bran was found to have the relation of 123 to 100. In other words, sheep digesting their food as they did in this experiment would get as much nutriment from 100 pounds of the middlings as from 123 pounds of bran.

(See further on for feeding experiment with middlings and bran.)

COMPOSITION AND DIGESTIBILITY OF PEA MEAL.

Peas are one of our most highly nitrogenous vegetable foods, as is shown by numerous analyses. The number of analyses of peas made in this country is very small so far, however, and it is worth while to inquire a little more fully into the composition of the American product.

The peas, the analysis of which follows, and which were used in the digestion experiments herewith described, were bought in the Bangor market under the name of Canada Peas, being a small, smooth variety. Their composition is stated below:

	Water.	Ash.	Protein Nx6.25.	Fiber.	Nitrogen-free extractive matter.	Fat.	In 100 parts water-free substance. Ash.	Protein Nx6.25.	Fiber.	Nitrogen-free extractive matter.	Fat.
XCVIII, Pea Meal....	12.48	2.36	23.50	2.53	57.69	1.44	2.69	26.85	2.89	65.92	1.64

In the case of this particular lot of peas over one-fourth of the dry substance consists of nitrogenous material, which is more than twice the amount found in corn meal, a fact that points to peas as a Maine product well adapted to feeding young animals or milch cows.

Digestibility of Peas. During the period that Sheep 3 and 4 were being fed for the determination of the digestibility of Southern Corn Ensilage, Sheep 1 and 2 were fed daily, 1500 grams of the same ensilage and 400 grams of pea meal. The digestibility of the ensilage being ascertained by the use of the first-named sheep, it becomes possible to calculate the digestibility of the peas in the latter case, the usual data being obtained.

Composition of the Feces.

From	Fresh Feces.		In 100 Parts Water-Free Substance.				
	Water—per cent.	Water-free substance—per cent.	Ash—per cent.	Protein—per cent.	Fiber—per cent.	Nit-free extractive matter—per cent.	Fat—per cent.
Sheep 1.							
Southern Corn Ensilage and Pea Meal	72 33	27.67	13.13	20.09	21.57	41 51	3.70
Sheep 2.							
Southern Corn Ensilage and Pea Meal	74.95	25.05	12 90	22 70	19 89	40.92	3.59

Weights of Foods Eaten and Feces Excreted.

	Food Eaten in Five Days.		Feces Excreted in Five Days.	
	As fed—grams.	Water-free—grams.	Fresh—grams	Water-free—grams.
Southern Corn Ensilage, Sheep 1....................	7500	1333.9	2499	692
Pea Meal, Sheep 1..................................	2000	1750.4		
Southern Corn Ensilage, Sheep 2....................	7500	1333.9	3000	751.6
Pea meal, Sheep 2..................................	2000	1750.4		

Digestibility of Pea Meal.

	Dry substance.	Organic matter.	Ash.	Protein Nx6.25.	Fiber.	Nitrogen-free extractive matter.	Fat.
XCVIII, PEA MEAL.							
Sheep 1.							
Fed in ensilage in five days......	1333.9	1254.3	79.23	136.32	427.51	652.68	38.15
Fed in pea meal in five days.....	1750 4	1703.3	47.08	469.98	50.59	1153.86	28.71
Total fed........................	3084.3	2957.6	126.31	606.30	478.10	1806.54	66 86
Excreted in feces in five days	692.1	601.2	90.86	139.02	149.26	287.24	25.60
Total digested....................	2392.2	2356.4	35.45	467.28	328.84	1519.30	41.26
Digested from ensilage	843.2	831.6	11.84	63.56	315.70	428.21	24.91
Digested from pea meal	1549.0	1524.8	23.61	403.72	13 14	1091.09	16.35
Per cent. digested from pea meal..	88 5	89 5	50.2	85.9	26.00	94.5	56.9
Sheep 2.							
Total fed	3084 3	2957.6	126 31	606.30	478.10	1806.54	66.86
Excreted in feces in five days . ..	751.6	654.6	96.96	170 62	149.50	307.56	26.98
Total digested	2332.7	2303.0	29.35	435.68	328.60	1498.98	39.88
Digested from ensilage	843 2	831 6	11.84	63.56	315.70	428.21	24.91
Digested from pea meal..........	1489.5	1471.4	17.51	372.12	12.90	1070.77	14.97
Per cent. digested from pea meal..	85 1	86.4	37.2	80.5	25.5	92 8	52.1
Average per cent. digested by two animals	86 8	87.9	43.7	83.2	25.7	93.6	54.5

RESULT OF EXPERIMENT.

In this experiment nearly nine-tenths of the dry substance of the peas was digested. This result, considered in connection with their composition, coincides with previous tests in showing that peas take a high standard as a cattle food, especially as compared with those foods which are the possible products of Maine farms.

FEEDING EXPERIMENTS.

MISCELLANEOUS.

THE VALUE OF THE DIGESTIBLE MATTER OF GOOD HAY AS COMPARED WITH THE DIGESTIBLE MATTER OF CORN ENSILAGE, FOR MILK PRODUCTION.

During the past year and a half an accurate record has been kept of the yield and composition of milk from several cows owned and fed by the station. Any changes in the amount and quality of the milk, due to changes in the food, it has been possible to detect, therefore. The food has also been carefully weighed, and in some instances its composition and digestibility have been determined.

The direct object of this work has been a study of the products of several breeds, but the data collected allow conclusions to be drawn in regard to other matters of interest. The food of these cows has for the most part consisted of hay and a mixture of cotton-seed meal, bran and corn meal, but in the spring of 1888, for about two months a portion of the hay was replaced by ensilage. It was noticed that after the cows had been eating the ensilage for a day or two, there was a sudden and unmistakable increase in the yield of milk, and as marked a decrease was observed when the ensilage was taken from the ration.

To what were these changes due? Did the hay alone contain less digestible material than the hay and ensilage combined? It was the intention to feed practically the same amount of digestible matter after the ensilage was added to the ration, as was eaten before. If this was done. then we must grant that in this case a pound of digestible substance from corn ensilage was somewhat superior to the same amount of digestible substance from good hay. Let us study the evidence which the data furnish.

The ensilage was fed from March 8th, 1888, to May 10, 1888, inclusive. From March 8th to April 8th, the ensilage fed was that from the field corn, after which date the sweet corn ensilage was eaten excepting the last five days, when a change was made to southern corn ensilage. The amount of grain eaten was the same before, during and after the ensilage.

The cows whose records are given in this connection are the following:

Jansje 2d, Holstein, 6 years; last calf June 7th, 1888; due to calve Aug. 25th, 1889.

Queen Linda, Ayrshire, 4 years; last calf Oct. 11th, 1888; due to calve Nov. 13th, 1889.

Agnes, Jersey, 8 years; last calf Sept. 8th, 1888; due to calve Sept. 11th, 1889.

Ida of Beech Grove, Jersey, 4 years; last calf Aug. 26th, 1888; due to calve Aug. 28th, 1889.

The following figures show the weekly yields of milk from the four cows from Feb. 17th to May 25th inclusive, a period of time extending from three weeks before, to two weeks after the feeding of the ensilage.

JANSJE.

YIELD OF MILK.

		lbs.	oz.	
	Feb. 17 to Feb. 23	196	6	milk.
Hay 27 lbs........	Feb. 24 to March 2.......	195	5	"
	March 3 to March 9......	197	6	"
Grain 8 lbs	Total yield, (21 days).....	589	1	"
	Average daily yield......	28.05 lbs.		

		lbs.	oz.	
	Mar. 10 to Mar. 16......	215	8	milk.
	Mar. 17 to Mar. 23......	214	4	"
	Mar. 24 to Mar. 30.......	213	6	"
Hay 16.7 lbs.......	Mar. 31 to Apr. 6*.......	167	2	"
	Apr. 7 to Apr. 13	203	3	"
Ensilage 41.7 lbs...	Apr. 14 to Apr. 20......	204	10	"
	Apr. 21 to Apr. 27.......	182	13	"
Grain 8.0 lbs.......	Apr. 28 to May 4.........	183	11	"
	May 5 to May 11.......	176	5	"
	Total yield, (63 days)....	1759	14	"
	Average daily yield.......	27.9 lbs.		

		lbs.	oz.	
	May 12 to May 18	162	2	milk.
Hay 28 lbs.........	May 19 to May 25........	147	1	"
Grain 8 lbs........	Total yield, (14 days).....	309	3	"
	Average daily yield.......	22.08 lbs.		

*Jansje was sick for two or three days during this time, and failed to eat well.

QUEEN LINDA.

YIELD OF MILK.

Feed	Period	lbs.	oz.	
	Feb. 17 to Feb. 23.......	182	12	milk.
Hay 24.6 lbs.......	Feb. 24 to Mar. 2	173	8	"
	Mar. 3 to Mar. 9	180	0	"
Grain 7.0 lbs.......	Total yield, (21 days)...	536	4	"
	Average daily yield.......	25.5 lbs.		

Feed	Period	lbs.	oz.	
	Mar. 10 to Mar. 16.......	185	0	milk.
	Mar. 17 to Mar. 23.......	182	13	"
	Mar. 24 to Mar. 30......	179	2	"
Hay 14.9 lbs.......	Mar. 31 to Apr. 6	178	3	"
	Apr. 7 to Apr. 13.........	179	4	"
Ensilage 40 lbs.....	Apr. 14 to Apr. 20	177	6	"
	Apr. 21 to Apr. 27.......	165	1	"
Grain 7 lbs	Apr. 28 to May 4.	166	15	"
	May 5 to May 11	163	4	"
	Total yield, (63 days).....	1577	0	"
	Average daily yield	25 lbs.		

Feed	Period	lbs.	oz.	
	May 12 to May 18	155	0	milk.
Hay 23.3 lbs.......	May 19 to May 25	150	7	"
Grain 7.0 lbs.......	Total yield, (14 days).....	305	7	"
	Average daily yield	21.8 lbs.		

AGNES.

YIELD OF MILK.

Feed	Period	lbs.	oz.	
	Feb. 17 to Feb. 23.......	149	2	milk.
Hay 26.1 lbs.......	Feb. 24 to Mar. 2	143	6	"
	Mar. 3 to Mar. 9..	155	4	"
Grain 7.0 lbs.......	Total yield, (21 days).....	448	12	"
	Average daily yield........	21.4 lbs.		

Feed	Period	lbs.	oz.	
	Mar. 10 to Mar. 16	160	2	milk.
	Mar. 17 to Mar. 23	164	6	"
	Mar. 24 to Mar. 30........	164	0	"
Hay 15.1 lbs.......	Mar. 31 to Apr. 6	165	2	"
	Apr. 7 to Apr. 13.........	170	9	"
Ensilage 40 lbs....	Apr. 14 to Apr. 20	173	5	"
	Apr. 21 to Apr. 27........	166	4	"
Grain 6 lbs........	Apr. 28 to May 4.........	167	2	"
	May 4 to May 11.........	162	1	"
	Total yield, (63 days).....	1512	15	"
	Average daily yield	24 lbs.		

		lbs.	oz.
Hay 25.6 lbs.	May 12 to May 18	157	0 milk.
Grain 6 lbs.	May 19 to May 25	147	14 "
	Total yield, (14 days)	304	14 "
	Average daily yield	21.8 lbs.	

IDA OF BEECH GROVE.

YIELD OF MILK.

		lbs.	oz.
Hay 22.7 lbs.	Feb. 17 to Feb. 23	83	14 milk.
Grain 6 lbs	Feb 24 to Mar. 2	81	8 "
	Mar. 3 to Mar 9	85	14 "
	Total yield, (21 days)	251	4 "
	Average daily yield	12 lbs.	

		lbs.	oz.
Hay 13.5 lbs.	Mar. 10 to Mar. 16	87	15 milk.
Ensilage 33.3 lbs.	Mar. 17 to Mar. 23	86	10 "
Grain 6 lbs	Mar. 24 to Mar. 30	88	12 "
	Mar. 31 to Apr. 6	90	7 "
	Apr. 7 to Apr. 13	91	9 "
	Apr. 14 to Apr. 20	94	5 "
	Apr. 21 to Apr. 27	93	10 "
	Apr. 28 to May 4	93	2 "
	May 5 to May 11	87	9 "
	Total yield, (63 days)	813	15 "
	Average daily yield	12.9 lbs.	

		lbs.	oz.
Hay 25.6 lbs	May 12 to May 18	91	12 milk.
Grain 6.0 lbs.	May 19 to May 25	86	10 "
	Total yield, (14 days)	178	6 "
	Average daily yield	12.7 lbs.	

The average yields of the four cows for the three periods are placed together so as to render comparison easier.

	Daily yield on hay and grain, February 17th to March 9th.	Daily yield on hay, ensilage and grain, March 10th to May 11th.	Daily yield on hay and grain, May 12th, to May 25th.
Jansje	28.05 lbs.	27.9 lbs.	22.08 lbs.
Queen Linda	25.5 "	25. "	21.8 "
Agnes	21.4 "	24. "	21.8 "
Ida	12. "	12.9 "	12.7 "
Average	21.74 lbs.	22.45 lbs	19.6 lbs.

These figures show that during the time when ensilage was fed, 63 days, the cows maintained an average yield somewhat greater than from the previous exclusive hay and grain feeding, even though a decrease in milk flow would ordinarily have taken place. When a return is made from hay and ensilage to hay alone, a sudden and decided drop in production occurs.

The effect of the ensilage in the ration is more clearly seen perhaps by comparing the production of milk for the last fourteen days before, and the first fourteen days after feeding ensilage, and the last fourteen days before and the first fourteen days after stopping the ensilage ration.

Yield of Milk.

	Jansje.		Queen Linda.		Agnes.		Ida.	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
Last 14 days before feeding ensilage, Feb. 24th to March 9th.	392	11	353	8	298	10	167	6
First 14 days after feeding ensilage, March 10th to March 23d.	429	12	367	13	324	8	174	9
Last 14 days of feeding ensilage, April 28th to May 11th.	360	0	330	3	329	3	180	11
First 14 days after stopping ensilage ration, May 12th to May 25th.	309	3	305	7	304	14	178	6

The somewhat favorable effect of the ensilage in the milk yield is unmistakable. Did the milk change in quality, so that the ensilage merely caused a larger quantity of milk with no increase of milk solids? The evidence of the analyses in regard to this point is conclusive.

	Jansje.		Qu'n Linda		Agnes.		Ida.	
	Solids—p'r cent.	Fat—p'r cent.	Solids—p'r cent.	Fat—p'r cent.	Solids—p'r cent.	Fat—p'r cent.	Solids—p'r cent.	Fat—p'r cent.
Feb. 25th to March 1st.	12.55	3.46	12.62	3.27	15.13	5.08	15.88	5.84
April 1st to April 1st.	12.58	3.48	12.87	3.49	15.42	5.38	16.02	5.93
April 29th to May 3d.	12.49	3.43	12.69	3.42	15.48	5.19	16.04	6.03
June 3d to June 7th.	13.23	3.71	13.04	3.44	14.98	4.96	16.95	6.45

It is seen that the milk had practically the same composition while the ensilage was fed as before, the slight changes that did occur being generally in favor of the ensilage, so that we may safely conclude that after March 10th there was an increased production of milk solids.

To what is this larger production due? The grain ration remained the same, so we need to inquire whether hay alone contained more or less digestible matter than the hay and ensilage combined.

The digestibility of the ensilage was ascertained by experiments with sheep, already described. It was scarcely possible to obtain the digestibility of an average sample of all the hay eaten for nearly four months, so the best that can be done is to assume that the hay fed to the cows, which was the earliest cut and was very largely Timothy, had practically the same digestibility as the early-cut Timothy, taken from the same field during the same season, the composition and digestibility of which are previously given.

The hay is assumed to have had 12.5 per cent. moisture and 4.5 per cent. of ash, or 83 per cent. of organic matter, and the ensilage had on the average 16 per cent. of organic matter. The organic matter of the hay and of the ensilage had a digestibility of 61 per cent. and 71* per cent. respectively.

These data furnish the following average quantities of digestible matter consumed, excepting that of the grain, which was the same throughout.

Digestible Matter Eaten Daily in Hay and in Hay and Ensilage.

		Jansje.	Queen Linda.	Agnes.	Ida.
February 17 to March 9—*Hay*		13.67	12.44	11.79	11.49
March 10 to May 11	*Hay*	8.45	7.54	7.64	6.83
	Ensilage	4.73	4.54	4.54	3.78
	Total	13.18	12.08	12.18	10.61
May 12 to May 25—*Hay*		14.17	13.21	12.95	12.95

The change from hay alone to hay and ensilage seems not to have increased, but rather slightly diminished the amount of digestible matter eaten. The outcome of the experiment seems to warrant the following remarks:

*Average for field corn and sweet corn.

(1) In this experiment the addition of ensilage to the ration resulted in a somewhat increased production of milk solids, which was not caused by an increase in the digestible food material eaten, but which must have been due either to the superior value of the nutrients of the ensilage over those of the hay, or to the general physiological effect* of feeding a greater variety of foods. In other words 8.8 pounds of ensilage proved to be somewhat superior to 1.98 pounds of hay (mostly Timothy,) the quantity of digestible material being the same in the two cases.

(2) Nevertheless, the testimony of such results as this experiment furnishes, sustains rather than destroys the general practical utility of the rule in making rations, that two fodders have a relative value that is proportionate to their digestible material.

(3) Assuming the digestible matter of hay and ensilage to be equal in value, pound for pound, when hay is worth $10 per ton, ensilage of the kind used in this experiment would be worth $2.25 per ton. But this ensilage contained more water than the average, or 83.3 pounds to the hundred, while the average fifty-seven American analyses is 80.5 pounds of water or 19.5 pounds of dry matter to the hundred.

Had this ensilage been of average quality, then the ton value reckoned on the above basis would be $2.62. But in this case we should give the ensilage the credit of the increased milk production, which seems to have been at the rate of 85 lbs. of milk to each ton of ensilage.

THE VALUE OF THE DIGESTIBLE MATTER OF ENSILAGE AS COMPARED WITH THE DIGESTIBLE MATTER OF HAY, FOR GROWTH.

An experiment was carried on with young steers in the winter and spring of 1889, for the purpose of testing the value of ensilage in the ration, similar to the experiment with milch cows, just described. The plan of feeding was the same in the two cases. A change was made from a hay ration to a hay and ensilage ration, then from a hay and ensilage ration to a hay ration, with a final change back to hay, and ensilage in all, four periods. These periods were:

(1) Jan. 4th to Feb. 23d, inclusive, hay and mixed grains.
(2) Feb. 24th to May 29th " hay, ensilage and mixed grains.
(3) May 30th to June 27th " hay and mixed grains.
(4) June 28th to July 31st " hay, ensilage and mixed grains.

*That such an effect is possible is somewhat problematical.

From Jan. 4th to March 30th, the grain ration was three pounds of mixed grains to each animal daily, and after that four pounds. The grains were the same in kind and mixed in the same proportions throughout. The amount of hay fed was adapted to the appetite of the animals, while twenty pounds of ensilage were fed daily to each steer during the entire experiment.

In order to secure the most accurate statement possible of the relative growth with and without ensilage, the amounts of food and grain are given, and comparisons are made for the following periods of time:

Jan. 4th to Feb. 23d is compared with Feb. 24th to March 27th.

April 29th to May 29th is compared with May 30th to June 27th.

A part of Period 2 is left out of consideration, as it seems more accurate to compare closely contiguous periods of time. Period 4 is not mentioned, as during part of July the animals were so harassed by flies that their growth must have been greatly affected.

There can be seen below the weights of hay and ensilage eaten, both total and digestible, and the gain made by each animal during each period. The grain eaten is not stated, as it was the same in the periods compared.

As has already been shown the digestibility of the ensilage was determined by actual trials, as was also that of the hay fed from Jan. 4th to Feb. 23d, it being the early and late cut Timothy, the composition and digestibility of which are given on pages 10 and 11 of this report. The hay fed during the other periods, was that cut during the first of the haying season, and was mostly Timothy, and so its digestibility is assumed to be the same as early cut Timothy grown the same year and harvested at nearly the same time. A description of the steers used in this experiment, with a fuller statement of their rations, weights, etc., will be found later. The data given in this connection are only a part of an experiment covering more than a year's time, the object of which was to compare the growth of different breeds, and only such facts are now stated as are needed for showing the effect of changing part of a hay ration for corn ensilage.

Hay, Three Pounds Grain Daily—Jan. 4th to Feb. 23d, 50 days.

	Hay eaten —pounds	Total digestible matter eaten in hay —pounds.	Digestible matter eaten daily in hay —pounds.	Total gain—pounds.	Daily gain—pounds.
Steer 1	520.	263. *	5.26	92†	1.84
Steer 2	505.	255.5	5.11	78	1.56
Steer 3	493.	249.5	4.99	81	1.62
Steer 4	520.	263.	5.26	80	1.60
Steer 5	520.	263.	5.26	58	1.16
Steer 6	520.	263.	5.26	72	1.44
Totals	3078.	1557.		461	

*The hay is assumed to have 83 per cent of organic matter throughout.

†The weights of the steers were found by averaging their weighings made on three consecutive days.

Hay and Field Corn Ensilage. Three Pounds Grain Daily—Feb. 24th to March 27th, 32 days.

	Hay eaten —pounds.	Ensilage eaten—pounds.	Total digestible matter eaten in hay and ensilage —pounds.	Digestible matter eaten daily in hay and ensilage —pounds.	Total gain—pounds.	Daily gain—pounds.
Steer 1	260.	634.	203.8	6.37	79	2.47
Steer 2	250.	581.	192.7	6.02	55	1.72
Steer 3	250.	611.	196.1	6.13	64	2.00
Steer 4	255.	619.	199.6	6.24	58	1.81
Steer 5	250.	584.	193.0	6.03	61	1.90
Steer 6	250.	513.	185.0	5.78	56	1.75
Totals	1515	3542.	1170.2		373	

Hay and Southern Corn Ensilage. Four Pounds Grain Daily—April 29th to May 29th, 31 days.

	Hay eaten —pounds.	Ensilage eaten—pounds.	Total digestible matter eaten in hay and ensilage —pounds.	Digestible matter eaten daily in hay and ensilage —pounds.	Total gain—pounds.	Daily gain—pounds.
Steer 1	290.	620.	223.	7.19	54	1.74
Steer 2	265.	620.	210.3	6.78	56	1.81
Steer 3	250.	620.	202.8	6.54	64	2.06
Steer 4	270.	620.	212.9	6.87	65	2.09
Steer 5	270.	620.	212.9	6.87	55	1.77
Steer 6	265.	620.	210.3	6.78	60	1.93
Totals	1610.	3720.	1272.2		354	

Hay. Four Pounds Grain Daily—May 30th to June 27th, 29 days.

	Hay eaten—pounds.	Total digestible matter eaten in hay—pounds.	Digestible matter eaten daily in hay—pounds.	Total gain—pounds.	Daily gain—pounds.
Steer 1	410.	207.4	7.15	49	1.69
Steer 2	390.	197.3	6.80	56	2.00
Steer 3	380.	192.3	6.63	40	1.38
Steer 4	395.	199 9	6.89	70	2.48
Steer 5	390.	197.3	6.80	50	1.72
Steer 6	390.	197.3	6.80	40	1.38
Totals	2355	1191.5		305	

Summary.

	Length of feeding periods days.	Total hay eaten by six steers—pounds	Total ensilage eaten by six steers—pounds.	Total digestible matter eaten by six steers in hay and ensilage—pounds.	Average digestible matter eaten daily by each steer in hay and ensilage—pounds.	Total gain of six steers—pounds.	Daily average gain of each steer—pounds.
HAY.* Jan. 4th to Feb. 23d	50	3078		1557.	5.19	461	1.54
HAY AND ENSILAGE.* Feb. 24th to Mar. 27th	32	1515	3542	1170.2	6.09	373	1.94
HAY AND ENSILAGE † Apr. 29th to May 29th	31	1610	3720	1272.2	6.84	354	1.90
HAY.† May 30th to June 27th	29	2355		1191.5	6.84	305	1.75

*With 3 pounds grain daily. †With 4 pounds grain daily.

In comparing the growth from Jan. 4th to Feb. 23d on hay and grain with that made from Feb. 24th to Mar. 27th, on hay, ensilage and grain, we find a more rapid gain during the latter period. We also find that in the second period the animals each ate about a pound a day more of digestible matter than in the first period, which is sufficient to account for at least a part of the increased growth, as the ratio of food to live weight was somewhat larger in this period. The ratio of digestible food to growth was practically the same in the two cases.

In the case of the later periods, Apr. 29th to May 29th, and May 30th to June 27th, in passing from a ration of hay, ensilage and grain to one of hay and grain, there was a small decrease in the rate of gain, while the amount of digestible material consumed per day remained unchanged.

In regard to this experiment comparing hay and ensilage in feeding for growth, we are warranted in saying:

(1) A pound of digestible matter from the corn ensilage produced somewhat more growth than a pound of digestible matter from Timothy hay. The difference was small, however, amounting in the case of the last two periods, where the more accurate comparison is possible, to an increased growth of only 15 pounds of live weight for each ton of ensilage fed.

(2) If no account is made of this difference in nutritive effect, one pound of hay proved to be equal to 4.1 pounds of ensilage, of the kind fed.

(3) The experiment furnishes still further evidence that the amount of digestible matter present may be regarded as a safe basis for comparing the feeding value of foods of the same class.

GENERAL REMARKS CONCERNING ENSILAGE AND OTHER SUCCULENT FOODS.

There is one question which is very commonly asked when ensilage, roots and similar cattle foods are discussed from the standpoint of their composition and digestibility, viz: "Have not those foods a value which the chemist's figures do not show?" The real meaning of this question is that there is a belief on the part of many that because a cattle food is green and has never been dried it has a peculiar value not found in hay and grain, and so ought not to be "weighed in the balance" and judged by the impartial and searching logic of mathematics which is applied to foods of a different class. Scientific men, and many observing men of practice, have never shown this notion much favor. It is a cardinal principle in science, expressed in homely phrase, that "you cannot get something from nothing."

Growth, muscular activity and animal heat are effects which must have equivalent causes. They are the direct products of matter and energy stored in the food, and the animal cannot get out of a ration more pounds of matter or units of force or heat than are actually in it, nor can the farmer by any magic of combinations or treatment of foods do more than make available their maximum nutritive value.

It should always be remembered that greenness and wetness add nothing to what a food can supply to the animal body of matter or energy, other things being equal, but are merely conditions affecting palatableness. It is the digestible dry matter of a food that determines its value.

It has been demonstrated repeatedly that carefully dried grass is as digestible after as before drying, and the same of fodder corn dried and as ensilage. Dryness is therefore no disadvantage in this respect. Such experiments as those just discussed, show, moreover, that a pound of digestible matter in ensilage with its accompanying seven or eight pounds of water can do only practically the same work as a pound of digestible material from Timothy hay with its water nearly all dried out. There is a small difference in favor of the ensilage, to be sure, and an absolutely hard and fast equivalence, pound for pound, is not claimed in comparing even foods of the same class, because one food may be superior to another in the amount of the more valuable carbohydrates found in the digested portions. But after making an allowance for these minor points which cannot be expressed or even recognized in a general rule, there is still room for the assertion that science has given practice no safer or more useful conclusion than this: *Cattle foods have nutritive value in proportion to the digestible dry matter which they contain.* If farmers will apply this rule in studying feeding stuffs, especially in comparing fodders with fodders, and grains with grains, they will avoid mistakes of a serious nature. But after this is done, there is still a chance for the exercise of good judgment in combining foods.

AN EXPERIMENT IN FEEDING EARLY AND LATE CUT TIMOTHY HAY, FOR GROWTH.

On pages 10 and 11 of this report are given the composition and digestibility of two lots of Timothy hay, cut on July 9th and July 24th. One lot was cut while in bloom, and the other after the seeds were quite fully formed.

Over a ton of hay was harvested from each cutting, or enough for a feeding experiment. Six steers from six to nine months old were used to test the relative value of the hay. The experiment covered two periods of time, one from Dec. 7th to Jan. 3d, inclusive, and the other from Jan. 4th, to Feb. 13th inclusive. Late cut hay was fed during the first and early cut during the second period. Three pounds of grain were fed each day to each animal, during both periods. The hay was readily and entirely consumed throughout the experiment and the animals maintained a very satisfactory condition, also.

The figures which show the result of the experiment follow.

Late Cut Hay. Period 1—December 7th to January 3d, 28 days.

	Total hay eaten*—pounds.	Total digestible matter eaten in hay—pounds.	Digestible matter eaten daily in hay by each steer—pounds.	Total gain of each steer—pounds.	Daily gain of each steer—pounds.
Steer 1	266.5	131.3	4.7	48	1.71
Steer 2	266.5	131.3	4.7	37	1.32
Steer 3	262.	129.2	4.3	37	1.32
Steer 4	266.5	131.3	4.7	33	1.18
Steer 5	266.5	131.3	4.7	57	2.03
Steer 6	266.5	131.3	4.7	35	1.25
Totals	1594.5	785.7		247	

*The amount of grain fed being the same during both periods, and the only variation in the ration being in the kind of hay, it is not necessary to take the grain into account in discussing the outcome of the experiment.

Early Cut Hay. Period 2—January 4th to February 13th, 41 days.

	Total hay eaten—pounds.	Total digestible matter eaten in hay—pounds.	Digestible matter eaten daily in hay by each steer—pounds.	Total gain of each steer—pounds.	Daily gain of each steer—pounds.
Steer 1	410.	206.2	5.0	66	1.61
Steer 2	395.	198.7	4.8	57	1.39
Steer 3	385.	193.6	4.7	67	1.63
Steer 4	410.	206.2	5.0	62	1.51
Steer 5	410.	206.2	5.0	53	1.29
Steer 6	410.	206.2	5.0	63	1.54
Totals	2420.	1217.1		368	

Summary.

	Total eaten by six steers—pounds.	Total digestible matter in hay eaten—pounds.	Total gain of six steers—pounds.	Daily average gain of each steer—pounds.	Pounds of hay fed with each pound of grain.	Pounds of digestible matter of hay with each pound of gain.
Period 1, 28 days, late cut hay	1594.5	785.7	247	1.47	6.45	3.18
Period 2, 41 days, early cut hay	2420.	1217.1	368	1.49	6.58	3.30

So far as an experiment of this kind can furnish reliable evidence, we have reason to believe that there was practically no difference in the feeding value of this two lots of hay. This is what might be expected after finding that the hay had so little difference in composition and digestibility, and may be considered as adding to the constantly accumulating evidence that the relative value of fodders can be ascertained quite closely without an actual feeding trial.

It is rarely the case, however, that early and late cut hays show so little difference in composition and digestibility, and so the result here recorded should not be considered as representative.

AN EXPERIMENT FOR COMPARING THE FEEDING VALUE OF WHEAT MIDDLINGS AND WHEAT BRAN.

The values of wheat middlings and wheat bran, when judged by composition alone, do not seem to be greatly different. As proof of this, the average composition of seven samples of middlings and six samples of bran as given on page 27 of this report, are cited here.

	Water.	Ash.	Protein.	Fiber.	Nitrogen-free extractive matter.	Fat.
Wheat middlings	11.25	3.01	16.98	4.16	60.80	4.35
Wheat bran	11.50	6.33	16.86	7.92	52.81	4.58

A determination of the digestibility of the middlings and bran with sheep (see page 32 of this report) revealed the fact that as much was digested from 100 lbs. of middlings as from 123 lbs. of bran. This indicated quite a difference in feeding value, and it only remained to test the matter by ascertaining whether in an actual feeding trial with these two foods growth would be obtained in proportion to the digestible matter which they seemed to furnish. There were used for this feeding trial four swine weighing about 200 lbs. each. Previous to the time when this experiment began these animals had been eating a ration of skimmed milk and corn meal, and they were in a very thrifty condition. The four animals were divided into two lots, and one lot ate bran while the other lot ate middlings. The experiment was continued during two periods, and the order in which these foods were fed in the first period was reversed in the second, this being done so as to test the growth of each pair of hogs with both middlings and bran.

The figures which follow show that the amount of food eaten was not the largest possible, moderate rations being considered essential to those experiments whose especial object is the testing of the relative nutritive value of foods.

It is hoped that the figures stated below plainly show how the hogs were fed and the result of the experiment.

PERIOD 1.

June 20th to July 20th, 31 days.

	Lot A—lbs.	Lot B—lbs.
Wheat bran fed daily	5	
Total bran eaten	155	
Wheat middlings fed daily		5
Total middlings eaten		155
Skimmed milk eaten daily	20	20
Total skimmed milk eaten	620	620
Weight of hogs on June 18th and 19th	398	386¾
Weight of hogs on July 19th and 20th	422½	425¼
Gain of each lot in 31 days	24½	38½

PERIOD 2.

July 21st to Aug. 30th, 41 days.

	Lot A—lbs.	Lot B—lbs.
Wheat bran fed daily to Aug. 5th		6
" " Aug. 6th to Aug. 30th		6½
Total bran eaten		258½
Wheat middlings fed daily to Aug. 5th	6	
Wheat middlings fed daily Aug. 6th to Aug. 30th,	6½	
Total middlings eaten	258½	
Skimmed milk fed daily to Aug 5th	16	16
Skimmed milk fed daily Aug. 6th to Aug. 30th	10	10
Total skimmed milk eaten	506	506
Weight of hogs on July 19th and 20th	422½	425¼
Weight of hogs on Aug. 29th and 30th	494	454½
Gain of each lot in 41 days	71½	29¼

SUMMARY OF BOTH PERIODS.

Gain of two hogs in 72 days on	$413\frac{1}{2}$ lbs. middlings, 1126 lbs. skimmed milk,	110 lbs.
Gain of two hogs in 72 days on	$413\frac{1}{2}$ lbs. bran, 1126 lbs. skimmed milk,	$53\frac{3}{4}$ lbs.

The growth obtained from feeding the middlings is clearly much greater than that produced by the bran. The explanation of this fact is not hard to find. From the data previously given, and estimating the skimmed milk to have ten per cent. of solids, practically all of which are digestible, we find that the animals eating middlings consumed in the 72 days 377 pounds of digestible material, while those eating bran received only 317 pounds, the difference being sixty pounds. In other words, the middlings fed hogs ate 19 per cent. more digestible matter than the bran fed, though the weight of food was the same in the two cases, which means that the animals eating the middlings had available just so much more of nutrients to be applied to growth.

The results of this experiment combined with the facts previously brought out, seem to establish the superior feeding value of wheat middlings as compared with wheat bran.

SUMMARY OF COMPARISON OF WHEAT MIDDLINGS AND WHEAT BRAN.

(1) The middlings and bran sold in Maine do not at present differ greatly in composition, the bran containing somewhat more ash and somewhat less of carbohydrates.

(2) In a trial with sheep, the middlings were found to be much more digestible than bran, the ratio of digestibility being as 123 to 100 in the two cases.

(3) A feeding trial with swine, where very moderate rations of both middlings and bran were fed in connection with skimmed milk, the growth from the middlings ration was over twice that from the bran ration, or in the ratio of 110 to 53.

FEEDING EXPERIMENTS WITH SWINE.

The feeding experiments that have been carried on at this Station during the past two years have largely involved the use of swine as the experimental animals. It should not be assumed from this that the hog is regarded as of unusual importance in Maine agriculture. Pork production must certainly rank in this State much below the dairy or stock growing, but it is, nevertheless, a matter of general interest, for on each farm more or less swine are grown either for home consumption or for sale. Moreover, swine are useful in consuming and converting into a cash product, the waste materials from the dairy.

Again, experiments in pig feeding are in some respects especially satisfactory as compared with those conducted with milch cows or steers, for the reason that there is much less uncertainty due to the daily variations in weight of the experimental animals. The weights of a thousand pound steer taken on two consecutive days may differ as much as ten or fifteen pounds, whereas the weight of a growing pig will uniformly increase by approximately the amount of growth. Conclusions based upon the relative growth of swine fed upon different rations seem therefore to be especially safe, and so a test of a theory of nutrition by the use of these animals may promptly give a definite answer, which may have a practical bearing not only upon the matter of pork production but upon production of other kinds as well.

The feeding experiments with swine which are grouped together on the following pages have been going on during the past two years, and are now published for the first time. The publication of the earlier experiments has been delayed until they could be discussed in connection with the later ones now just completed, because they are all more or less related in purpose. These experiments were planned and begun with the idea of illustrating the feeding value of skimmed milk, but as one question after another has arisen, they have been enlarged and modified until they have furnished testimony bearing upon several points important from both the scientific and practical standpoints. These points stated somewhat in the language of science are:

(1) The most efficient ratio of nutrients in a ration.

(2) The relation between the nutritive ratio and the character of the growth.

(3) The equivalence of different classes of nutrients.

(4) The relative value of animal and vegetable protein.

(5) The effect of much water in the food upon assimilation.

Let us translate the above considerations, with others, into the language of the farm.

(1) The most profitable mixture of foods for swine.

(a) For growth.

(b) For fattening.

(2) The relation between food and growth with swine.

(3) Can we substitute nitrogenous vegetable foods like pea meal or gluten meal for skimmed milk, with equally good results?

(4) Does a large amount of drink, as in the case of swill fed pigs, for instance, diminish growth?

(5) The relative food value of skimmed milk and corn meal.

(6) The money value of skimmed milk.

The experiments from which data are drawn for the discussion of the above points have involved the use of twelve swine, six lots, two animals in a lot, and were carried on at various times during nearly eighteen months. In the case of four of the animals, two lots, the record kept of their food and growth was continuous from the young pigs to the marketed product.

The animals were fed three times per day, and unless otherwise specified, the meal or other dry material was wet with the drink. A small amount of bone meal was put into the food two or three times each week, so that with none of the rations should there be a lack of mineral compounds for bone formation. Only one case of lameness occurred, and that was one of the animals of Lot 3, when quite mature, and during one of the least important periods.

It was the intention, when feeding two lots of pigs with different rations for the purpose of comparing the growth obtained, to give the same amount of digestible material to each lot. In order to make the estimates necessary for doing this it was assumed (1) that the skimmed milk contained ten per cent. of solids, all of which was digestible, and (2) that equal weights of pea meal, gluten meal and corn meal supplied equal weights of digestible material. These assumptions would not have been admissible in an investigation demanding rigid exactness, but they are consistent with the conclusions attempted. As a matter of fact, occasional analyses of the skimmed milk and an analysis and actual determination of the digestibility of one lot of peas fed make it seem reasonably certain that any errors of calculation due to these assumptions emphasize, rather than otherwise, some of the principal lessons of the experiments.

It would have required a large amount of time and labor to have ascertained the composition and changes in the water content of the numerous lots of corn meal fed during nearly a year and a half, and it was felt that the purposes of the experiments did not require this. There is so great a degree of uniformity in the composition of western corn that a large error is not probable in assuming that the average of several lots will agree with the general average of composition and digestibility.

EXPERIMENT WITH LOTS 1 AND 2.

The feeding of the four pigs in these two lots was begun in June 9th, when they weighed less than twenty-five pounds each, and was continued until the animals were slaughtered in the following February. For the first seventy-seven days, or until August 24th, both lots were fed a mixture of skimmed milk and corn meal, the skimmed milk supplying two-thirds the digestible matter with Lot 1 and one-third, with Lot 2, the total amount of digestible matter in the ration being the same in the two cases. After August 24th, the proportion of milk to meal was changed, somewhat, and after October 27th, Lot 2 ate nothing but corn meal and water. Lot 1 continued to eat milk until December 20th, after which date this lot was given a ration consisting of one-third pea meal and two-thirds corn meal. Until October 27th, the gain of the two lots of pigs was practically the same, but from that time on there was a marked difference in favor of Lot 1. These pigs were from the same litter, and the lots were similar as to sex. The figures giving a history of this experiment have been arranged in a tabular form below:

Daily Rations of Pigs—Lots 1 and 2.

	Lot 1.				Lot 2.			Change in Weight.	
	Water—lbs.	Skimmed milk—lbs.	Corn meal—lbs.	Pea meal—lbs.	Water—lbs.	Skim'd milk—lbs.	Corn meal—lbs.	Lot 1.—lbs.	Lot 2—lbs.
June 9th to June 29th,		8	½	-	-	4	1	47¾ to 71½	49 to 64½
June 30th to July 26th,	-	12	¾	-	-	6	1½	71½ to 102½	64½ to 93
July 27th to Aug. 24th,	-	16	1	-	-	8	2	102½ to 130	93 to 123
Aug. 25th to Sept. 14th,	-	20	1¼	-	-	8	2¾	130 to 157	123 to 154½
Sept. 15th to Sept. 29th,	-	20	2½	-	3	5	4¼	157 to 180½	154½ to 177½
Sept. 30th to Oct. 27th,	-	20	5	-	3	5	6¾	180½ to 247	177½ to 237
Oct. 28th to Nov. 20th,	-	25	7	-	12	-	10	247 to 323½	237 to 301
Nov. 21st to Dec. 20th,	-	30	11¼	-	15	-	15	323½ to 453½	301 to 408½
Dec. 21st to Jan. 19th,	15	-	10	5	15	-	15	453½ to 577	408½ to 500
Jan. 20th to Feb. 19th,	15	-	8⅔	4⅓	15	-	13	577 to 690	500 to 552

Food eaten and growth made by pigs. Lots 1 and 2. Period 1—Food of both lots, skimmed milk and corn meal. Each lot ate the same amount of digestible material, more of which came from skimmed milk with Lot 1 than with Lot 2.

	Lot 1.			Lot. 2.		
	Milk eaten—pounds.	Corn meal eaten—pounds.	Gain in weight—pounds.	Milk eaten—pounds.	Corn meal eaten—pounds.	Gain in weight—pounds.
June 9th to June 29th, 21 days	168	10½	23¾	84	21	15½
June 30th to July 26th, 27 days.....	324	20¼	31	162	40½	28½
July 27th to Aug. 24th, 29 days.....	464	29	27½	232	58	30
Aug. 25th to Sept. 14th, 21 days	420	26¼	27	168	57¾	31½
Sept. 15th to Sept. 29th, 15 days.....	300	37½	23½	75	63¾	23
Sept. 30th to Oct. 27th, 28 days......	560	140	66½	140	189	59½
Totals, 141 days	2236	263½	199¼	861	430	188

Period 2—Food of Lot 1, skimmed milk and corn meal, and of Lot 2, water and corn meal. Each lot ate the same amount of digestible material.

	Lot 1.			Lot 2.		
	Milk eaten—pounds.	Corn meal eaten—pounds.	Gain in weight—pounds.	Milk eaten—pounds.	Corn meal eaten—pounds.	Gain in weight—pounds.
Oct. 28th to Nov. 20th, 24 days ..	600	168	76½	-	240	64
Nov. 21st to Dec. 20th, 30 days....	900	337½	130	-	450	107½
Totals, 54 days..............	1500	505½	206½	-	690	171½

PERIOD 3. *Food of Lot 1, water, pea meal and corn meal and of Lot 2, water and corn meal. Both lots ate the same amount of digestible material.*

	Lot 1.			Lot 2.		
	Pea meal eaten—lbs.	Corn meal eaten—lbs.	Gain in weight—lbs.	Milk eaten—lbs.	Corn meal eaten—lbs.	Gain in weight—lbs.
Dec. 21st to Jan. 19th, 30 days	150	300	123½	–	450	91½
Jan. 20th to Feb. 19th, 31 days	134	269	113	–	403	52
Totals, 61 days	284	569	236½		853	143½

EXPERIMENTS WITH LOTS 3 AND 4.

Two experiments were performed with these pigs, but they were of such a nature that one experiment did not unfit the animals for the succeeding one. The animals of the two lots were from the same litter, and of corresponding sex. They weighed at the beginning of the first experiment an average of thirty-eight pounds each. From November 2d to March 1st they were fed alike on skimmed milk and corn meal, and Lot 4 drank in addition an amount of water equal in weight to the skimmed milk. From March 2d to May 28th the skimmed milk in the ration of Lot 3 was replaced by pea meal, but was continued in the ration of Lot 4. The growth of the two lots was practically the same throughout.

The tables immediately following give the result of these methods of feeding:

Daily Rations of Pigs. Lots 3 and 4.

	Lot 3.		Lot 4.			Change in weight of pigs.	
	Skimmed milk—lbs.	Corn meal—lbs.	Water—lbs.	Skimmed milk—lbs.	Corn meal—lbs.	Lot 3—lbs.	Lot 4—lbs.
Nov 2d to Nov. 20th................	5	2	5	5	2	76 to 99	76 to 96½
Nov. 21st to Dec. 8th................	8	2½	8	8	2½	99 to 117½	96½ to 116½
Dec. 9th to Jan 10th................	10	4	10	10	4	117½ to 176	116½ to 171
Jan. 11th to Mar. 1st................	15	5	15	15	5	176 to 276	171 to 266
	Pea meal						
Mar. 2d to Apr. 17th................	2½	5		20	5	276 to 360½	266 to 358
Apr. 18th to May 28th..............	3	6		24	6	360½ to 450	358 to 447

Food Eaten and Growth Made by Pigs. Lots 3 and 4.

PERIOD 1. *Food of both lots the same, only that Lot 4 was given twice as much drink as Lot 3.*

	Lot 3.			Lot 4.			
	Milk eaten—lbs.	Meal eaten—lbs.	Gain in weight—lbs	Water given—lbs.	Milk eaten—lbs.	Meal eaten—lbs.	Gain in weight—lbs.
Nov. 2d to Nov. 20th, 19 days............	95	38	23	95	95	38	20½
Nov. 21st to Dec 8th, 18 days............	144	45	18½	144	144	45	20
Dec. 9th to Jan. 10th, 33 days............	330	132	58½	330	330	132	54½
Jan. 11th to Mar 1st, 50 days............	750	250	100	750	750	250	95
Totals, 120 days............	1319	465	200	1319	1319	465	190

PERIOD 2. *Food of Lot 3, pea meal and corn meal, and of Lot 4, skimmed milk and corn meal. Both lots ate the same amount of digestible material.*

	Lot 3.			Lot 4.			
	Pea meal eaten—lbs.	Meal eaten—lbs.	Gain in weight—lbs.	Water given—lbs	Milk eaten—lbs.	Meal eaten—lbs.	Gain in weight—lbs.
Mar 2d to Apr. 17th, 47 days	117½	235	84½	-	940	235	92
Apr. 18th to May 28th, 41 days	123	246	89½	-	984	246	89
Totals, 88 days	240½	481	174		1924	481	181

EXPERIMENTS WITH LOTS 5 AND 6.

Four pigs were again selected from a litter, and when they had reached a weight of over thirty pounds, the two lots into which they were divided began to receive radically different rations. Lot 5 was fed from Nov. 7th to Dec. 8th on skimmed milk, corn meal and potatoes, and Lot 6 on corn meal and potatoes. On Dec. 9th the skimmed milk in the ration of Lot 5 was replaced by pea meal, the materials of the rations of Lot 6 remaining unchanged, and this feeding was continued until March 26th.

It was realized before hand that it might be difficult to get a satisfactory development of the animals of Lot 6 with such a ration, and this proved to be the case, though the pigs seemed vigorous and healthy. It was found impossible to induce this lot to eat, without waste, more than a very moderate amount. Lot 5, on the contrary, would have eaten very much more than the ration allowed, even after the pea meal was substituted for the milk, but the food of this lot was limited to the amount fed to Lot 6. Considering the quantity of food eaten, the gain of Lot 5 was very satisfactory.

From March 26th until the following October, the pigs of Lots 5 and 6 were all fed on skimmed milk, bran and corn meal, and the animals of Lot 6 regained their lost ground, and reached practically the size and condition of Lot 5, their average live weight on Oct. 10th, being about 275 pounds. It was the intention at this time to have put these animals on the market, but as it was thought they were not fat enough to sell to advantage, though in fair condition, it was decided to feed them for a time so that they would take on fat rapidly. The standard food for this purpose has always been corn meal, and is what many farmers would now use exclusively as a fattening ration. It was determined to test the wisdom of the practice with the case in hand. For a time Lot 5 was fed a mixture of gluten meal and corn meal, and Lot 6 was fed pure corn meal. For a second period this order of feeding was reversed, Lot 5 receiving the pure corn meal. The advantage of the mixed ration was too marked to be doubted for an instant, as the record below shows.

Daily Rations of Pigs—Lots 5 and 6.

	Lot 5.				Lot 6.			Changes in weight of pigs.	
	Water drank—lbs.	Skimmed milk—lbs.	Corn meal—lbs.	Potatoes—lbs.	Water drank—lbs	Corn meal—lbs.	Potatoes—lbs.	Lot 5—lbs.	Lot 6—lbs.
Nov. 7th to Nov. 20th		6	1¼	2	6	2	2	69½ to 84½	61½ to 70
Nov. 1st to Dec. 8th		8	2	3	8	3	3	84½ to 113	70 to 84½
Dec. 9th to Jan 10th..........	10	Pea meal. 1⅓	2⅔	4	10	4	4	113 to 160½	84½ to 121½
Jan. 11th to Jan. 19th........	12	2	4	4	12	6	4	160½ to 271½	121½ to 175
Jan 20th to Mar. 26th........	12	1⅔	3⅓	4	12	5	4		

Food Eaten and Growth Made by Pigs—Lots 5 and 6.

PERIOD 1. *Food of Lot 5, skimmed milk, corn meal and potatoes, and of Lot 6, corn meal and potatoes. Both lots ate the same amounts of digestible material.*

	Lot 5.				Lot 6.		
	Milk eaten—lbs.	Corn meal eaten—lbs	Potatoes eaten—lbs.	Gain in weight—lbs.	Corn meal eaten—lbs	Potatoes eaten—lbs.	Gain in weight—lbs.
Nov. 7th to 20th, 14 days..............................	84	17½	28	15	28	28	8½
Nov 21st to Dec. 8th, 18 days	144	36	54	28½	54	54	14½
Total, 32 days..............................	228	53½	82	43½	82	82	23

Period 2—Food of Lot 5, pea meal, corn meal and potatoes, and of Lot 6, corn meal and potatoes. Both lots ate the same amount of digestible material.

	Pea meal eaten.	Corn meal eaten.	Potatoes eaten.	Gain.	Corn meal eaten.	Potatoes eaten.	Gain.
Dec. 9th to Jan. 10th, 33 days,	44	88	132	47½	132	132	37
Jan. 11th to Mar. 26th, 75 days,	128	256	300	111	384	300	53½
Totals, 108 days	172	344	432	158½	516	432	90½

Daily Rations of Hogs—Lots 5 and 6.

	Lot 5.			Lot 6.			Changes in Weight.	
	Water drank—lbs.	Corn meal—lbs.	Gluten meal—lbs	Water drank—lbs	Corn meal—lbs.	Gluten meal—lbs	Lot 5—lbs	Lot 6—lbs.
Oct. 13th to Nov 12th,	20	8	4	20	12	–	552½ to 651	548½ to 624½
Nov. 13th to Nov. 20th,	20	10	5	20	15	–	651 to 668	624½ to 640
Nov. 21st to Dec. 28th,	20	15	–	20	10	5	668 to 765	640 to 769½

Food eaten and growth made by hogs. Lots 5 and 6. Period 3—Lot 5 ate gluten meal and corn meal, and Lot 6, corn meal. The same weight of food was eaten in the two cases.

	Lot 5.			Lot 6.	
	Gluten meal eat'n—pounds	Corn meal eaten—pounds.	Gain in weight—pounds.	Corn meal eaten—pounds.	Gain in weight—pounds.
Oct. 13th to Nov. 12th, 31 days.........	124	248	98½	372	76
Nov. 13th to Nov. 20th, 8 days	40	80	17	120	15½

Period 4—Lot 6 ate gluten meal and corn meal, and Lot 5, corn meal. The same weight of food was eaten in the two cases.

	Lot 6.			Lot 5.	
	Gluten meal eat'n—pounds.	Corn meal eaten—pounds.	Gain in weight—pounds	Corn meal eaten—pounds.	Gain in weight—pounds.
Nov. 21st to Dec. 28th, 38 days.........	190	380	129½	570	97
Totals, 77 days..................	354	708	245	1062	188½

THE NUTRITIVE RATIO—THE PROFITABLE MIXTURE OF FOODS.

These feeding experiments with swine offer some very direct and emphatic testimony bearing on that much discussed problem in the feeding of farm animals, viz: the nutritive ratio. This is the problem: Should a farmer take into consideration the composition as well as the price of cattle foods? Can he by purchasing an oil meal instead of corn meal, get a combination of foods with sufficiently greater food value, pound for pound, to warrant paying more for the oil meal than the corn meal would cost? In short, of the foods available to the farmer, is one combination better than another?

These questions relate to an important matter, and one concerning which farmers get great variety of advice. They are told on the one hand to adhere to the formulas known as the German rations, and on the other hand to buy what costs least per pound.

The following figures, the result of a close analysis of the data of these swine-feeding experiments, furnish the inquirer with facts relating to this matter that may need some explanation, but no emphasizing. They are the outcome of a careful test of a theory, and being the answer which several animals have given to a definite question, they deserve unpredjudiced consideration.

Table Showing the Growth of Swine With Various Food Combinations.

			Age of pigs—months	Average weight of two pigs—lbs.	Kind of Food Eaten	Total Digestible Matter Eaten.				No. of days in periods.	Total gain of two animals —lbs.	Daily gain of two animals —lbs.	Digestible matter eaten daily—lbs.	Digestible matter for each pound of gain —lbs	Nutritive ratio.
						Protein—lbs.	Carbohydrates —lbs.	Fats—lbs.	Total—lbs.						
Lots 1 and 2	Period 1	Lot 1.	2 to 6	147.4	S. milk and corn meal	93.3	289.1	17.6	400	141	199¼	1.41	2.84	2.08	1:3.6
		Lot 2.	2 to 6	142.4	S. milk and corn meal	63.7	331.7	19.2	414.6	141	188	1.33	2 94	2.21	1:6.0
	Period 2	Lot 1.	6 to 8	350	S. milk and corn meal	93.7	420.9	25.2	539.9	54	206½	3.81	10 00	2.61	1:5.2
		Lot 2.	6 to 8	322.8	Corn meal	59.3	463.1	26.2	548.6	54	171½	3.18	10.10	3.20	1:8.9
	Period 3	Lot 1.	8 to 10	571.8	Pea meal and corn meal	107.6	540.8	24	672.4	61	236½	3.87	11.00	2.85	1:5.6
		Lot 2.	8 to 10	480	Corn meal	73.3	571.8	33	678.1	61	143½	2.35	11.10	4.73	1:8.9
Lots 3 and 4	Period 1.	Lot 3.	2 to 6	176	S. milk and corn meal	83.5	384.6	22.9	491	120	200	1.66	4.09	2.45	1:5.3
		Lot 4.	2 to 6	171	S. milk and corn meal	83.5	384.6	22.9	491	120	190	1.58	4.09	2.58	1:5.3
	Period 2	Lot 3.	6 to 9	363	Pea meal and corn meal	91.1	457.4	20	568.5	88	174	1.98	6.46	3.26	1:5.6
		Lot 4.	6 to 9	356½	S. milk and corn meal	112.5	424.8	27.9	565.2	88	181	2 06	6.42	3.12	1:4.[illegible]
Lots 5 and 6	Period 1.	Lot 5.	2 to 3	91	S. milk, corn meal and potatoes	13.5	63.7	2.9	80.1	32	43½	1.34	2.51	1.84	1:5.2
		Lot 6.	2 to 3	72	Corn meal and potatoes	8.4	70	3.5	81.9	32	23	.72	2.56	3.56	1:9.4
	Period 2	Lot 5.	3 to 7	192	Pea meal, corn meal and potatoes	72.1	407.6	14.3	494	108	158½	1.47	4.57	3.12	1:6.1
		Lot 6.	3 to 7	129	Corn meal and potatoes	51.3	427.4	19.6	498.3	108	90½	.84	4.61	5.50	1:9.3
	Period 3	Lot 5.	13 to 14	610	Gluten meal and corn meal	69.2	307.4	20.3	396.9	39	115½	2.96	10.20	3.44	1:5.2
		Lot 6.	13 to 14	594	Corn meal	42.3	330.1	18.7	391.1	39	91½	2.35	10.00	4.27	1:8.9
	Period 4.	Lot 5.	14 to 15	716	Corn meal	49	382.5	21.6	453.1	38	97	2.50	11.90	4.70	1:8.9
		Lot 6.	14 to 15	709	Gluten meal and corn meal	80.2	356.1	23.5	459.8	38	129½	3.41	12.00	3.55	1:5.2

The experimental feeding of these six lots of swine included nine periods, varying in length from 32 to 141 days. In six of these periods the food of the lots of pigs whose growth was compared differed greatly in the nutritive ratio, or in other words, in the relation in quantity of the digestible protein to the digestible carbohydrates and fats. The ration of one lot of pigs in each of the six cases contained the equivalent of from 5.2 pounds to 6.1 pounds of digestible carbohydrates for each pound of digestible protein, and with these combinations the average daily gain of two pigs was 2.81 pounds, the quantity of digestible food required for one pound of grain being 2.90 pounds. The corresponding lots of pigs in each of the six periods ate less protein and more carbohydrates, the ratio being 8.9 pounds to 9.4 pounds of digestible carbohydrates to one pound of digestible protein. Here the gain of two pigs averaged only 1.99 pounds per day, 4.33 pounds of digestible material being used for each pound of grain. The pigs eating the smaller amount of protein consumed about 50 per cent. more digestible food for each pound of growth than did the others.

Now these comparisons of rations were made with swine of various ages and conditions, from young growing pigs to large hogs that were being fattened. Consequently each period or comparison may profitably be considered separately, for while the general average is largely in favor of the rations containing most protein, a closer examination may show that what is true of young pigs does not hold for mature animals that are being fattened.

The feeding of the two lots of pigs, numbered 1 and 2, began when the animals were about two months old. For 141 days both lots ate skimmed milk and corn meal, Lot 1 eating more milk and less meal than Lot 2, the digestible matter being practically the same. The growth of the two lots differed but little on these rations, though the nutritive ratio in one case was 1 : 3 6, and in the other 1 : 6.0. The milk was then taken from the ration of Lot 2 and continued with Lot 1, and for the next 54 days the advantage was decidedly with Lot 1, these animals gaining 35 pounds more than the others. During the third period of 61 days the corn meal ration of Lot 2 was continued, and pea meal was substituted for skimmed milk in the ration of Lot 1. In this period Lot 1 gained 93 pounds more than Lot 2. The feeding of the animals of Lots 5 and 6 also began when they were young, but the rations compared differed more widely than was the case with Lots 1 and 2. For 32 days Lot 5 ate skimmed milk, corn meal and potatoes, and Lot 6 corn meal and potatoes, and the former animals made nearly twice the growth of the latter, the respective nutritive ratios being 1 : 5.2 and 1 : 9.4. Lot 5 was then put on a ration of pea meal, corn meal and potatoes, the materials of the food of Lot 6 remaining unchanged. Here the ratios were 1 : 6.1 and 1. 9.3, and the gain of Lot 5 receiving the more nitrogenous ration, was in 108 days 68 pounds more than the growth of Lot 6.

The pigs of Lots 5 and 6 were then not fed weighed rations for several months, the intention being to fit them for the market. During this time their food was milk, bran and meal. On the first of October these animals had reached an average live weight of 275 pounds and it was decided to "finish them off" so that they would command the best market price. For this purpose it was determined to test a full ration of corn meal against one more nitrogenous. The food that was selected to combine with the corn meal was gluten meal, which is really a corn meal residue from which much of the starch has been extracted. This residue contains about three times as large a percentage of protein as corn meal. In this experiment the animals were given all they would eat readily, with one lot of hogs the food consisting of one-third gluten meal. In 77 days the gluten meal and corn meal mixture produced with two animals 57 pounds more of fat hog than did the corn meal alone. This result may be relied on as involving no large error, for the experiment was so planned as to eliminate the effect of individual differences in the experimental animals. It is worthy of remark that the mixture of gluten meal and corn meal seemed to be fully as favorable to the production of fat as the clear corn meal.

The lesson of these several feeding tests with swine is that not only do nitrogenous foods exert a very favorable influence on growth but they seem also to materially increase the rate of gain during the fattening periods.

What shall we conclude in the light of these experiments? Do these results encourage a farmer who has hogs to fatten, and who must buy food for that purpose, to purchase corn meal exclusively, simply because it costs less per pound than other concentrated foods? Certainly if there is any place where exclusive corn meal feeding is likely to prove satisfactory it is in the "ripening off" of hogs, and yet we see that for this purpose 172 pounds of gluten meal not only took the place of that amount of corn meal but caused a greater production of at least 50 pounds of dressed pork. Allowing that the corn meal cost a cent a pound, the gluten meal gave returns at the rate of $48 per ton, which is nearly twice its cost* price. Pea meal is seen to have h.d an equally favorable effect with another lot of somewhat mature animals.

We must conclude that the way in which a farmer combines the foods at his command is a matter of great importance and one that may determine whether some feeding operations shall result in profit or in loss.

THE RELATION BETWEEN THE KIND OF FOOD AND THE CHARACTER OF THE GROWTH PRODUCED.

To what extent can we modify the composition of a hog's carcass by controlling the foods? Can we increase or decrease at will the proportion of lean meat to fat? Experiments by Professors Henry and Sanborn indicate that not only does a liberal proportion of nitrogenous food insure a more vigorous development of the hog, but the carcass contains a much larger proportion of muscular tissue (lean meat). In these experiments in Missouri and Wisconsin the rations differed radically, being on the one hand milk, blood and bran, and on the other corn meal alone. The rations fed to the pigs of Lots 1 and 2 at this Station differed in the same way but not to the same extent. The two lots of animals ate practically the same amount of digestible material, containing 294.6 pounds of digestible protein in one case and 196.3 pounds in the other. This difference was continuous throughout the entire life of the animals. To what extent were the carcasses of the two lots of hogs unlike? These hogs were slaughtered by an experienced butcher, who, with others, carefully inspected the meat, as seen by making sections of the carcasses. The various organs were weighed and also the intestinal fat and leaf lard. It is not claimed that this was anything more than a very superficial examination. Certainly the structure and composition of the animals might differ considerably and the fact not to be detected in this way. Such an inspection would only make evident any especial differences in those qualities of the meat that are of interest to the butcher and consumer.

Unmistakable differences of this kind did not appear, however. The fat portions of the carcasses were equally light colored and solid. The dealer who cut up the hogs thought that possibly the

*The gluten meal cost the station in small lots, $25 per ton in Bangor.

protein fed hogs would furnish him a slightly larger percentage of cuts of lean, but it was very evident after all that the pork resulting from rations so materially unlike differed mainly in quantity. Neither the butcher nor the consumer could see much chance for preference in the matter of quality. The testimony of the weights of the organs and internal fat coincides with the above statement.

	Lot 1. More Protein.		Lot 2. Less Protein.	
	Hog 1	Hog 2.	Hog 3.	Hog 4.
Weight of carcass	283 lbs	288 lbs	234 lbs	226 lbs.
heart	15 oz.	13 oz.	14 oz.	12 oz.
lungs	15 "	16½ "	12 "	13 "
liver	78 "	54 "	43 "	51 "
kidneys	10 "	12 "	7 "	7 "
intestinal fat	148 "	117 "	132 "	107 "
leaf lard	238 "	268 "	218 "	208 "

The internal fat of those animals which ate the larger proportion of nitrogenous food was 8.6 per cent. of the weight of the carcass, and 9.0 per cent. in the case of the other animals, a difference that does not signify much. Of the organs weighed only the kidneys varied much in relative size. The results of this experiment are not put forward as conflicting with the teachings of experiments made elsewhere, but as showing that these unlike rations had more influence on the *amount* than on the *kind* of produce. The *kind* of produce is very largely determined by those constitutional characteristics that have become fixed by years of breeding, and unless the food is so one-sided as to be greatly abnormal, it undoubtedly may vary within quite wide limits during the life of a single generation without largely modifying the composition of the body which it builds up and nourishes. The effect of special feeding would be cumulative, doubtless, and after several generations we might expect a modification of product somewhat marked and persistent.

WHAT EXTENT OF VARIATION MAY OCCUR IN THE RELATION IN QUANTITY OF THE NITROGENOUS AND NON-NITROGENOUS CONSTITUENTS OF A RATION WITHOUT GREATLY AFFECTING THE RATE OF GROWTH?

A safe answer to this question would demand a large number of observations. Nevertheless the fact that the nutritive ratio may vary without affecting the rate of growth sufficiently to be determined by practical experiments is undoubted, and is well illustrated in the experiments now under consideration. The pigs of Lot 1 gained 199 pounds in the same time that the pigs of Lot 2 gained 188 pounds, the amount of digestible food being nearly the same, and the nutritive ratios being 1 : 3.6 and 1 : 6.0 respectively. In an eighty-eight day period with the animals of Lots 3 and 4 a nutritive ratio of 1 : 5.6 with Lot 3, did practically the same work as a ratio of 1 : 44 with Lot 4, the increase in weight being 174 and 181 pounds in the two cases. It seems that in these feeding trials with swine, the various rations having a nutritive ratio of 1 : 6.1, or below, were equal efficient, and much more efficient than rations with a ratio of 1 : 9.0 or thereabouts. It is fair to conclude from this that in feeding for any particular purpose the proportion of protein must be kept up to a certain standard if the maximum results are to be attained, as a departure from this standard in the direction of less protein results in a diminished production. On the other hand, a deviation from this standard, by increasing the proportion of protein seems to be without marked effect, within certain limits, at least. How shall we explain this? Let us suppose the ration is intended for a growing animal. A certain part of the new substance which constitutes growth consists of muscular tissue and other nitrogenous compounds, the only source of which is the protein of the food. Protein also plays a necessary, though unexplained, part in muscular activity. If, therefore, the food is deficient in protein, growth must either be checked or become abnormal, and it is the former that is most likely to occur. But whenever a ration contains protein in access of the *necessary* amount, the results are quite different. Although protein is the sole source of certain compounds essential to growth, it may and does perform other offices, such as the production of heat. When, therefore, the protein of the food is increased and the carbohydrates decreased, the former may furnish the fat or heat otherwise derived from the latter. To be sure the one class of compounds does not replace the other pound for pound.

According to the estimates of physiological chemists a hundred parts of protein may furnish 51 parts, while the maximum product of one hundred parts of starch would be only 41 parts, of fat. The heat producing power of protein and of starch is not greatly different. These differences are not such, however, as to be easily detected by the crude methods of a practical experiment, and so there has sometimes been but little apparent effect from quite a wide variation of the nutritive ratio in past feeding trials.

The position of the writer in the matter of feeding formulas is this: The fact that protein has important and peculiar functions in the nutrition of animals that do not pertain to any other class of nutrients demands that a certain proportion of it shall be present in a ration, in order that growth shall not be restricted because of a lack of special building material. It is probable that few cases occur where it would not be profitable to supply protein to this extent. Whether more than this shall be fed, so that the albuminoids unnecessarily take the place of carbohydrates, is a matter that must be decided by the relative cost of different classes of foods.

THE RELATIVE VALUE OF ANIMAL AND VEGETABLE PROTEIN. CAN WE SUBSTITUTE NITROGENOUS VEGETABLE FOODS, LIKE PEA MEAL OR GLUTEN MEAL, FOR SKIMMED MILK, WITH EQUALLY GOOD RESULTS?

The efficiency of skimmed milk as food for swine has become proverbial. It is a nitrogenous food, its constituents are wholly digestible, or practically so, and it serves admirably as a supplement of the grain and other vegetable foods that are fed to swine. It is a question of some importance whether the farmer, who has no skimmed milk, or an insufficient supply, can fill its place with nitrogenous vegetable foods such as his farm or the market affords.

The verdict of these experiments is that it is not a question of skimmed milk, but of protein, and that skimmed milk can be successfully replaced by pea meal furnishing an equal quantity of digestible material.

In two instances pea meal was substituted for skimmed milk without any decrease in the rate of gain, and in one instance an amount of digestible matter from pea meal was fed against the same quantity from skimmed milk with practically equivalent results.

When the pigs of Lots 1 and 2 reached the age of eight months they were eating thirty pounds of skimmed milk and eleven and one-fourth pounds of corn meal. This ration was exchanged for one made up of five pounds of pea meal and ten pounds corn meal. The milk and meal ration contained 10 pounds of digestible matter and caused a gain of 4.14 pounds daily, while the latter ration supplied 11 pounds digestible substance, the gain being 4 27 pounds for the succeeding thirty days.

A similar exchange was made with animals of Lots 5 and 6, when they were about three months old. The rate of gain continued in this case to be satisfactory, and in marked contrast to that of the animals eating corn meal alone.

But the most accurate test of this question was with Lots 3 and 4 during a period of eighty-eight days. Both lots ate the same amount of corn meal, viz: 481 pounds. In addition to this Lot 3 consumed 240½ pounds of pea meal, and Lot 4, 1,924 pounds of skimmed milk, it being estimated that these weights of pea meal and milk contained equal amounts of digestible material. The growth of Lot 3 was 174 pounds and of Lot 4, 181 pounds, a difference of only seven pounds. In other words 568.5 pounds of digestible matter, one-third of which came from pea meal, produced practically the same growth as 565.2 pounds digestible matter, one-third of which came from skimmed milk.

THE EFFECT OF THE AMOUNT OF DRINK UPON GROWTH.

The results of certain past investigations are to the effect that excessive drink is prejudicial to growth or fattening, by causing increased protein of fat consumption in the body. Swill fed pigs or those eating skimmed milk exclusively, certainly take large quantities of drink. Is growth materially diminished, thereby? This Station has made a single experiment bearing on this point, the data of which are already given

When the experiment began the animals averaged in weight 38 pounds apiece. At the end of 120 days they weighed 135 pounds apiece. During this time one lot of two pigs drank 1,319 pounds of skimmed milk, and the other, 1,319 pounds of milk and 1,319 pounds of water, the meal ration being the same in the two cases. The amount of drink was at first 5 pounds and 10 pounds, and these quantities were gradually increased. For the last 50 days of the experiment Lot 3 had 15 pounds of drink daily and Lot 4, 30 pounds, this being at the rate of 3.6 quarts and 7.2 quarts for animals weighing during this period an average of 111 pounds. In the whole time of 120 days Lot 4 receiving the larger amount of drink gained 10 pounds less than Lot 3, and in the last 50 days the difference was 5 pounds in favor of Lot 3. The only safe assertion which can be made concerning the outcome of this experiment is that the difference in the amount of drink had no pronounced effect on the profits of feeding.

THE RELATIVE VALUE OF SKIMMED MILK AND CORN MEAL THE MONEY VALUE OF SKIMMED MILK.

The estimation of the relative values of foods, or even their pecuniary value, on the basis of the results of experiments, is a matter of great difficulty. It is practically impossible to assign to cattle foods hard and fast relative values that hold under all circumstances. For instance, in these experiments skimmed milk gave *relative* returns quite unlike, according to the circumstances of feeding. In Period 1 of the experiment with Lots 1 and 2, 2,236 pounds of skimmed milk and 263½ pounds of corn meal produced practically the same growth as 861 pounds of skimmed milk and 430 pounds of corn meal. Here 1,374 pounds of skimmed milk did the same work as 166½ pounds corn meal, or one pound of meal proved to be approximately equal to eight pounds of milk. It is significant that the digestible matter is very nearly the same in these weights of milk and meal. When, however, the milk was withdrawn from the ration of Lot 2, the skimmed milk fed to Lot 1 not only replaced corn meal in the ratio of 8 to 1, but it should also be credited over and above this with the difference in growth of 2½ pounds of live weight for each 100 pounds of milk fed.

Again in the experiments with the pigs of Lots 5 and 6, where Lot 5 was fed milk, meal and potatoes, and Lot 6 only meal and potatoes, eight pounds of milk took the place of one pound of meal, and caused an extra growth with two young pigs of 20½ pounds in thirty-two days, or at the rate of 9 pounds of live weight for each 100 pounds of milk fed.

In another case, Period 2 with the pigs of Lots 3 and 4, 1,924 pounds of skimmed milk did the same work, practically, as 240½ pounds of pea meal, which is exactly 8 pounds of milk to one pound of pea meal.

Let us closely examine these several instances. In the first, much more milk was fed to one lot of animals than to the other.

The two rations contained the same amount of digestible material and were equally efficient. In other words, the pigs eating the smaller quantity of milk had enough to give the ration its maximum efficiency, and the extra milk fed to the other animals simply took the place of so much corn meal, consequently it was worth only the price of corn meal, which was 12½ cents for each 100 pounds of skimmed milk, with meal at one cent per pound. If then, a farmer has some skimmed milk, enough to make up a third of the digestible dry substance of the ration, for instance, whether he shall buy skimmed milk or corn meal to furnish part or all the rest of the ration must be decided by the cost of these articles of food. According to the Station experiments eight pounds of skimmed milk, will, under such circumstances make about the same growth as one pound of corn meal.

But it it is a question of feeding swine and *no* skimmed milk is furnished from the farm, then the farmer can afford to pay for *some* milk much more than a price corresponding to the cost of corn meal. The foregoing experiments show that a certain minimum amount of skimmed milk paid at the rate of twenty-five cents per hundred pounds, at least, with corn meal at one dollar per hundred, and peas at two dollars per hundred.

To sum up, corn meal is just as good as skimmed milk for part of the ration, and so far market values should determine which is to be used, but for the remaining part of the ration the milk has a special and superior value that may overrule the considerations of the market. The same would be true of any nitrogenous food that is needed to add a certain kind of strength to a ration.

SUMMARY OF FEEDING EXPERIMENTS WITH SWINE.

(1) The foregoing experiments teach that the profits of feeding swine may depend in part upon the way in which foods are combined, and not wholly upon market values. A certain proportion of nitrogenous foods like skimmed milk, pea meal and gluten meal increased the efficiency of the ration in a marked manner.

In six feeding periods where the rations compared contained practically the same digestible material, 2643 pounds of digestible food with a nutritive ratio* ranging from 1 : 5.2 to 1 : 6.1 produced 890

*The *nutritive ratio* is the relation of the digestible protein to the digestible carbohydrates and fats. A ration having a nutritive ratio of 1: 6 contains one pound of digestible protein to six pounds (or the equivalent) of digestible carbohydrates. A *narrow* ratio is one having much protein, and a *wide* ratio means a small proportion of protein.

pounds of growth, while 2651 pounds of digestible food with a nutritive ratio varying from 1 : 8.9 to 1 : 9.4 produced 617 pounds of growth. It took nearly one-half more food to produce a pound of growth with one set of rations than with the other.

(2) There seemed to be no advantage in putting into the rations more than a certain proportion of protein. A ratio of 1 : 6 was compared with one of 1 : 3.6, and one of 1 : 5.6 was compared with another of 1 : 4.4, the resulting growth being practically the same.

(3) The advantage of a nitrogenous food in the ration seems to pertain to the fattening period as well as to the period of growth. A mixture of pea meal and corn meal or of gluten meal and corn meal, proved to be greatly more efficient than corn meal alone in feeding animals already well grown and quite fat. The relative growth was from twenty to sixty per cent. in favor of the ration containing one of the nitrogenous foods. When we consider that over 70 per cent. of the weight added to the body of a fattening hog is fat, while only 6.5 per cent is lean meat,* the favorable influence (at least indirect) of a liberal supply of protein upon fat production is very apparent.

(4) Nitrogenous vegetable foods seemed to exert a favorable influence upon the growth of swine similar to that of skimmed milk. Moreover, the digestible matter of pea meal and of skimmed milk proved to have a nutritive value practically equivalent.

(5) No marked effect was exerted upon growth by a wide variation in the amount of drink given to the two lots of animals. Pigs weighing but little over 109 pounds took approximately seven quarts of water daily and made but slightly less gain than animals of the same size drinking only half as much.

(6) When skimmed milk is substituted for part of a ration of corn meal without changing the amonnt of digestible dry matter fed, the efficiency of the ration was greatly increased. A still further substitution of milk for meal appeared not to materially increase the rate of growth. For instance, a ration one-third the nutrients of which were furnished by skimmed milk in a single trial proved to be worth practically as much as a ration two-thirds of the nutrients of which came from skimmed milk.

In the latter case some milk simply replaced corn meal in the ratio of 8 pounds of milk to 1 pound of meal, which is almost the exact ratio of equal quantities of digestible material.

*Shown by Lawes & Gilbert with eighty animals.

TESTS OF SEVERAL BREEDS OF DAIRY COWS—A STUDY OF DAIRY PRODUCTS.

In the spring of 1888 it was decided by those in control of this Experiment Station to undertake tests of different breeds of dairy cows. At that time the Director of this Station addressed letters to quite a number of other stations suggesting co-operation in this line of work, as it seemed to him that in this way reliable business figures could be reached most quickly and satisfactorily. Although several stations were considering the matter of making such a test, there seemed to be quite a divergence of opinion, not only as to the practicability of such a scheme but also as to the methods to be adopted. Certainly no general desire was expressed to enter into this work in accordance with some uniform plan. Several stations are making these tests, however, and we may expect essentially the same class of facts to be brought out.

The first question to be considered was, shall the test be made with a large or small number of animals of each breed? It was decided to use two cows only of each kind, on the ground that two well selected typical animals should clearly show the prominent characteristics of the breed which they represent, and besides it was not possible to make a comprehensive study of the milk, butter and waste products of each cow, if any larger number of animals was used. The relation of milk, cream and butter, the waste of fat in the skimmed milk and butter milk, the effects of food, period of lactation and season upon the composition and other qualities of the milk, the reliability of the work of the chemist as a test of a cow's butter capacity, and the determination of what may properly constitute a butter standard, are points of supreme importance both in a study of breeds and in general dairy management, and the chemical and dairy work which they involve preclude the use of more than two or three animals of each breed.

The points studied which are more directly business considerations, are the following:

(1) The cost of food.

(2) The yield of milk, milk solids, fat, cream and butter, and the relations in quantity which these sustain.

(3) The cost of milk, milk solids, fat, cream and butter, the food alone considered.

Many facts are being brought out in connection with this test which should be of interest to dairymen generally, viz:

(4) The composition of the whole milk.

(5) The composition of the skimmed milk and butter milk.

(6) The waste of fat in the skimmed milk and butter milk.

(7) The effect of food and other conditions upon the availability (churnability) of the fat in the milk.

(8) The relation of the fat in the milk and cream to the butter actually obtained.

These tests began in June 1888, and are still in progress. The results of only one year, June 1888 to 1889, are here reported for five animals. One of the Holsteins has not yet completed her first year's production and so no figures are given for her. This is really then, a report of progress.

It is to be distinctly understood that no single test of several breeds of dairy cows, especially of two animals of each breed, can determine the relative profits from their use; but notwithstanding this, such work has great value. Whatever of testing has been done in the past has mostly been done by the special advocates of each breed with a view to "booming" their business, and while our breeders of thoroughbred stock are as a rule men of high standing and undoubted integrity of character, it is quite probable, as they would doubtless confess, that they have more fully reported the production of phenomenal animals than of those of average capacity, and that tests of production have generally been made under a high pressure system of feeding and care which is very far removed from what is feasible in general practice. It is certainly well that a study of our dairy breeds by disinterested parties is being inaugurated at several stations, under uniform conditions, that are attainable in farm practice, and with animals as nearly representative as possible.

It is hardly probable that the consensus of the reports that will ultimately be made will do injustice to any breed, and we shall in this way come into possession of a mass of facts free from the bias of business interests, that will go far towards showing clearly what are the prominent characteristics, proper uses and present limitations of the breeds that are claiming attention as dairy animals.

THE ANIMALS USED AT THIS STATION.

The following are the six animals with which a dairy test is at present being conducted, a year's production from five of which is here reported:

They represent the Holstein, Ayrshires and Jerseys.

Jansje 2d, Holstein, No. 3281, H. H. B., bred by P. Schenck, Wiernigerwaard, N. H., sire Graaf Adolf, Neth, H. B. No. 98; Dam, Jansje. Neth, H. B. No. 672. Born January 1, 1882, weight, 1,275 pounds. Bought of F. W. Berry, New Gloucester, Me. Jansje dropped her first calf after coming to the Station on June 7, 1888, and her second one on September 2, 1889.

Agnes Smit, Holstein. (The records of this cow are not at hand for insertion here, but will be given later.)

Nancy Avondale, Ayrshire, No. 5539, A. B. Association. Bred by C M. Winslow, Brandon, Vt. Sire, Hebron, No. 2083, dam, Avis, No. 4815. Born March 24, 1881; weight, 1,050 pounds. Bought of C. M. Winslow, Brandon, Vt.

Nancy Avondale dropped a calf on January 10, 1889, previous to coming to the Station in June. Her next calf was dropped March 25, 1889.

Queen Linda, Ayrshire, No. 8,497, A. B. Association. Bred by Alonzo Libbey, Saccarappa, Me. Sire, Hebron, No. 2,083; dam, Queen Lindetta, No. 6,190. Born October 15, 1884; weight, 1,020 pounds. Bought of C. M. Winslow, Brandon, Vt. Queen Linda dropped a calf on October 11, 1888, and again in October 1889.

Agnes, Jersey, No. 834, M. S J. B. Bred by Seth Andrews, Warren. Sire, Ike, No. 376, M. S. J. H. B. Dam, Angie, No. 831, M. S. J. H. B. Born April 29, 1881, weight, 870 pounds. Bought of C. G. Whitney, Thomaston, Me. Agnes dropped a calf on September 8, 1888, and again on September 13, 1889.

Ida of Beach Grove, Jersey, No. 466, M. S. J. H. B. Bred by C. G. Whitney, Thomaston, Maine. Sire, Syringas, Lenox No. 340, M. S. J. H. B. Dam, Lena No. 473, M. S. J. H. B. Born February 20, 1885, weight, 920 pounds. Bought of C. G. Whitney, Thomaston, Maine. Ida dropped a calf on August 26, 1888, and again on August 28, 1889.

FOOD OF THE COWS.

In feeding these cows, an effort has been made to adapt the food to their needs and appetite.

While the cows have been in milk they have received, excepting for a few weeks before parturition and for a short time after, the following grain rations:

Jansje,	8 lbs. mixed grain,
Nancy Avondale,	7 " "
Queen Linda,	7 " "
Agnes,	6 " "
Ida,	6 " "

This grain was a mixture of two parts of corn meal, and one part each of cotton-seed meal and wheat bran, by weight. For a time before and after parturition no cotton-seed meal has been fed, the amount of grain being diminished and made to contain a larger proportion of wheat bran.

The amount of hay fed was adapted more or less to the appetite of the cows, care being taken that the ration should be readily and completely eaten.

During two months of the spring of 1889 ensilage was fed in connection with the hay, fifty pounds being the maximum and forty pounds the minimum quantity eaten daily.

In the season of 1888 the cows were turned out to grass from June 6th to September 22d, and in 1889 from June 11th to October 10th. Excepting during June and part of July the cows ate more or less hay while at pasture. The grain ration was continued unchanged.

The next table gives the dates within which a year's trial of each cow was made, the total weights of food eaten, the length of time at pasture, and the average weights of food and time of pasturage reckoned for each of the three hundred and sixty-five days in the year.

Food Eaten by Cows in One Year.

	Jansje (Holstein), June 13, 1888, to June 13, 1889.	Nancy Avondale (Ayrshire), June 17, 1888, to June 17, 1889.	Queen Linda (Ayrshire), October 20, 1888, to October 20, 1889.	Agnes (Jersey), September 13, 1888, to September 13, 1889.	Ida (Jersey), September 1, 1888, to September 1, 1889.
Total hay eaten, lbs	6740	6375	5800	5600	5500
Total ensilage eaten, lbs	2670	1648	2540	2540	2540
Total cotton-seed meal eaten, lbs	524	250	486	459	427
Total corn meal eaten, lbs	1442	827	982	976	913
Total wheat bran eaten, lbs	724	778	748	616	605
Total food eaten in barn, lbs	12100	9878	10556	10191	9985
Days of pasturage	102	102	122	104	104
Hay eaten daily for 365 days, lbs	18.5	17.4	16.0	15.4	15.1
Ensilage eaten daily for 365 days, lbs	7.3	4.5	7.0	7.0	7.0
Grain eaten daily for 365 days, lbs	7.4	5.1	6.1	5.6	5.3
Pasturage daily for 365 days, hours	2.2	2.2	2.7	2.3	2.3

COST OF THE FOOD.

The foods which Maine farmers feed to their cattle generally comprise those grown on the farm and those purchased. In estimating the cost of feeding an animal, two methods are adopted, viz: the home raised food is reckoned at what it costs to produce it and the purchased foods at cost price, or all the materials consumed, both home raised and purchased, are reckoned at what they are worth in the market.

The latter method is necessarily the one adopted here. If the Station had produced the hay and grain given to these experimental cows, it would have been both valuable and interesting to have kept a careful account with each crop for the purpose of ascertaining the actual cost of feeding farm animals from home raised foods. The method of adopting market prices answers every purpose in this case, however, as it is largely a question of comparative cost.

Again, the prices adopted must be somewhat arbitrary, as they always fluctuate during a year. An attempt has been made to approximate quite closely to the average market prices for the first year during which this test has been carried on.

The following are the prices used: Hay, $10 per ton; cotton-seed meal, $28 per ton; corn meal, $20 per ton; wheat bran, $20 per ton; ensilage, $3 per ton; pasturage estimated for each cow.

Applying these prices to the quantities of hay, ensilage and grain found in the previous table, we have the figures below as the cost of keeping the cows one year. Any one who wishes to use different prices can make calculations that will apply to his peculiar conditions.

Cost of Food for One Year.

	Jansje.	Nancy Avondale	Queen Linda	Agnes.	Ida.
Cost of hay	$33 70	$31 87	$29 00	$28 00	$27 50
Cost of cotton-seed meal	7 34	3 50	6 80	6 42	5 97
Cost of corn meal	14 42	8 27	9 82	9 76	9 13
Cost of wheat bran	7 24	7 78	7 48	6 16	6 05
Cost of ensilage	4 00	2 47	3 80	3 80	3 80
Cost of pasturage	6 50	6 00	7 00	5 50	5 50
Total cost for one year	$73 20	$59 89	$63 90	$59 64	$57 95

It may be asserted by some, and perhaps correctly, that by a different method of feeding these cows might have been kept more cheaply without diminishing production. But this work has not been carried on so far for the purpose of testing the comparative profits from various possible rations, and so the feeding has been done in accordance with the majority of practice of cattle feeders who give proper attention to the way in which the foods are mixed. There may be farmers so situated that they can feed the cows as well at a much smaller cost. Doubtless there are such, especially those who have such pasturage that the feeding of hay or grain from early summer to early autumn is at no time necessary. This question is is not of importance, however, in this connection, and is only mentioned to prevent misunderstanding.

THE YIELD OF MILK, MILK SOLIDS, FAT, CREAM AND BUTTER.

The records kept of the production from these cows has been as follows:

The weights of milk from each milking; the weights of cream from each milking; the weights of cream at the time of churning; the weights of butter milk, and the weights of worked, unsalted butter.

The cream was raised in Cooley cans submerged in water having a temperature ranging from 42° F. to 45° F. The cans containing the several cows' milk have been set in the same cabinet, consequently the temperature has been same for all. The cream has been measured in pounds. This has been done by carefully drawing off the skimmed milk and then the cream, the latter being weighed.

During a part of the year 1890 a record of cream will also be kept in inches, it having been suggested that the skimmed milk may not be drawn off with the same completeness in some cases as in others, and so the relative butter value of the cream from different cows may not be correctly ascertained by this method.

The yields of milk solids and pure fat are calculated from the amounts and composition of the milk.

The method of doing this is not to multiply the total yield of milk for the year by the average percentages of solids and fat for the year, but to multiply each monthly yield or thereabouts by the corresponding percentages of solids and fats as determined for each month from the analysis of five consecutive days' milk.

The weights of solids and fats thus obtained must correspond very closely to the actual yield.

Table Showing Production from Cows for one Year.

	Jansje.	Nancy Avondale.	Queen Linda.	Agnes.	Ida.
No. of days milked	365	281	287	340	322
Yield of milk, lbs	9991	5948	6983	6876	4107
Yield of milk solids, lbs*	1227.7	751.1	893.6	1015.2	638.4
Yield of fat, lbs*	340.4	208.8	245.9	352	237.8
Yield of cream (fresh), lbs	1819	1008	1008	1586	951
Weight of cream when churned, lbs.	1763	971	947	1546	911
Yield of butter (unsalted), lbs.	349½	197	188	379½	238
Average yield of milk per day during time milked, lbs	27.5	21.2	24.3	20.2	12.7

*The analyses of the milk from which these yields are calculated, are given on subsequent pages.

THE RELATION IN QUANTITY OF MILK, MILK SOLIDS, FAT, CREAM AND BUTTER.

In the table below can be found information on the following points:

(1) The quantity of milk required for one pound of milk solids.
(2) The quantity of milk required for one pound of butter fat.
(3) The quantity of milk required for one pound of cream.
(4) The quantity of milk required for one pound of butter.
(5) The quantity of cream required for one pound of butter

	Jansje—lbs.	Nancy Avondale —lbs	Queen Linda—lbs	Agnes—lbs.	Ida—lbs.
Milk for each pound milk solids	8.13	7.92	7.82	6.77	6.43
" " fat	29.35	28.49	28.40	19.52	17.27
" " cream	5.49	5.90	6.92	4.34	4.32
" " butter	28.59	30.19	37.13	18.12	17.26
Cream for each pound butter	5.20	5.12	5.36	4.18	4.00

The fact of most importance that is shown by these figures is that the cows giving the poorest milk furnish the poorest cream. The butter value of the Jersey cream is twenty-five per cent. higher in these particular cases, than that from the Holstein and Ayrshires. It yet remains to be proved whether this difference would be maintained in cream from herds of these animals, and whether it will be equally plain when the cream is measured in inches and not by weight as drawn off.

Another point that is raised by dairymen is this: Has cream from cows fresh in milk the same value as that from cows approaching the time of parturition? The claim of some is that the butter value of cream is less at the latter time, and the data collected by the Station in this connection seem to substantiate this position, as can be seen by reference to the following figures:

TABLES SHOWING THE BUTTER VALUE OF CREAM AT DIFFERENT TIMES DURING THE PERIOD OF LACTATION—JANSJE.

Jansje dropped a calf on June 7th, 1888, and again on September 2d, 1889.

	Lbs.	Oz.
Cream from June 14th to July 4th, 1888	122	1
Butter " " " "	28	15
Ratio of butter to cream, 1 : 4.2.		
Cream from December 30th to January 25th, 1889. ...	131	4
Butter " " " "	26	12
Ratio of butter to cream, 1 : 4.9.		
Cream from May 20th to June 15th, 1889	106	4
Butter " " " "	20	8
Ratio butter to cream, 1 : 5.2.		

NANCY AVONDALE.

Nancy Avondale dropped a calf on January 10th, 1888, and again on March 25th, 1889.

	Lbs.	Oz.
Cream from June 18th to July 10th, 1888	89	0
Butter " " " "	19	5
Ratio butter to cream, 1 : 4.6.		
Cream from December 10th, 1888, to January 6th, 1889,	62	6
Butter " " " "	12	0
Ratio butter to cream, 1 : 5.2.		

	Lbs.	Oz
Cream from April 1st to 28th, 1889..	135	6
Butter " " "	28	2
Ratio butter to cream, 1 : 4.8.		

QUEEN LINDA.

Queen Linda dropped a calf on October 11th, 1888, and again in October, 1889.

	Lbs.	Oz.
Cream from October 22d to November 18th, 1888......	143	3
Butter " " " "	28	10
Ratio butter to cream, 1 : 4.8.		
Cream from February 3d to March 1st, 1889..........	83	10
Butter " " " "	17	14
Ratio butter to cream, 1 : 4.7.		
Cream from June 16th to July 14th, 1889.	72	4
Butter " " " "	11	3
Ratio butter to cream, 1 : 6.5.		

AGNES.

Agnes dropped a calf on September 8th, 1888, and again on September 13th, 1889.

	Lbs.	Oz.
Cream from September 13th to October 5th, 1889......	98	0
Butter " " "	24	6
Ratio butter to cream, 1 : 4 0.		
Cream frcm February 3d to March 1st, 1889..........	131	10
Butter " " "	32	14
Ratio butter to cream, 1 : 4.0.		
Cream from July 20th to August 18th, 1889..........	92	2
Butter " " "	19	8
Ratio butter to cream, 1 : 4.7.		

IDA.

Ida dropped a calf on August 26th, 1888, and again on August 28th, 1889.

	Lbs.	Oz.
Cream from September 1st to 23d, 1888	73	0
Butter " " "	18	12
Ratio butter to cream, 1 : 3.9.		
Cream from February 3d to March 1st, 1889..........	74	2
Butter " " "	19	8
Ratio butter to cream, 1 : 3.7.		
Cream from June 3d to 30th, 1889..................	73	6
Butter " " "	17	14
Ratio butter to cream, 1 : 4.1.		

COST OF MILK, MILK SOLIDS, FAT, CREAM AND BUTTER.

In computing the cost of the production of these cows, the food is alone considered. Moreover, the cost given for the butter fat and butter represents the whole value of the food, no allowance being made for the other solids which are retained in the waste products from butter making, and which are certainly worth something. If there was a recognized market price for skimmed milk and butter milk, or if the skimmed milk of these animals was alike in value, in short, if an allowance made for the skimmed and butter milk could be anything but a purely arbitrary estimate, relatively unfair in any case unless based upon the percentage of solids, it would be possible to calculate the case of butter on a different basis. As it is, each farmer must make his own estimate of the worth to him of the waste products of the dairy.

The following table of *costs* is calculated from the figures given in the two preceding tables:

	Jansje	Nancy Avondale.	Queen Linda	Agnes.	Ida.
Cost of milk per pound, cts.	.7326	1.0068	.9151	.8674	1.411
milk per quart, cts *......	1.56	2.16	1.96	1.86	3.02
milk solids per pound, cts.,	5.96	7.97	7.15	5.87	9.08
fat per pound, cts.........	21.50	28.68	25.58	16.94	24.39
cream per pound, cts.	4.02	5.94	6.34	3.76	6.09
cream per quart, cts.*. . .	8.61	12.73	13.59	8.06	13.05
butter per pound, cts......	20.94	30.40	33.99	15.72	24 35

*The wine quart of 2 1-7 pounds Cream really weighs slightly less.

Fifteen months elapsed between the times at which Jansje dropped her two calves since coming to the Station, and as her year's test includes the first twelve months of this time her production was larger during that time though she had dropped a calf three months earlier, as would ordinarily have been the case. It is fair to expect that during her second year's trial she will produce less milk, and consequently at a greater cost. This will be determined later. It is worthy of note that the pound cost of the total milk solids differs less with the several cows than does the cost of the milk, cream or butter. The writer ventures the suggestion that the expense of producing milk will be found to depend not so much upon the yield by volume as upon the amount of dry matter it contains, other things being equal; or in other words, the milk that is worth least costs least. This is not strictly true in the Station trials, though it is indicated.

THE RELATIVE PROFITS FROM SELLING MILK, CREAM OR BUTTER.

The figures of the above table should be interesting to any farmers or others who are questioning as to the relative profits from selling milk, cream or butter, at the prices which they are able to command.

In the cases under consideration the amounts of milk, cream and butter from each cow are known, and it is possible, consequently, to calculate the prices at which cream or butter should sell in order to realize certain prices for the milk.

The figures below show the cream and butter prices corresponding to the milk at a cent per pound, and three (3), four (4), and five (5) cents per (wine) quart.

These calculations contain no allowance for the differences in the labor involved in selling the various products of the dairy cow, as this element of cost varies greatly according to circumstances, and must be estimated for each individual case.

Prices of Cream and Butter Corresponding to Milk at a Cent a Pound.

	Jansje.	Nancy Avondale.	Queen Linda.	Agnes.	Ida.
Cream per quart, cts...... ...	11.8	12.6	13.1	9.3	9.2
Butter per pound, cts........	28.6	30.2	37.1	18.1	17.3

Prices of Cream and Butter Corresponding to Milk at Three Cents per Quart.

	Jansje.	Nancy Avondale.	Queen Linda.	Agnes.	Ida.
Cream per quart, cts.........	16.5	17.7	18.3	13.	12.9
Butter per pound, cts........	40.	42.3	51.9	25.3	24.2

Prices of Cream and Butter Corresponding to Milk at Four Cents per Quart.

	Jansje.	Nancy Avondale.	Queen Linda.	Agnes.	Ida.
Cream per quart, cts..........	22.	23.6	24.4	17.3	17.3
Butter per pound, cts........	53.4	56.4	69.2	33.8	32.3

Prices of Cream and Butter Corresponding to Milk at Five Cents per Quart.

	Jansje.	Nancy Avondale.	Queen Linda.	Agnes.	Ida.
Cream per quart, cts.........	27.5	29.5	30.5	21.7	21.6
Butter per pound, cts........	66.7	70.5	86.6	42.3	40.4

COMPOSITION OF THE MILK.

The milk of the several animals of the three breeds tested has been analyzed to as full an extent as time would permit.

The intention has been to analyze the milk of each cow on five successive days of each month, and this has been done with a few exceptions. During the time from June, 1888 to April, 1889, the night's milk and morning's milk have been analyzed separately, but since that time equal quantities of the two have been mixed and this mixture has been analyzed.

The percentage of ash, which is seen to be uniformly 75 per cent. has so far not been determined, but is assumed. An error of 10 per cent. or less is thereby caused, possibly, which falls on the sugar. It is probable that this percentage should be slightly less with the Holsteins and Ayrshires, judging from a few determinations that have been made.

The percentage of caseine, albumen, etc., has been obtained by multiplying the percentage of nitrogen by 6.33. The percentage of sugar has been calculated by difference, but not until after this method was compared with actual gravimetric determinations.

The analysis shown in the tables below include the milk of from forty-five to sixty days. The averages for the periods of five days and for the whole year, are given:

Table Showing the Composition of Milk from Holstein, Ayrshire and Jersey Cows.

JANSJE—*Holstein.*

	Solids—per cent.	Ash—per cent.	Caseine, etc-per ct.	Sugar—per cent.	Fats—per cent.
June 18-22	12.82	.75	3.43	5.12	3.52
July 23-27	11.44	.75	2.84	4.86	2.98
August 27-31	11.56	.75	3.03	4.67	3.11
September 24-28	11.65	.75	2.98	4.75	3.15
October 22-26	11.95	.75	3.10	4.74	3.46
November 19-23	12.29	.75	3.13	4.80	3.62
December 17-21	12.17	.75	3.04	4.81	3.57
January 21-25	12.43	.75	3.12	4.98	3.57
February 25-March 1	12.55	.75	3.29	5.04	3.46
April 1-6	12.58	.75	3.24	5.11	3.48
April 29-May 3	13.07	.75	3.65	5.24	3.43
June 3-7	13.23	.75	3.76	5.02	3.71
Average	12.31	.75	3.22	4.92	3.42

NANCY AVONDALE—*Ayrshire.*

	Solids—per cent.	Ash—per cent.	Caseine, etc-per ct.	Sugar—per cent.	Fats—per cent.
June 18-22	12.64	.75	3.40	5.14	3.35
July 23-27	11.79	.75	3.39	4.47	3.18
August 27-31	11.93	.75	3.21	4.60	3.37
September 24-28	12.36	.75	3.26	4.96	3.39
October 22-26	13.04	.75	3.63	4.99	3.67
November 19-23	14.57	.75	4.24	5.31	4.27
December 17-21	14.78	.75	4.26	5.52	4.25
April 1-6	13.88	.75	3.25	4.95	4.92
April 29-May 3	12.34	.75	3.12	5.25	3.24
June 3-7	12 04	.75	3.09	5.16	3.05
Average	12.94	.75	3.48	5.03	3.67

QUEEN LINDA—*Ayrshire.*

	Solids—per cent.	Ash—per cent.	Caseine, etc-per ct.	Sugar—per cent.	Fats—per cent.
October 22-26	13.62	.75	3.40	5.15	4.32
November 19-23	12.51	.75	3.01	5.26	3.49
December 17-21	12.43	.75	2.91	5.32	3.43
January 21-25	12.47	.75	2.89	5.37	3.47
February 25-March 1	12.62	.75	3.16	5.43	3.27
April 1-6	12.87	.75	3.21	5.41	3.49
April 29-May 3	12.64	.75	3.33	5.14	3.42
June 3-7	13.04	.75	3.47	5.38	3.44
July 15-19	14.27	.75	4.04	5.19	4.29
Average	12.94	.75	3.27	5.29	3.62

Agnes—*Jersey.*

	Solids—per cent.	Ash—per cent.	Caseine, etc-per ct.	Sugar—per cent.	Fats—per cent.
September 24-28	13.72	.75	3.90	4.75	4.32
October 22-26	14.53	.75	4.01	4.60	5.17
November 19-23	14.62	.75	3.89	4.87	5.11
December 17-21	14.94	.75	4.05	4.97	5.19
January 21-25	14.95	.75	3.87	5.25	5.08
February 25-March 1	15.13	.75	4.19	5.16	5.08
April 1-6	15.42	.75	4.13	5.15	5.38
April 29-May 3	14.40	.75	4.34	5.20	5.19
June 3-7	14.98	.75	4.11	5.16	4.96
July 15-19	14.74	.75	4.11	4.69	5.18
Average	14.74	.75	4.06	4.98	5.06

Ida—*Jersey.*

	Solids—per cent.	Ash—per cent.	Caseine, etc-per ct.	Sugar—per cent.	Fats—per cent.
September 24-28	14.06	.75	3.56	4.77	4.98
October 22-26	14.88	.75	3.75	4.51	5.88
November 19-23	15.19	.75	3.98	4.71	5.76
December 17-21	15.15	.75	3.97	4.86	5.57
January 21-25	15.39	.75	3.98	4.96	5.69
February 25-March 1	15.88	.75	4.23	5.06	5.84
April 1-6	16.02	.75	4.17	5.16	5.93
April 29-May 3	16.04	.75	4.32	4.93	6.03
June 3-7	16.95	.75	4.43	5.32	6.45
July 15-19	17.52	.75	5.06	5.83	5.88
Average	15.71	.75	4.14	5.01	5.80

Several facts are shown by these analyses which may not be new, but which are worthy of special mention.

(1) The order of richness of the milk is Jersey, Ayrshire and Holstein, the Jersey leading the other two breeds by a large difference.

(2) It is noticable that the milk of two cows for a time fell below what is considered in some states the legal standard, and would be condemned by an inspector as watered milk.

(3) Analyses made of milk of three of the cows from one to two weeks after parturition showed it to be much richer than it was a month later, when it dropped to the point of least solids. In this decrease the Jerseys did not share. From the point of least solids there was a gradual increase in the percentage of solid matter up to the time of going dry, excepting with the Jersey "Agnes." This increase was not of fat alone, or caseine alone, but took place with all the solids.

(4) The lowest percentage of solids found for any cow was with the Holstein Jansje, 10.12 per cent. on July 25th, 1888, and the highest was with the Jersey Ida, 17.63, on July 16th, 1889. The percentage of fat in the two cases was 2.29 and 6.71 respectively.

COMPOSITION OF THE SKIMMED MILK, CREAM AND BUTTER MILK.

The whole milk has been analyzed for five successive days of each month, or nearly so, as has been seen, and so have the skimmed milk, cream and butter milk coming from the milk during these periods.

The skimmed milk has been sampled and analyzed on each day of the five, but it has been necessary to sample only one lot of cream and butter milk. These samples are taken as follows: The skimmed milk is drawn off to within an inch of the cream, then stirred and a portion taken for analysis, after which the skimming is completed. In this way the accidental presence of fat from the cream is avoided. The cream is thoroughly stirred before churning and then sampled. The samples of butter milk are taken before it is mixed with the washings from the butter. The analyses have not been complete, only the total solids and fat having been determined. The results appear below:

Tables Showing the Composition of the Skimmed Milk, Cream and Butter Milk from the Several Cows.

JANSJE.

	Skimmed Milk.		Cream.		Butter Milk.	
	Solids—per cent	Fat—per cent.	Solids—per cent.	Fat—per cent.	Solids—per cent.	Fat—per cent.
June 18-22	9.94	.54	26.00	19.26	9.35	.35
July 23-27	8.91	.24	21.72	14.60	8.83	.31
August 27-31	8.95	.36	22.82	15.72	8.98	.24
September 24-28	8.97	.18	22.73	15.46	8.78	.08
October 22-26	8.94	.21	24.00	16.76	9.94	1.26
November 19-23	9.15	.26	24.43	16.73	9.25	.21
December 17-21	9.05	.20	24.20	16.68	9.86	.65
January 21-25	9.33	.21	24.05	16.30	10.24	1.14
February 25-March 1	9.51	.26	23.73	15.95	9.81	.40
April 1-6	9.85	.41	22.73	14.63	10.05	.35
April 29-May 3	10.16	.22	24.02	15.77	10.28	.55
June 3-7	10.22	.44	24.59	15.74	10.80	.18
Average	9.41	.29	23.75	16.13	9.68	.48

Nancy Avondale.

	Skimmed Milk.		Cream.		Butter Milk.	
	Solids—per cent.	Fat—per cent.	Solids—per cent.	Fat—per cent	Solids—per cent.	Fat—per cent.
June 18-22	10.06	.73	24.59	17.26	10.14	.82
July 23-27	9.81	.50	24.77	17.46		
August 27-31	9.39	.56	24.30	17.25	9.30	.64
September 24-28	9.48	.34	23.96	16.68	9.82	.95
October 22-26	10.21	.61	23.80	15.82	9.69	.35
November 19-23	11.46	.86	25.27	16.16	10.89	.20
December 17-21	11.46	.68	24.90	15.92	11.52	.23
April 1-6	10.10	.66	25.95	17.90	9.41	.20
April 29-May 3	9.61	.34	24.45	16.68	9.77	.57
June 3-7	9.60	.30	25.02	16.78	9.96	.28
Average	10.12	.56	24.70	16.79	10.05	.47

Queen Linda.

	Skimmed Milk.		Cream.		Butter Milk.	
	Solids—per cent.	Fat—per cent.	Solids—per cent	Fat—per cent.	Solids—per cent.	Fat—per cent.
October 22-26	10.77	1.03	26.21	18.50	9.59	.09
November 19-23	9.89	.72	23.46	15.60	9.64	.18
December 17-21	10.10	.76	23.55	15.80	10.44	1.05
January 21-25	10.08	.91	24.81	16.95	9.65	.25
February 25-March 1	10.62	.97	24.18	16.27	9.75	.08
April 1-6	10.67	1.04	25.97	16.65	9.85	.20
April 29-May 3	10.75	1.21	23.97	16.00		
June 3-7	11.07	1.39	27.01	18.84	10.36	.09
July 15-19	12.38	2.24	20.16	11.29	10.35	.83
Average	10.70	1.14	24.37	16.21	9.95	.34

Agnes.

	Skimmed Milk.		Cream.		Butter Milk.	
	Solids—per cent	Fat—per cent.	Solids—per cent.	Fat—per cent.	Solids—per cent.	Fat—per cent.
September 24-28	9.92	.13	26.15	18.43	9.56	.18
October 22-26	10.04	.14	26.84	19.19	9.68	.12
November 19-23	10.16	.25	26.94	18.77	10.14	.12
December 17-21	10.36	.21	27.55	19.63	10.23	.09
January 21-25	10.82	.15	27.08	18.72	10.52	.45
February 25-March 1	10.70	.16	26.90	18.63	10.23	.05
April 1-6	10.79	.24	26.77	18.28	10.82	.05
April 29-May 3	10.81	.23	28.67	20.37	10.70	.17
June 3-7	10.48	.45	29.68	20.38	11.14	.21
July 15-19	10.53	.48	27.60	19.60	10.70	.30
Average	10.46	.24	27.42	19.20	10.37	.17

Ida.

	Skimmed Milk.		Cream.		Butter Milk.	
	Solids—per cent.	Fat—per cent.	Solids—per cent.	Fat—per cent.	Solids—per cent.	Fat—per cent.
September 24-28	9.77	.20	27.71	20.43	9.52	.12
October 22-26	9.70	.16	28.70	21.45	9.30	.06
November 19-23	10.12	.32	26.98	18.73	10.25	.13
December 17-21	10.17	.24	27.55	19.61	10.70	.22
January 21-25	10.57	.49	27.04	18.92	10.32	.31
February 25-March 1	10.81	.32	27.82	19.45	10.43	.07
April 1-6	11.09	.64	28.33	19.79	10.50	.15
April 29-May 3	11.66	1.11	28.78	20.17	11.03	.35
June 3-7	12.50	1.51	29.10	19.97	11.75	.20
July 15-19	13.19	1.65	24.80	15.39	11.18	.29
Average	10.96	.67	27.68	19.39	10.50	.19

The composition of these products can be more readily compared if the averages of the above tables are brought together.

Average Composition for One Year of the Skimmed Milk, Cream and Butter Milk.

	Skimmed Milk.		Cream.		Butter Milk.	
	Solids—per cent.	Fat—per cent.	Solids—per cent.	Fat—per cent.	Solids—per cent.	Fat—per cent.
Jansje	9.41	.29	23.75	16.13	9.68	.48
Nancy Avondale	10.12	.56	24.70	16.79	10.05	.47
Queen Linda	10.70	1.14	24.37	16.21	9.95	.34
Agnes	10.46	.24	27.42	19.20	10.37	.17
Ida	10.96	.67	27.68	19.39	10.50	.19

There has prevailed somewhat generally the opinion that the skimmed milk of Jersey cows is of poorer quality than that of the Ayrshires or other breeds whose milk is not so rich in fat. That opinion is not sustained by these analyses, the Jersey skimmed milk proving to contain a higher per cent. of solids than that of the other two breeds. The same is true of the butter milk. Except for the first month or so, there is a gradual increase in the solids of the skimmed milk and butter milk up to parturition.

The average percentage of fat in the skimmed milk varies greatly, being least with one of the Jerseys, and largest with one of the Ayrshires. It is true, however, that during the time of a full flow of milk the percentage of fat in the skimmed milk of the Ayrshires were much larger than in the case of the other breeds, the Jerseys showing the instances of the most complete separation. It is true of all the cows without respect to breed, that the percentage of fat in the skimmed milk, or in other words the waste of fat, increases in a marked manner as the period of milking lengthens and parturition approaches.

The butter milk of the Jerseys shows least fat, the percentage being only about half that of the other cows.

Later will be given the percentage of the total fat of each cow which passes off in the waste products, when the relative loss will be more clearly seen.

The analyses of the cream coincide with the churn tests in showing the Jersey cream to be considerably richer in fat than that from the other breeds. Again while the cream grows richer in solids as the period of lactation lengthens and parturition approaches, (which is also true of the milk,) the percentage of fat does not increase but rather diminishes. The following figures show that this increase in solid matter falls upon other constituents of the cream than upon the fat, which is equivalent to showing that the fat in the milk of cows approaching to parturition separates from the casein, etc., less readily and therefore less completely than in the early stages of the milking period:

Ratio of the Other Solids in Cream to the Fat.

	Jansje.		Nancy Avondale.		Queen Linda.		Agnes.		Ida.	
	Solids not fat.	Ratio of other solids to fat.	Solids not fat.	Ratio of other solids to fat.	Solids not fat.	Ratio of other solids to fat.	Solids not fat.	Ratio of other solids to fat.	Solids not fat.	Ratio of other solids to fat.
June 18th to June 22d...........	6.74	1:2.9	7.33	1:2.4						
July 23d to July 28th	7.12	1:2.0	7.31	1:2.4						
August 27th to August 31st	7.10	1:2.2	7.05	1:2.4						
September 24th to September 28th,	7.27	1:2.1	7.28	1:2.1	-	-	7.72	1:2.4	7.28	1:2.8
October 22d to October 26th......	7.24	1:2.3	7.98	1:2.0	7.71	1:2.4	7.65	1:2.5	7.25	1:3.0
November 19th to November 23d..	7.70	1:2.2	9.11	1:1.8	7.86	1:2.0	8.17	1:2.3	8.25	1:2.3
December 17th to December 21st..	7.52	1:2.2	8.98	1:1.8	7.75	1:2.0	7.92	1:2.5	7.94	1:2.5
January 21st to January 25th....	7.75	1:2.1	-	-	7.86	1:2.1	8.36	1:2.2	8.12	1:2.3
February 25th to March 1st......	7.78	1:2.0	-	-	7.91	1:2.1	8.27	1:2.2	8.37	1:2.3
April 1st to April 6th...........	8.10	1:1.8	8.05	1:2.2	9.32	1:1.8	8.49	1:2.1	8.54	1:2.3
April 29th to May 3d............	8.25	1:1.9	7.77	1:2.1	7.97	1:2.0	8.30	1:2.4	8.61	1:2.3
June 3d to June 7th.............	8.75	1:1.8	8.24	1:2.0	8.07	1:2.2	9.30	1:2.2	9.21	1:2.1
July 15th to July 19th	-	-	-	-	8.87	1:1.3	8.00	1:2.4	9.41	1:1.6

It is a matter of some importance to know just what is the distribution of the solids of the milk in the various products into which it is separated, viz: The skimmed milk, butter milk and butter. In other words, what proportion of the food value of the milk does a farmer retain in the skimmed milk, or butter milk, or both?

Knowing the quantities of whole milk, skimmed milk and butter milk, and also their monthly composition, we are in a position to calculate to a close approximation the total solids of each for the year, as has already been done for the whole milk.

The attention of those who are debating the question of selling milk or making butter is invited to the figures here presented as furnishing a definite basis for the consideration of the matter:

Table Showing the Quantities of Dairy Products from Each Cow.

	Jansje—lbs.	Nancy Avondale—lbs.	Queen Linda—lbs.	Agnes—lbs.	Ida—lbs.
Whole milk	9991	5948	6983	6876	4107
Cream (sour)	1770	971	947	1546	910
Skimmed milk	8172	4940	5974	5290	3156
Butter milk	1278	688	681	1000	567
Butter	349	197	188	379	238

Table Showing the Solid Matter in the Dairy Products from Each Cow.

	Jansje.	Nancy Avondale.	Queen Linda.	Agnes.	Ida.
Whole milk solids, pounds	1227.7	751.1	893.6	1015.2	638.4
Cream solids, pounds	415.2	238.8	230	415.7	253.18
" per cent of total milk solids	33.8	31.8	25.7	40.9	39.7
Skimmed milk solids, pounds	768.5	491.9	632.1	557.2	340.9
" " per cent of total milk solids	62.6	65.5	70.6	54.9	53.4
Butter milk solids, pounds	124.2	68.01	64.1	104.07	59.04
" " per cent of total milk solids,	10.1	9.0	7.2	10.2	9.2

It appears that the solids of the skimmed milk and butter milk range with these five cows from 63 per cent. to 77 per cent. of the total milk solids, and that the total quantity of solids in the skimmed milk is from five to ten times as large as those of the butter milk.

THE WASTE OF FAT IN THE SKIMMED MILK AND BUTTER MILK.

A cow's butter producing capacity does not wholly depend upon the quantity and quality of her milk, but in part also upon the amount of fat that is retained by the skimmed milk and butter milk. It is possible that the centrifugal machine or butter extractor will reduce all milk, without regard to breed or individual, to the same level in the matter of waste, but with the present cold-setting method, even when it is well managed, there is an unquestioned difference in the way in which the milk of different cows behaves.

The cows involved in this test furnish a striking illustration not only of the great variation with different animals of the fat in the waste products from butter making, but also of the large loss that may occur in ordinary practice and not be observed. It is very evident that the individuality of the animal has much more to do with the amount of fat left in the skimmed milk than has food or season.

The figures below are suggestive, and in part furnish an argument for the use of the separator:

Table Showing the Waste of Fat in the Skimmed Milk and Butter Milk for One Year.

	Jansje—lbs.	Nancy Avondale—lbs.	Queen Linda—lbs.	Agnes—lbs.	Ida—lbs.
Total fat in milk	340.4	208.8	245.9	352.	237.8
Fat left in skimmed milk	22.9	24.8	64.	13.1	19.3
Fat left in butter milk	6.1	3.3	2.1	1.4	1.0
Total fat in waste products	29.	28.1	66.1	14.5	20.3
Per cent. waste in skimmed milk	6.7	11.9	26.0	3.7	8.1
" " butter milk	1.8	1.6	0.8	0.4	0.4
" total waste	8.5	12.5	26.8	4.1	8.5

The yearly loss with individual cows varied from 14.5 pounds to 66.1 pounds of fat, or from one pound in twenty-five to one pound in four of the total butter fat. At least ninety per cent. of this loss was in the skimmed milk. Granting that a separator would take out the fat from the milk of all the cows equally clean, so that in no case would the residue exceed .10 per cent., then the loss in the skimmed milk would vary with these cows from three to eight pounds yearly.

The yearly saving for a herd of cows like the Jersey Agnes would then not exceed $1.50 per cow, while for such cows as Nancy Avondale and Queen Linda the saving would be not far from $5.50 and $16.50 respectively, reckoning butter at twenty-two cents per pound. It is possible that the milk of such cows as Queen Linda can be manipulated in some other way by the addition of water or otherwise, so as to overcome to some extent the cause which prevents the easy rise of the fat globules.

THE EFFECT OF FOOD UPON THE AVAILABILITY OF THE FAT OF MILK.

The term "churnability," or the availability for conversion into butter of the fat of milk, is one of no significance, sóme claim. That may be true if the milk is to be manipulated with the aid of the separator or butter extractor, but not if the cream is to be raised by the method now most commonly in use in Maine. We have seen how largely different the percentage of waste of fat is with different cows. What as to the waste with the same cow when fed rations greatly unlike? It now seems to be accepted by some, prematurely it appears to others, that ensilage as a food increases the proportion of the total fat of the milk which finds its way into the butter. The observations made at this Station during the past year do not accord with that view. Let us examine the data bearing upon this point.

During the season of 1888–89, the cows were fed dry food exclusively until March 8th. From that date to May 10th they were given from forty to fifty pounds of ensilage per day, when they were returned to dry feed until they were sent to the pasture early in June.

As analyses of the skimmed milk and butter milk were made for five consecutive days in each month, it is possible to ascertain whether these products contained less fat while the ensilage was being eaten than before or aftem. Below can be seen the percentage of fat in the waste products from January to July inclusive:

	Jansje.		Queen Linda.		Agnes.		Ida.	
	Fat in skimmed milk—per cent.	Fat in butter milk—per cent.	Fat in skimmed milk—per cent.	Fat in butter milk—per cent.	Fat in skimmed milk—per cent.	Fat in butter milk—per cent.	Fat in skimmed milk—per cent	Fat in butter milk—per cent.
DRY FOOD.								
January 21st to January 25th	.21	1.14	.91	.25	.15	.45	.49	.31
February 25th to March 1st	.26	.40	.97	.08	.16	.05	.32	.07
Average	.23	.77	.94	.16	.15	.25	.40	.19
ENSILAGE.								
April 1st to April 6th	.41	.35	1.04	.20	.24	.05	.64	.15
April 29th to May 3d	.22	.55	1.21	-	.23	.17	1.10	.35
Average	.31	.45	1.12	.20	.23	.11	.87	.25
DRY FOOD.								
June 3d to June 7th	.44	.18	1.39	.09	.45	.21	1.51	.20
GRASS.								
July 15th to July 19th	-	-	2.24	.83	.48	.30	1.65	.29

It does not appear from the above results that the ensilage or grass exerted any influence upon the amount of fat left in either the skimmed milk or butter milk. There is a gradual increase of fat in the skimmed milk due to the advancing period of lactation, while the butter milk follows no general law. Certainly if the change in food produced any effect upon the "churnability" of the milk it was so small as to be obscured by other influences.

THE RELATION OF THE TOTAL FAT IN THE MILK TO THE BUTTER OBTAINED.

There seems to be a desire among those taking a leading interest in dairy matters to fix some butter standard that shall constitute a basis for testing single cows or herds. It is suggested that a *standard butter*, i. e., a butter of a certain composition, shall be adopted, and that a cow's yield shall be so many pounds of such butter. It is further suggested that the amount of this standard butter can be computed from the amount of fat contained in the milk of the cow tested, without the trouble of a churning test. Such a prompt and labor saving method is certainly desirable. The objection raised to it is that a much smaller percentage of the total fat of the milk finds its way into the butter with some cows than with others, and that if it is characteristic of an individual or a breed to leave a large residue of fat in the waste products this fact should have its influence upon the outcome of the test. It is urged on the other hand that by the most approved methods of handling milk the fat residues in the skimmed milk and butter milk can be made practically the same for all animals without regard to individuality or breed, and that a cow should be judged by what she will do when her milk is manipulated in the best possible manner. If it is true that we can now overcome the characteristic differences of milk from different animals, or are likely to do so, so that the fat becomes equally available in all cases, then it would certainly be wise to base a cow's butter capacity upon the fat in her milk. The data collected in testing the Station cows bear upon this question to some extent.

There is known the total fat in the milk, the fat in the waste products, the fat in the cream, and the weight of butter produced.

Table Showing the Relation of the Quantities of Fat in the Milk, Cream and Butter.

	Jansje.	Nancy Avondale	Queen Linda.	Agnes.	Ida.
Weight of butter, lbs	349.5	197.	188.	379.5	238.
Total fat of milk, lbs	340.4	208.8	245.9	352.	237.8
Fat in waste products, lbs	29.	28.1	66.1	14.5	20.3
Fat left for butter, lbs	311.4	180.7	179.8	337.5	217.5
Fat found in sour cream, lbs	285.	163.5	154.	292.9	178.5
Fat in butter milk, lbs	6.1	3.3	2.1	1.4	1.0
Fat left for butter, lbs	278.9	160.2	151.9	291.5	177.8
Ratio of whole fat minus fat of waste products, to the weight of butter.* Butter=100	89	92	96	89	91
Ratio of fat of sour cream minus fat of butter milk, to weight of butter. Butter=100	80	81	81	77	75

*Worked, unsalted butter.

In studying these figures we discover that these two sets of results are inconsistent.

The fat in the whole milk diminished by the amount in the skimmed milk and butter milk should be the same as that of the cream less the fat in the butter milk. This does not seem to be the case, however, neither does there appear to be any error in the data. We are not now able to explain this discrepancy. The possible causes are an actual loss of fat, errors of weighing, and errors of chemical analysis. It is already ascertained that the second named cause could not have existed, certainly not to produce an error so large, so uniform and always on the same side. By using the figures of a previous table we learn that the solids of the sour cream added to the solids of the skimmed milk, also fall short of equaling the solids of the whole milk. The difference can be seen below:

	Jansje—lbs.	Nancy Avondale—lbs.	Queen Linda—lbs.	Agnes—lbs.	Ida—lbs.
Solids in whole milk	1227.7	751.1	893.6	1015.2	638.4
Solids in sour cream and skimmed milk	1183.7	730.7	862.1	972.9	594.1
Difference	44.	20.4	31.5	42.3	44.3
Discrepancy in fats	32.5	20.5	27.9	46.	39.7

There is a similarity in these two sets of figures that is significant. It is very evident that this apparent loss of solids falls almost entirely upon the fat. Is it an *actual* loss of fat? An investigation having as an object a definite answer to this question is already planned. It is possible that it will receive a negative reply, but it is difficult to understand what can be the nature of the error, if one has occurred. Whatever it may be, whether of analytical work or not, it is worth while to find it.

It is a fact that the amount of fat found in the sour cream stands in about the right relation to the weight of butter, i. e., as 79 to 100. Fresh, unsalted butter will average less rather than over eighty per cent. of fat. This makes it appear that the weight of fat in the whole milk diminished by the amount of fat in the skimmed milk and butter milk is too large for the butter produced, the ratio being 91 to 100. This fact goes to show that the discrepancy is not due to errors in the laboratory.

THE LENGTH OF TIME REQUIRED FOR CHURNING THE CREAM FROM THE DIFFERENT COWS.

A careful record has been kept of the length of time required for churning each mess of cream from each cow, and the average for the year is as follows:

	Time of churning.	Temperature of cream.
Jansje	44 minutes,	64° F.
Nancy Avondale	33 "	63° "
Queen Linda	37 "	64° "
Agnes	41 "	64° "
Ida	38 "	64° "

SUMMARY.

(1) The amount and cost of production from the three breeds can more safely be discussed at the end of another year's work.

(2) The results of this test show that milk or butter production may be profitable or unprofitable according to the kind of animal used. The food expense of a pound of milk solids, a quart of cream or a pound of butter fat is from fifty-five to sixty-nine per cent. larger, as the case may be, with the cows producing the smallest quantities.

(3) A pound of dry matter has been produced from these five cows at an average food-cost of 7.2 cents, which is not far from half the food-cost of the dry matter in a fat steer's carcass, only about fifty per cent. of which is edible.

(4) The cream from different cows was unlike in butter value, that from the cows giving the poorest milk yielding less butter by about twenty-five per cent. than the Jersey cream.

(5) Cream from the cows when in an advanced state of pregnancy had a diminished butter value.

(6) The Holstein milk averaged the poorest and the Jerseys the richest in total solids and fat.

(7) The milk of all the cows but one gradually increased in its percentage of solid matter as the period of lactation lengthened, and the time of parturition approached.

(8) The Jersey skimmed milk proved to contain a slightly larger percentage of solids than the Ayrshire skimmed milk, the Holstein skimmed milk being much poorer than that of the other two breeds, the order being 10.7 per cent., 10.4 per cent., and 9.4 per cent.

(9) The skimmed milk of the Ayrshires contained a large percentage of fat throughout the entire milking period, the separation of fat seeming to be less perfect than with the other two breeds.

(10) The butter milk of each cow contained about the same percentage of total solids as her skimmed milk, the quality following the same order as to breeds, viz: 10.44 per cent., 10.00 per cent. and 9.68 per cent.

(11) The butter milk of the Jerseys contained less than half as much fat as that of the other two breeds.

(12) A careful test with five cows furnishes no evidence that a change of food from hay to ensilage or to grass diminished the waste of fat in the skimmed milk and butter milk.

(13) From 53 per cent. to 70 per cent. the solids of the milk were found in the skimmed milk, and from 7 per cent. to 10 per cent in the butter milk.

(14) The percentage waste of fat in the skimmed milk and butter milk varied from 4.1 per cent. to 26.8 per cent, of the total fat, being least for the Jerseys and greatest for the Ayrshires. Over 90 per cent. of this waste was in the skimmed milk.

(15) The fat in the sour cream was 79 per cent of the weight of worked unsalted butter.

EXPERIMENTS WITH FERTILIZERS.

Prof. WALTER BALENTINE.

In accordance with the recommendations of the Station Council, the experiments on the availability of phosphoric acid in finely ground phosphatic rocks have been continued by using South Carolina rock and Caribbean Sea guano, in field and pot experiments.

The South Carolina rock was selected for the work on account of its being a crude material which is a standard article in the fertilizer trade. The Caribbean Sea guano was a phosphate of iron and alumina, and was used in the experiments because it seemed to be desirable to obtain further information in regard to the action of this class of phosphates on crops.

The crude phosphates used in both field and pot experiments were finely ground, the South Carolina rock carrying 27.2 per cent. phosphoric acid and the Caribbean Sea guano 37.5 per cent. The soluble phosphoric acid was furnished by acid South Carolina rock having 13.3 per cent. available and 3.1 per cent. insoluble phosphoric acid.

FIELD EXPERIMENTS BY FARMERS.

For the field experiments sets of fertilizers were prepared in duplicate to be applied to plots of one-tenth of an acre. Two plots were to receive acid South Carolina rock at the rate of 500 pounds per acre, with ammonium sulphate at the rate of 150 pounds and muriate of potash at the rate of 100 pounds per acre. The two plots thus manured would receive a liberal supply of available plant food.

Two plots were to receive finely ground South Carolina rock at the rate of 1,000 pounds per acre, with sulphate of ammonia at the rate of 150 pounds and muriate of potash at the rate of 100 pounds per acre. This would give to these two plots the same amount of potash and nitrogen as the plots to which the acid South Carolina rock was applied and four times as much phosphoric acid, but the phosphoric acid would be in an insoluble form. The cost of the phosphoric would be about the same in each case.

Two plots were to receive ground Caribbean Sea guano at the rate of 725 pounds per acre with the same amount of sulphate of ammonia and muriate of potash as in the preceding cases. This also provides for four times the amount of phosphoric acid in an insoluble form as would be applied of soluble phosphoric acid where the acid South Carolina rock was used, at about the same cost per plot.

Two plots were to be cultivated with an application of 150 pounds of sulphate of ammonia and 100 pounds of muriate of potash, to show to what extent the phosphates ncreased the crop in each case over what would have been produced if they had not been applied.

In addition two plots were to be cultivated without manure, to determine the capacity of the soil to produce crops at the time of the experiment.

Sets of fertilizers like those described above were sent out to four farmers in different parts of the State, with directions for their application. Three of these farmers have furnished reports of their work which are of considerable interest. In each case one-half of the fertilizers were applied broadcast and the remainder in the hill.

Following are given the reports of the farmers having charge of the work.

Mr. H. L. Leland's Experiment at East Sangerville--Description of Soil.

Hill land; a dry, slaty loam; a good potato soil; land in grass previous season, cut one-half ton of hay per acre, plowed in fall of 1888. Planted to Beauty of Hebron potatoes, using for seed ten bushels per acre. Fertilizers applied at the time of planting. The crop was well hoed and kept free from weeds.

The following table gives the numbers of the plots, fertilizers used, rate of application and yield per acre:

Number of plot.	Name of Fertilizer.	Amount per acre --pounds.	Yield per acre of potatoes bushels*
1	Acid South Carolina rock Sulphate of ammonia Muriate of potash	500 150 100	68⅓
2	Fine ground South Carolina rock Sulphate of ammonia Muriate of potash	1000 150 100	50
3	Caribbean Sea guano Sulphate of ammonia Muriate of potash	725 150 100	40
4	Sulphate of ammonia Muriate of potash	150 100	22
5	No fertilizer	-	30
1a	Acid South Carolina rock Sulphate of ammonia Muriate of potash	500 150 100	65
2a	Caribbean Sea guano Sulphate of ammonia Muriate of potash	1000 150 100	48⅓
3a	Caribbean Sea guano Sulphate of ammonia Muriate of potash	725 150 100	33⅓
4a	Sulphate of ammonia Muriate of potash	150 100	21⅓
5a	No fertilizer	-	29⅓

*Rust killed potato vines about August 15th, or the yield would probably have been greater.

Mr. William Downes' Experiment at Sebec—Description of Soil.

Corn was planted on old sod land that had received no manure for six years. The ground was plowed May 22d six inches deep; corn planted May 25th. The result is shown in the following table:

Number of plot.	Name of Fertilizer.	Amount per acre—pounds.	Yield per Acre of		
			Corn on cob—pounds.	Equivalent of shelled corn—bushels.*	Corn fodder—pounds.
1	Acid South Carolina rock Sulphate of ammonia Muriate of potash	500 150 100	4660	66.6	4610
2	Fine ground South Carolina rock Sulphate of ammonia Muriate of potash	1000 150 100	2630	37 6	2730
3	Caribbean Sea guano Sulphate of ammonia Muriate of potash	725 150 100	2660	38.0	2370
4	Sulphate of ammonia Muriate of potash	150 100	1260	18.0	2120
5	No fertilizer	-	1130	16.1	1450
1a	Acid South Carolina rock Sulphate of ammonia Muriate of potash	500 150 100	3720	53.1	4640
2a	Fine ground South Carolina rock Sulphate of ammonia Muriate of potash	1000 150 100	2320	33.1	3410
3a	Caribbean Sea guano Sulphate of ammonia Muriate of potash	725 150 100	2410	34.4	3340
4a	Sulphate of ammonia Muriate of potash	150 100	1220	17.1	1570
5a	No fertilizer	-	1570	22.4	1910

*Calculated into bushels of shelled corn by dividing the weight of corn on cob by 70.

Mr. G. A. Glover's Experiment at Naples—Description of Soil.

The land selected for this experiment produced about a ton and a half of hay to the acre nine years ago; has been in pasture since, the cattle being housed at night. Soil heavy loam with hard pan subsoil.

No. of plot.	Name of Fertilizer.	Amount per acre—lbs.	Yield per acre of Shelled corn —bush.	Yield per acre of Corn fodder —lbs.
1	Acid South Carolina rock Sulphate of ammonia Muriate of potash	500 150 100	58.7	7500
2	Fine ground South Carolina rock Sulphate of ammonia Muriate of potash	1000 150 100	46.7	5327
3	Caribbean Sea guano Sulphate of ammonia Muriate of potash	725 150 100	34.7	4200
4	Sulphate of ammonia Muriate of potash	150 100	29.4	3620
5	No fertilizers	-	3.3	1500
1a	Acid South Carolina rock Sulphate of ammonia Muriate of potash	500 150 100	61.9	8160
2a	Fine ground South Carolina rock Sulphate of ammonia Muriate of potash	1000 150 100	44.5	5160
3a	Caribbean Sea guano Sulphate of ammonia Muriate of potash	725 150 100	38.7	4730
4a	Sulphate of ammonia Muriate of potash	150 100	28.8	3520
5a	No fertilizer	-	3.2	1437

In these experiments it will be fair to attribute the gain in crops on the plots to which the phosphates were applied, over those on which sulphate of ammonia and muriate of potash alone were used, to the phosphoric acid taken up by the crop from the phosphatic fertilizing material.

In Mr. Leland's experiment, the highest yield per acre of the plots to which sulphate of ammonia and muriate of potash alone were supplied, was 22 bushels. Taking this as a measure of what the soil was able to produce under the conditions of the experiment when only sulphate of ammonia and muriate of potash were applied, we have on the plots on which fine ground South Carolina rock was used in addition to sulphate of ammonia and muriate of potash a gain of $26\frac{1}{3}$ bushels in one case and 28 bushels in another. The Caribbean Sea guano gave a gain of $11\frac{1}{3}$ bushels in one case and 18 bushels in another.

In Mr. Downes' experiment if we take the highest yield of the sulphate of ammonia and muriate of potash plots as the measure of capacity of the soil when manured with those materials alone, under the conditions of the experiment, then we have on plot 2, 20.2 bushels corn due to the application of finely ground South Carolina rock and on plot 2a, 15 bushels; and in plot 3, 20.9 bushels and 3a, 17.3 bushels to be attributed to Caribbean Sea guano.

In Mr. Glover's experiment the indications of the availability of the insoluble phosphoric acid of South Carolina rock and the Caribbean Sea guano are less marked; but even here the least amount of corn to be attributed to the action of the crude phosphates is 5.3 bushels, while the largest amount reaches 17.3 bushels. Plots 1 and 1a to which the acid South Carolina rock was applied gave a much larger yield in every case than those plots to which the crude phosphates were applied, though the total amount of phosphoric acid was only one-fourth as much.

The conclusions to be drawn from the above data are: (1) That the insoluble phosphoric acid in the finely ground South Carolina rock and the finely ground Caribbean Sea guano was able to furnish a considerable amount of phosphoric acid to the crops; (2) That the first crops were not able to avail themselves of as much phosphoric acid from the 272 pounds furnished by the 1,000 pounds of finely ground South Carolina rock and the 725 pounds of Caribbean Sea guano as from the 65 pounds soluble phosphoric acid furnished by the 500 pounds of acid South Carolina rock. There is left, however, for the use of future crops a much larger amount of phosphoric acid from the finely ground rock phosphates than from the acid rock.

Attention may be called to the different action of the potash and nitrogen when applied without phosphates. In the experiments of Messrs. Leland and Downes they had practically no effect on the crops, while in Mr. Glover's experiment when applied alone they increased the crop in one case 26.1 bushels and in another 25.6 bushels.

POT EXPERIMENTS.

The pots in which our pot experiments were conducted were like those devised and used by Wagner. They were constructed as follows: A cylinder of galvanized iron ten inches in diameter and twenty inches high with a row of perforations about an eighth of an inch from the bottom, is soldered into the centre of a pan fourteen inches in diameter and three inches high. At the top of the pan a collar is soldered to the cylinder and to the pan, which has a perforation for the introduction of water into the pan. Through the bottom of the pan, outside of the cylinder, pass two tubes, one being flush with the bottom of the pan on the inside, and the other extending up into the pan just two inches. Both extend about two inches below the bottom of the pan.

The first tube is for washing out the pots, and is corked when the pots are in use. The second is the overflow tube which regulates the height of the water in the reservoir. A little below the top of the cylinder, handles are soldered to opposite sides for convenience in handling the pots. The inside of the pots were painted with asphaltum paint to prevent rusting, and the outside with white lead to prevent undue absorption of heat.

Pots of the above description were filled to the depth of one inch with coarse gravel and then to the top with crushed quartz sand. It required for this purpose 65 pounds of sand for each pot, with the last 35 pounds of which was mixed the fertilizers used in the experiment.

These pots were set in double rows on a bench running nearly north and south. Water was then introduced into the reservoirs until it rose to the top of the overflow tube under which there had previously been placed glass jars. The water, passing through the perforations in the cylinders, rose to the height of two inches on the inside, so that it stood in all of the pots eighteen inches from the top. Rain water from a slate roof was supplied to the pots daily to make good the loss by evaporation, except that after rains when the water falling on the pots caused an overflow of the reservoir into the glass jars below, the overflow water was used for watering the pots.

In each of these pots were planted twenty oats of the same variety. After they had grown to the height of about three inches, the plants were thinned out to eighteen to the pot, on account of one or two plants having died in some of the pots. The oats rusted badly, which doubtless depressed the yield in all of the pots, and to this may in part be attributed the variation in yield of pots receiving like treatment as to fertilizers.

The phosphates used in the pot experiments were of the same kind and composition as those used in the field experiments.

The tables below show the kinds and amounts of fertilizers supplied to each pot, and the amount of grain and straw product:

Kind and Quantity of Fertilizers.	No. of pot.	Weight of grain in grams.	Weight of straw in grams.
3 grams muriate of potash	16	22.88	67
10 grams nitrate of soda	20	18.85	72
10 grams acid South Carolina rock	24	24.37	65
3 grams muriate of potash	2	3.19	12
10 grams nitrate of soda	6	1.72	5
5.5 grams South Carolina rock	10	2.74	10
3 grams muriate of potash	3	5.60	15
10 grams nitrate of soda	7	6.75	17
4 grams Caribbean Sea guano	11	6.98	15

The average yield of oats in pots 16, 20 and 24 was at the rate of 128 bushels per acre, showing that these pots received plant food of all kinds in quantities sufficient to produce a good crop.

Pots 2, 6 and 10 received the same amounts of potash and nitrogen and twice as much insoluble phosphoric acid as 16, 20 and 24 had of soluble phosphoric acid. The average yield of grain, however, was only at the rate of about 15 bushels per acre.

Pots 3, 7 and 11 were treated the same as 2, 6 and 10 with the exception that the same quantity of phosphoric acid was furnished in Caribbean Sea guano instead of South Carolina rock. The average yield of grain was at the rate of 37.8 bushels per acre. The depression of the yield caused by the substitution of the crude phosphates for acid South Carolina rock may have been in part due to the fact that the acid phosphate contained a considerable portion of sulphate of lime which the crude rock could have carried only to a slight degree. The principal cause of the depression, however, is believed to be due to the inability of the plants to obtain a sufficient amount of phosphoric acid to produce a maximum crop from the materials presented. Let the cause of the depression be what it may the experiment leaves little room to doubt that a considerable amount of phosphoric acid was obtained by the plants from the crude phosphatic rock, amounting in the case of the Caribbean Sea guano to enough to produce more than an average crop of grain.

EXPERIMENTS WITH FELDSPAR AS A SOURCE OF POTASH.

In connection with the experiments with finely ground phosphatic rock as a source of phosphoric acid for plants, pot experiments have been undertaken to determine to what extent plants can avail themselves of the potash of potash feldspar. The pots used for the experiments were like those described above and used in the phosphate experiments. They were also filled in the same manner, having first a layer of gravel at the bottom and above this 65 pounds of quartz sand, with the last 35 pounds of which were mixed the experimental fertilizers.

Three pots, 1, 5 and 9 were supplied each with 10 grammes of feldspar carrying 11.61 per cent. of potash, 10 grammes of nitrate of soda and 10 grammes of acid South Carolina rock. Three other pots, 13, 17 and 20, were fertilized with 20 grammes of feldspar and the same amount of nitrate of soda and acid phosphate as was supplied to 1, 5 and 9. In these pots were planted oats. When the oats were two or three inches high they were thinned out to 18 plants per pot. The pots were watered in the same manner as were those in which the experiment with phosphates were conducted.

In the tables below are shown the results of substituting muriate of potash for feldspar as a source of potash.

Kind and quantity of fertilizers.	No. of pot.	Yield of grain in grams.	Yield of straw in grams.
10 grams feldspar	1	18.37	47
10 grams nitrate of soda	5	14.37	43
10 grams acid South Carolina rock	9	19.43	47
20 grams feldspar	13	17.28	47
10 grams nitrate of soda	17	16.78	47
10 grams acid South Carolina rock	21	16.83	52
3 grams muriate of potash	16	22.88	67
10 grams nitrate of soda	20	18.85	72
10 grams acid South Carolina rock	24	24.37	65

The pots receiving ten grammes of feldspar produced on the average about 79 per cent. of the average of the grain produced by those pots receiving three grammes of muriate of potash having 50 per cent. of actual potash. The amount of grain was not increased by increasing the feldspar to 20 grammes though there was a slight gain in straw.

The conclusion to be drawn from the experiment is that the oats were able to draw from the feldspar potash enough for a large crop of grain. If this conclusion is verified by future work, some of our feldspars may prove a cheap source of potash to the farmers of the State.

EXPERIMENTS IN GROWING MIXED GRAINS.

Prof. WALTER BALENTINE.

Experiments in determining the relative amount of stock food that can be produced by sowing mixed peas and oats as compared with oats grown alone, and mixed peas and barley as compared with oats and peas or oats, were not entirely satisfactory on account of the rust attacking the oats and thereby depressing the yield.

Three plots, 244 feet by 150 feet, containing 85-100 of an acre, were selected and fertilized at the rate of 1000 pounds of finely ground South Carolina rock, 150 pounds of sulphate of ammonia and 100 pounds of muriate of potash per acre. One plot was sown to oats and peas at the rate of two bushels of oats and one bushel of Canada peas per acre, one plot to oats at the rate of two bushels to the acre and one plot to barley and peas at the rate of one and one-half bushels of barley and one bushel of peas per acre.

Name of crop.	Total crop.	Grain.
Oats and peas,	2330 lbs.	700 lbs.
Oats,	2565 "	689 "
Barley and peas,	3200 "	978 "

The plot on which the barley and peas were sown produced but little barley, the barley plants apparently having been smothered by the peas.

One of the principal objects in sowing peas and grain together is that the peas shall be held in an upright position by the grain; this office the barley did not fulfill in our experiment, and on account of the weakness of the straw of the barley it is doubtful if it is desirable to use as a crop to grow with peas.

TESTS OF VARIETIES.

Prof. WALTER BALENTINE.

FIELD TESTS WITH VARIETIES OF BARLEY AND OATS.

For several years the Station has been doing considerable work in testing varieties of oats and barley. Of the many varieties of oats and barley on trial during these years only a few have been considered of sufficient merit to warrant us in continuing to grow them. Of these there were two of barley and five of oats, which were sown on half acre plots with the following results as to yield in grain:

No. of plot.	Name of Variety.	Yield of grain—lbs.
1	Chevalier Barley	813
2	Champion Two Rowed Barley	1112
3	White Seizure Oats	472
4	Victoria Oats	578
5	New Race Horse Oats	634
6	Clydesdale Oats	450
7	Henderson's Clydesdale	190

The yields of barley were very satisfactory but owing to the attack of rust on the oats the results are not as favorable for any of the varieties as was expected from the condition of the ground on which they were sown and the previous yields of these varieties on similar plots.

TEST OF VARIETIES OF PEAS.

Six varieties of peas which have not been tested previously at the Station have been on trial with the following results:

Number.	Name.	When planted.	Date of blossoming.	When peas were large enough to shell.	Date of pulling.	Weight.	Quality.
1	American Champion......	May 30	July 12	July 31	Aug. 28	12 lbs, 8 oz.	Good.
2	Yorkshire Gem	" 30	" 15	Aug. 3	" 28	18 lbs., 6 oz.	Extra.
3	Sander's Marrow.........	" 30	" 17	" 15	Sept. 10	15 lbs.	Good.
4	Epicure.................	" 30	" 2	July 20	Aug. 19	4 lbs., 2 oz.	Inferior.
5	Melting Sugar...........	" 30	" 10	Aug. 1	" 28	5 lbs., 9 oz	Inferior.
6	Henderson's Wild Summer,	" 30	" 13	" 3	" 28	6 lbs., 13 oz.	Extra.

POTATO TESTS.

One hundred and seven varieties of potatoes have been on trial with the results shown in the following table:

Number.	Name of Potatoes.	Date of planting.	Number of hills.	Date of blossoming.	Date of tops dying.	Date of digging.	Weight of large—lbs.	Weight of small—lbs.	Quality.
1	Advance	May 15	120	July 4	Aug. 12	Sept. 19	35	12	Good.
2	Alexander's Prolific	"	120	June 25	" 14	" 19	109½	11	"
3	Beauty of Hebron	"	120	" 27	" 12	" 19	39	10½	"
4	Belle	"	20	July 2	" 14	" 19	78	4½	"
5	Burbank Sport	"	20	" 8	" 15	" 19	84	12½	"
6	Burbank Seedling	"	120	June 27	" 15	" 19	114	12	"
7	Bonanza	"	120	July 8	" 20	" 20	45½	13	Inferior.
8	Brownell's Best	"	70	" 17	" 17	" 20	51	14	Good.
9	Bliss' Triumph	"	10	-	" 12	" 20	99	9	"
10	Beauty of Beauties	"	10	July 1	" 15	" 20	65	7½	"
11	Clark's No. 1	"	120	June 25	" 12	" 20	53½	12	"
12	Charter Oak	"	120	July 2	" 17	" 20	108	5½	Medium.
13	Charles Downing	"	120	" 2	" 17	" 20	119	35	Good.
14	Cowhorn	"	88	" 7	" 19	" 20	89	7	Medium.
15	Dunmore	"	120	" 11	" 19	" 20	75	13	Good
16	Dictator	"	120	-	" 20	" 20	101½	14	Inferior.
17	Delaware	"	120	June 22	" 20	" 23	114½	19	Good
18	Dakota Red	"	120	July 8	" 17	" 23	82	21	Medium.
19	Early Ohio	"	120	June 29	" 17	" 23	80	16	"
20	Early Maine	"	120	" 27	" 12	" 23	72	21	Inferior.
21	Early Vermont	"	120	July 4	" 12	" 23	55	20	Medium.
22	Early Sunrise	"	120	" 3	" 12	" 23	67	14	Good.
23	Early Essex	"	120	" 2	" 12	" 23	45	10	"
24	Early Goodrich	"	120	" 8	" 12	" 23	123½	16	Medium.
25	Early Gem	"	100	June 27	" 12	" 23	49	14	"
26	Early King	"	84	-	" 12	" 23	63	12	"
27	Early Mayflower	"	91	-	" 12	" 23	66	24	Good.
28	Early Rose	"	120	June 25	" 12	" 24	83½	20	"
29	Early Electric	"	76	July 6	" 12	" 24	55	8	"
30	Early Standard	"	120	June 27	" 12	" 24	70	22	"
31	Early Oxford	"	99	" 25	" 12	" 24	83½	14½	Medium.
32	Early Washington	"	120	July 8	" 12	" 24	66¾	24	Good.
33	Eight Weeks	"	120	June 29	" 12	" 24	65¼	19½	"
34	Empire State	"	120	" 25	" 15	" 24	69¼	11	Inferior.
35	Excelsior	"	78	-	" 15	" 24	41	13¼	"
36	Everitt	"	86	July 4	" 17	" 24	33½	6½	"
37	Filibasket	"	2	" 2	" 17	" 24	23	2½	"
38	Farina	"	102	" 4	" 15	" 24	60	12½	Good.
39	Garfield	"	120	June 25	" 12	" 25	115½	13	Medium.
40	Great Eastern	"	120	July 12	" 20	" 25	76	12½	Inferior.
41	Gold Flesh	"	82	" 17	" 19	" 25	60	15	Good.
42	Gregory's No. 1	"	74	June 25	" 19	" 25	65½	14½	"
43	Hale's Early Peach-blow,	"	120	July 4	" 20	" 25	99	10	Medium.
44	Hampden Beauty	"	92	June 27	" 17	" 25	73½	17½	Good.
45	Howe's Premium	"	1	-	" 12	" 25	13	2	"
46	Howe's Comfort	"	93	July 1	" 15	" 25	86½	11	Extra.
47	Hall's Peach-blow	"	41	" 2	" 15	" 25	35	4½	Good.
48	Improved White Rose	"	120	" 8	" 19	" 25	78	15¾	Inferior.
49	Irish Champion	"	66	" 12	" 19	" 25	69	11½	Medium.
50	Improved Irish Cup	"	90	June 29	" 19	" 26	70	16	"
51	Jackson White	"	120	July 1	" 20	" 26	110¾	9½	Inferior.
52	John Emerson's Seedling,	"	39	" 4	" 16	" 26	27	12	Good

POTATO TESTS—CONCLUDED.

Number.	Name of Potatoes.	Date of planting.	Number of hills.	Date of blossoming.	Date of tops dying.	Date of digging.	Weight of large—lbs.	Weight of small—lbs.	Quality.
53	Junkins.............	May 15	93	July 8	Aug. 16	Sept. 26	81½	16	Inferior.
54	Jumbo...............	“	120	-	“ 16	“ 26	87¾	9	Medium.
55	Jerrard's Cal. Seedling,	“	5	July 3	“ 12	“ 26	4	1	“
56	Lees' Favorite	“	120	June 27	“ 12	“ 26	121	19	Good.
57	Late Beauty of Hebron,	“	120	“ 27	“ 16	“ 26	130½	11½	Medium.
58	Morning Star.........	“	120	July 4	“ 15	“ 26	125	10	Good.
59	Monroe Co. Prize.....	“	120	July 4	“ 10	“ 26	127	6	Inferior.
60	Matchless.............	“	46	“ 8	“ 16	“ 26	37½	10¾	Good.
61	Minister...............	“	108	June 25	“ 13	“ 26	136½	24	“
62	Mullally..............	“	52	July 10	“ 13	“ 26	73½	11½	Medium.
63	Manhattan...........	“	83	-	“ 15	“ 26	104	15	“
64	....	“	112	June 27	“ 12	“ 26	110½	20	Good.
65	New Wide Awake......	“	120	July 1	“ 10	“ 26	114	15	Extra.
66	New Queen	“	111	June 27	“ 12	“ 26	131	10	“
67	Orange Co. White......	“	120	July 4	“ 19	“ 26	146	21	Medium.
68	O K. Mammoth Prolific,	“	120	-	“ 19	“ 26	109	19	“
69	Old White Carter......	“	120	July 2	“ 19	“ 27	68	19	“
70	Pearl of Savoy.........	“	120	June 25	“ 20	“ 27	96	20	Good.
71	Perfect Peach-blow....	“	120	July 4	“ 20	“ 27	135	23	Inferior.
72	Purple Blush..	“	86	-	“ 16	“ 27	74	20	Extra.
73	Putnam's Beauty......	“	96	July 8	“ 17	“ 27	64	14½	Good.
74	Putnam's Early	“	120	June 27	“ 12	“ 30	122½	19	Medium.
75	Putnam's Select.......	May 16	86	-	“ 12	“ 30	77	23¾	Extra.
76	Putnam's New Rose....	“	109	June 25	“ 12	“ 30	112¾	14½	Good.
77	Pecan................	“	78	“ 25	“ 15	“ 30	62½	15	“
78	Perfect Gem	“	78	-	“ 15	“ 30	80	5½	“
79	Pride of Palestine.....	“	96	July 2	“ 17	“ 30	98	16	“
80	Queen of the Roses.....	“	120	June 22	“ 13	“ 30	74	11	Medium.
81	Queen of the Valley....	“	120	“ 27	“ 16	“ 30	77	10	Good.
82	Rose's Magnum Bonum,	“	120	July 3	“ 13	“ 30	78	9½	“
83	Rural Blush	“	120	“ 1	“ 20	“ 30	85½	12	“
84	Rochester Favorite.....	“	120	“ 12	“ 19	Oct. 3	105½	9½	Medium.
85	Red Elephant.........	“	120	June 25	“ 16	“ 3	74	9½	“
86	Rose's New Giant......	“	120	July 2	“ 20	“ 3	106	11	Inferior.
87	Rose's B'uty of B'uties,	“	120	-	“ 15	“ 3	84	10½	Medium.
88	Rural N. Yorker No. 2,	“	120	July 4	“ 17	“ 3	46½	9	Inferior.
89	Randall's Beauty......	“	84	“ 4	“ 16	“ 3	70½	22½	Medium.
90	St. Patrick...........	“	120	“ 3	“ 19	“ 3	73	12½	“
91	Stray Beauties.........	“	120	-	“ 20	“ 3	110½	15	Good.
92	Snow Queen	“	90	-	“ 20	“ 3	51	20	Extra.
93	Seneca Red Jacket.....	“	120	July 8	“ 16	“ 3	79	10½	Medium.
94	Thorburn.............	“	120	June 27	“ 12	“ 3	104	14¼	Extra.
95	Thorburn Late Rose....	“	120	“ 27	“ 13	“ 3	86	12½	Good.
96	Triumph.	“	120	July 4	“ 12	“ 3	87	12	Medium.
97	Thunderbolt	“	88	-	“ 16	“ 4	79	11	Inferior.
98	Vanguard	“	120	July 2	“ 12	“ 4	77	17½	Good.
99	Vermont Champion....	“	120	-	“ 15	“ 4	109	17	Inferior.
100	Watson's Seedling	“	120	June 27	“ 20	“ 4	91½	18	Medium.
101	White Star............	“	120	July 12	“ 16	“ 4	102½	15	Inferior.
102	White Elephant.......	“	120	“ 4	“ 19	“ 4	108½	24	“
103	White Seedling........	“	120	“ 8	“ 20	“ 4	123½	6	“
104	Windoser's No 1.......	“	100	“ 2	“ 12	“ 4	39½	6½	Good.
105	Wood Ants..	“	78		“ 12	“ 4	51	19	“
106	Wall's Orange.........	“	120	July 4	“ 17	“ 4	77	16½	Medium.
107	White B'uty of Hebron,	“	120	June 27	“ 15	“ 4	113½	15½	Good.

REPORT OF BOTANIST AND ENTOMOLOGIST.

Prof. F. L. HARVEY.

The work of the division of Botany and Entomology, the past season, has been in the directions indicated below:

BOTANY.

1. Germination experiments. To determine the vitality and purity of seeds sold in Maine.
2. Testing varieties of grasses. To determine their adaptability to Maine.
3. Consideration of potato blight. In an exigency bulletin and more in detail for this report.
4. A compilation (for this report) of results of experiments on apple scab, made under the auspices of the Agricultural Department, Washington, D. C.
5. Examination of fungi affecting fruits, sent for determination by fruit growers.
6. Examination of weeds, grasses and other plants sent for determination.
7. Collection of herbarium specimens of grasses and other economic plants.
8. Collection of seeds of weeds and other plants, for use in naming seeds.
9. Paper—"Fungi Injurious to Fruits." Read before the State Pomological Society, and to appear in its annual report.
10. Consideration of false flax and rib grass in this report.

ENTOMOLOGY.

11. An exigency bulletin on the apple maggot.
12. The Apple Maggot.—An extended article for this report.
13. Paper—"The Apple Maggot." Read before the Pomological Society at Norway, Me.
14. Preliminary study of a scale insect affecting the elms in Maine.
15. Preliminary study of the White Marked Tussock Moth and the Fall Web Worm.
16. Study of the codling moth to learn whether there are two broods in Maine.

MISCELLANEOUS.

17. Answering of many letters about insects, plants, fungicides, insecticides, spraying and spraying apparatus.

18. Article on spraying and spraying apparatus for this report.

That portion of the work mentioned above, which is completed and is of enough importance, is considered below. When comparing the work of this Station in botany and entomology with that of others, it should be remembered that the botanist and entomologist gives but one-third of his time to Station duties. Mr. F. P. Briggs as assistant, has rendered efficient service in conducting germination tests, looking after the grass plots, and collecting for the herbarium. Correspondence regarding plants and insects, especially injurious fungi and insects, is solicited. Directions for sending specimens may be found in Station Report, 1888, p. 194, or in Maine Agricultural Report, 1888, p. 158. I desire to thank the citizens of the State for the aid they have given me in the prosecution of my work, and also to thank the director and other Station officers for their co-operation and encouragement.

GERMINATION EXPERIMENTS.

The germination experiments conducted the past season were a continuation of those performed and reported in 1888. They were conducted by Mr. F. P. Briggs in the same manner and with the same apparatus described in the Annual Report for 1888, p. 102. They were undertaken for two reasons: to test commission seeds, offered for sale in Maine, that were not examined in 1888; and to investigate a complaint from Aroostook county that dealers in that section were selling poor seeds.

For the first purpose we selected seeds put up by J. B. Rice, Cambridge, N. Y.; E. W. Lyman, Springfield, Mass.; A. H. Dunlap & Sons, Nashua, N. H.; and Lewis Atwood, Winterport, Me., and offered for sale on commission in Orono, Me. The detailed results of these tests are shown in the general table, numbers 151 to 190 inclusive. Below is given a special table showing the seeds tested, the per cent. of each kind that germinated and the average.

Comparative Results of Garden Seeds Tested.

Seeds Tested.	Lettuce.	Cabbage.	Celery.	Parsnips.	Onion.	Turnip.	Tomato.	Radish.	Carrot.	Beet.	Average per cent. germinated.
Rice's, commission........	46	90	68	58	81	74	84	88	45	81	71.5
Dunlap's, commission.......	98	74	10	52	36	79	78	76	56	92	65.1
Atwood's, commission.......	96	0	58	41	73	62	82	6	57	60	53.5
Lyman's, commission........	0	91	32	0	0	4	57	80	22	48	33.4

The above table shows, that Rice's seeds were the best, that Dunlap's were second, Atwood's next and Lyman's much below the others and very poor. Rice's seeds were all good Dunlap's seeds were all good excepting the celery. Leaving this out the others are nearly equal to Rice's. Atwood's cabbage and radish seed were the poorest tested and *very* poor. Leaving those out the others make a better showing, though inferior to either Rice's or Dunlap's. Lyman's cabbage seeds were the best tested and his radish seeds next best, but all the others were poor and none of the lettuce, parsnip and onion seed sprouted.

Among the seeds obtained from Aroostook county were some put up by the above dealers which has enabled us to farther test their quality. Lyman's seeds are not sold to any extent in Aroostook county. Those of Parker & Wood and Delano Moore, Presque Isle, Me., and Oscar Holloway, Auburn, Me., are sold. They are included in the table given below:

Seeds Tested.	Lettuce.	Cabbage.	Celery.	Parsnip.	Onion.	Turnip.	Tomato	Radish.	Carrot.	Beet.	Salsify.	Sweet corn.	Red clover.	Timothy.	Alsike.	Pea-vine clover.
Rice's, commission....................	83	85	23	58	84	72	99	83	46	77	66	85				
Dunlap's, commission	79	48	-	40	34	70	-	83	57	81						
Atwood's, commission	31	96	-	3	-	79	23	4	-	44						
Delano Moore's........................	-	-	-	82	-	99	-		82	84	-	90	81	93		
Oscar Holloway's......................	-	-	-	-	-	-	-	-		-	-	-	89	97	70	94
Parker & Wood's.......................	-	-	-	-	-	-	-	-	-	-	-	-	77	95	76	

The above table confirms the statement regarding the relative quality of Rice's, Dunlap's and Atwood's seeds. The garden seeds of Delano Moore, grown in Aroostook county, showed a high germination per cent. and great vitality, but the Timothy and clover seeds were a little inferior to others tested, though good. Those of Oscar Holloway and Parker & Wood did not include garden seeds, but their seeds of forage plants were of excellent quality.

For the pupose of easy comparison we reprint the table showing the result of work done in 1888.

Comparative Results of Garden Seeds Germinated.

Name.	Chick's seed in bulk.		Dunning's seed in bulk.		Emerson's commission seeds in packets.		Ferry's seeds in packets.		Iowa Seed Company's seeds in packets.		Dep. Agriculture seeds in packets.	
	Varieties tested.	Average per cent germinated.	Varieties tested.	Average per cent germinated.	Varieties tested	Average per cent germinated.	Varieties tested.	Average per cent germinated.	Varieties tested	Average per cent germinated.	Varieties tested	Average per cent germinated.
Lettuce	1	99	1	77	1	10	1	98	-	-	2	90
Turnip........	1	76	1	29	1	97	1	71				
Cabbage	1	69	1	88	1	92	1	73	-	-	4	80
Parsnip	1	44	1	34	1	49	1	70				
Celery.........	1	27	1	62	1	48						
Onion	1	74	1	62	1	95	1	67				
Beet..........	1	63	1	18	1	77	1	76	1	60		
Carrot.........	-	-	1	51	1	48	1	60	-	-	6	66
Tomato........	-	-	-	-	-	-	-	-	-	-	4	58

To investigate the complaints from Aroostook county, seeds were purchased from John Watson, Houlton, Me., E. Merritt & Sons, Houlton, Me.; Charles Wilson, Houlton, Me.; A. H. Fogg & Co.; Houlton, Me.; J. A. Miller, Houlton, Me.; J. F. Hacker, Fort Fairfield, Me.

An examination of the general table, Nos. 205 to 293, will show that the most of the seeds sold in Aroostook are commission seeds put up by various growers and dealers in and out of the State. The question then is largely what seeds sold in Aroostook are those of reliable growers, and what dealers handle them. The tables show that the garden seeds of Ferry, Rice and Moore have a high germinating power, that Dunlap's seeds are not quite so good, that only about 50 per cent. of Atwood's seeds will sprout and that Lyman's seeds are very poor. The garden seeds from Delano Moore were grown in Aroostook county and showing such vitality they give a promising outlook for Maine seed growers.

REMARKS.

The most of the seeds offered for sale in Maine are not grown in the State, but are sold by growers outside of the State directly to the farmers, or are sold on commission by dealers in the State. Other seeds grown outside the State are purchased in bulk by wholesale Maine seedsmen and by them retailed loose, or in packets. Reliable seedsmen, in the autumn or winter, gather the seeds not sold by commission merchants and replace them by new. The seeds offered by some dealers would indicate that old seed is re-distributed. It is to the interest of growers, wholesale dealers and packers to sell good seed, for a reputation cannot be sustained with inferior seeds. It is to the interest of commission merchants to handle only reliable seeds. Failure of crops from poor seed is liable to create suspicion. The tests made by the Station confirm the judgment of growers, for those seeds found to be poor, are the ones the farmers suspect and the merchants will not recommend. We need no State law to regulate this matter as it will sooner or later regulate itself. Farmers by always selecting good seed will drive poor seed from the market.

The object of testing seeds at the Station is to point out reliable growers and those dealers in Maine who put up, or handle on commission, the seeds of reliable growers. We do not conduct these experiments to test the honesty of seedsmen, but in the interest of both planter and seedsmen, that the grower may know what seeds are reliable and that the dealer may know where to obtain them.

Our tests show that the seeds of some dealers, wherever taken in the State, have a high germinating power, while the seeds of others are *invariably* poor. Most commission merchants offer for sale the seeds of several growers, and it is the object of germination tests to show which growers puts up the best seeds. There is not care enough taken by many farmers in the selection of seed. Where no preference is expressed the merchant is liable to dispose of the poorer seed. Farmers are sometimes in a hurry, and when the seed they usually plant cannot be readily had they take almost any kind. The selection of seed should be done before the rush of planting time, when care can be exercised. Our advice to farmers is to never buy seeds of doubtful character, and to dealers never to handle them. By working together, poor seed will be driven from the market, the business of reliable seedsmen become less precarious and the crops of the farmer more certain.

It should be remembered that the seeds tested were germinated under the most favorable conditions, and a larger number sprouted than would grow if planted in the ground. Two things may be learned from this: First, seeds which show a low vitality and germinating power with such favorable conditions would not germinate well in the ground. Second, seeds grown in a warmer climate may nearly all sprout in the germinator, but not come up well when put in the ground, or at least not produce a good crop, because they are not adapted to our climate. Good seeds grown in our latitude, if they could be obtained, would be the best to plant.

MOLDY SEEDS.

The apparatus used was scalded after each experiment, to destroy all germs of fungoid growth, but the seeds themselves, especially the poorer ones, contained spores which produced mold in two or three days. As seeds sprouted after being covered with mold for more than a week, it was supposed the surface mold did not affect their vitality. But to test the supposition, and also to see if anything could be found that would destroy the spores without injuring the seeds, a solution of corrosive sublimate in alcohol was tried. One part of the solution was diluted with ten thousand parts of water and the seeds dipped in this, then washed with water that had been boiled. In these cases the seeds did not mold nor did the solution injure them in any way as far as could be seen. About the same number sprouted as when the corrosive sublimate was not used. Only a few experiments were tried and these seemed to show, that the solution was neither beneficial nor predjudicial to germination, though the mold might affect the growth after sprouting. More extended trials might show different results, and such may be undertaken another year.

EXPLANATIONS.

In the following tables these abbreviations for the growers of seeds are used: Rice, J. B. Rice, Cambridge, N. Y.; Lyman, E. W. Lyman, Springfield, Mass.; Dunlap, A. H. Dunlap & Sons, Nashua, N. H.; Atwood, Lewis Atwood, Winterport. Me.; Dept. Agr., Department Agriculture, Washington, D. C.; Moore, Delano Moore, Presque Isle, Me.; Holloway, Oscar Holloway, Auburn, Me.; P. & W., Parker & Wood; Ferry, D. M. Ferry & Co., Detroit, Mich. Numbers 151 to 190 inclusive were obtained in Orono, all of one dealer. Numbers 193 and 194 are two varieties of cauliflower seed, sent to the Station by H. A. Marsh, Fidalgo, Wash. He claims that the seed can be grown at half the cost of imported seed. It not only shows a great germinating power, but also high vitality, as nearly all the seeds sprouted in two days.

Numbers 205 to 216 were obtained from John Watson, Houlton, Me.; 217 to 246, of E. Merritt & Sons, Houlton, Me.; 247 to 256, of Charles Wilson, Houlton, Me.; 257 to 268, of A H. Fogg & Co., Houlton, Me.; 269 to 293, of J. A. Miller, Houlton, Me.; 294 to 309, of J. F. Hacker, Fort Fairfield, Me.

Results of Germination Tests.

Serial number.	Station number.	Description.	Weight of 100 seeds in grams.	Number of seeds sprouted each day. 1st	2d	3d	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	Sound seeds left.	Per cent sprouted.	No. of days required for one-half to sprout.
		Commission Seeds Purchased in Orono, Me.																		
		LETTUCE.																		
151	165	Early Curled Silesia, Rice	.116	0	0	1	13	12	10	7	0	1	2	0	0	0	0	0	46	
152	166	" " " Lyman	.092	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
153	167	" " Simpson, Dunlap	.147	0	13	12	35	4	21	10	0	1	1	0	0	1	0	0	98	4
154	168	Lee's Immense Hardy Green, Atwood	.140	0	51	34	6	3	1	1	0	0	0	0	0	0	0	0	96	2
		CABBAGE.																		
155	169	Fottler's Improved Brunswick, Rice	.413	3	78	5	3	0	0	0	0	0	0	1	0	0	0	6	90	2
156	170	Premium Flat Dutch, Lyman	.405	2	62	14	4	2	2	3	1	1	0	0	0	0	0	5	91	2
157	171	Improved Low Flat Dutch, Dunlap	.339	2	54	14	0	3	1	0	0	0	0	0	0	0	0	15	74	2
158	172	Early York, Atwood	.350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	0	
		CELERY																		
159	173	Boston Market, Rice	.044	0	0	0	0	0	7	16	16	16	2	5	4	2	0	31	68	9
160	174	" Lyman	.043	0	0	0	0	0	4	8	3	2	2	9	5	0	0	68	33	
161	175	" Dunlap	.050	0	0	0	0	0	0	0	0	1	3	3	3	0	0	80	10	
162	176	" Atwood	.051	0	0	0	0	0	2	6	18	10	13	4	3	2	0	34	58	11
		PARSNIP.																		
163	177	Long White Dutch, Rice	.371	0	0	0	0	4	15	11	15	7	4	1	0	1	0	40	58	9
164	178	" " " Lyman	.436	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	
165	179	" " Smooth, Dunlap	.402	0	0	0	2	11	12	14	4	5	3	0	0	0	1	40	52	10
166	180	" Hollow Crown, Atwood	.392	0	0	0	0	0	10	17	4	3	6	1	0	0	0	28	41	

		ONION.																		
167	181	Yellow Danvers, Rice.	.303	6	8	31	27	6	1	0	0	0	0	1	1	0	0	5	81	4
168	182	" Lyman	.338	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	0	
169	183	" Dunlap	.347	6	6	11	14	4	1	0	0	0	0	0	0	0	0	40	36	
170	184	" Atwood	.290	8	19	12	31	3	0	0	0	0	0	0	0	0	0	0	73	4
		TURNIP.																		
171	185	Skirving's Purple Top, Rice	.281	0	48	13	5	2	1	2	2	0	0	0	0	1	0	20	74	3
172	186	Carter's Improved, Lyman	.293	0	0	0	0	2	0	0	2	0	0	0	0	0	0	34	4	
173	187	Skirving's Purple Top, Dunlap	.278	1	63	7	2	2	1	0	1	1	0	0	1	0	0	17	79	2
174	188	Shamrock, Atwood	.306	0	31	11	5	4	3	2	2	0	0	3	0	1	0	31	62	6
		TOMATO.																		
175	189	Mikado, Rice	.249	0	3	14	61	5	1	0	0	0	0	0	0	0	0	0	84	4
176	190	Triumph Acme, Lyman	.258	0	1	0	14	36	3	2	0	1	0	0	0	0	0	29	57	5
177	191	Early Perfection, Dunlap	.265	0	0	0	56	16	3	2	0	0	1	0	0	0	0	9	78	4
178	192	Trophy, Atwood	.282	0	0	0	46	27	5	1	2	1	0	0	0	0	0	20	82	5
		RADISH.																		
179	193	Early Scarlet Turnip, Rice	.960	7	68	8	1	2	1	0	1	0	0	0	0	0	0	0	88	2
180	194	London Long Scarlet, Lyman	1.295	1	9	45	18	6	0	0	1	0	0	0	0	0	0	0	80	3
181	195	Early Long Scarlet, Dunlap	1.340	0	32	25	5	5	5	1	3	0	0	0	0	0	0	0	76	3
182	196	Early Scarlet Turnip, Atwood	.900	0	0	0	0	4	1	1	0	0	0	0	0	0	0	0	6	
		CARROT.																		
183	197	Improved Long Orange, Rice	.100	0	0	0	29	10	5	1	0	0	0	0	0	0	0	35	45	
184	198	" " " Lyman	.132	0	0	0	5	11	5	1	0	0	0	0	0	0	0	54	22	
185	199	" " " Dunlap	.110	0	0	3	35	10	2	2	1	2	1	0	0	0	0	14	56	6
186	200	" " " Atwood	.106	0	0	3	36	12	4	1	1	0	0	0	0	0	0	21	57	5
		BEET.																		
187	201	Dening's Early Blood, Rice	1.585	0	0	1	30	28	15	2	2	0	0	0	0	2	1	13	81	5
188	202	" " " Lyman	1.481	0	0	0	17	19	6	2	2	1	0	1	0	0	0	30	48	6
189	203	" " " Dunlap	2.445	0	0	0	24	29	27	8	3	0	0	1	0	0	0	4	92	5
190	204	" " " Atwood	2.107	0	0	0	9	25	20	3	2	0	0	1	0	0	0	30	60	6
191	205	Salsify, Rice	1.230	0	0	35	16	1	1	7	3	1	0	0	0	2	0	18	66	4
192	206	" Lyman	1.026	0	0	0	0	1	0	3	1	2	0	0	0	0	0	1	7	

Results of Germination Tests—Continued.

Serial number.	Station number.	Description.	Weight of 100 seeds in grams.	Number of seeds sprouted each day. 1st	2d	3d	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	Sound seeds left.	Per cent. sprouted.	No. of days required for one-half to sprout.
		Sent by H. A. Marsh, Fidalgo, Washington. CAULIFLOWER																		
193	207	American Snowball, Marsh....	.402	3	82	11	0	0	0	0	0	0	0	0	0	0	0	0	96	2
194	208	Erfust Earliest Dwarf, Marsh....	.348	1	95	2	1	0	0	0	0	0	0	0	0	0	0	0	99	2
		Obtained from Dep't Agr'l, Washington, D. C. ONION.																		
195	209	Early White Nocera, Department Agriculture....	.323	0	2	41	15	4	2	0	0	1	0	1	0	0	0	0	66	4
196	210	New Aduatic Barletta, " "	.400	0	7	11	31	3	1	3	0	0	0	0	0	0	0	6	56	5
197	211	Flat Maderia, " "	.384	0	0	66	12	8	0	1	0	0	2	0	0	0	0	4	89	3
198	212	Giant White Italian Tripoli, " "	.324	0	18	34	16	9	2	0	0	0	1	0	0	0	0	12	80	3
199	213	" Blood Red Racca, " " ...	.391	0	10	55	15	4	0	0	0	0	1	0	0	0	0	4	85	3
200	214	Early White Queen, " "	.387	0	40	59	0	0	0	0	0	0	0	0	0	0	0	0	99	3
201	215	Mammoth Silver King, " "	.375	0	25	68	4	0	0	0	0	0	0	0	0	0	0	0	97	3
202	216	" Pompeii, " "	.376	4	57	10	2	1	1	0	1	1	1	0	0	0	0	9	78	2
203	217	Giant Yellow Globe Racca, " "	.424	1	9	69	14	3	0	0	0	0	0	0	0	0	0	0	96	3
204	218	White Maggiajola, " " ...	.312	0	22	51	15	1	0	0	1	0	0	0	0	0	0	0	90	3
		Obtained of John Watson, Houlton, Me.																		
205	219	Hollow Crown Parsnip, Moore....	.452	0	0	1	6	23	24	16	8	0	3	1	0	0	0	10	82	6
206	220	Early Eclipse Beet, "	1.528	0	0	0	25	32	20	5	0	1	0	1	0	0	0	8	84	5
207	221	" Cory Sweet Corn, "	29.582	0	0	0	13	45	21	8	1	2	0	0	0	0	0	0	90	5
208	222	Ox-heart Carrot, "	.143	0	5	62	13	1	2	0	0	0	0	0	0	0	0	0	83	3
209	223	American Ruta Baga Turnip, Moore....	.293	90	5	4	0	0	0	0	0	0	0	0	0	0	0	0	99	1

210	224	Danvers' Carrot, "	.102	40	30	10	0	1	0	0	0	0	0	0	0	0	0	0	81	2
211	225	Red Clover, "	.175	35	35	9	2	0	0	0	0	0	0	0	0	0	0	0	81	2
212	226	Timothy "	.038	0	28	32	33	0	0	0	0	0	0	0	0	0	0	0	93	3
213	227	Red Clover, Holloway	.145	51	20	18	0	0	0	0	0	0	0	0	0	0	0	0	89	1
214	228	Timothy, "	.032	0	24	56	16	1	0	0	0	0	0	0	0	0	0	0	97	3
215	229	Alsike Clover, "	.058	43	20	6	1	0	0	0	0	0	0	0	0	0	0	9	70	2
216	230	Pea-vine Clover, Holloway	.165	70	20	4	0	0	0	0	0	0	0	0	0	0	0	0	94	1
		E. Merrit & Sons, Houlton, Me.																		
217	231	Sweet Fodder Corn, P. & W	19.000	0	0	3	36	25	5	1	0	0	1	1	0	0	0	0	72	5
218	232	Sanford Field Corn, "	36.725	0	0	3	42	24	1	2	1	0	0	0	0	0	0	0	73	5
219	233	Marblehead " "	23.152	0	0	0	18	31	17	2	0	0	0	0	0	0	0	0	68	6
220	234	Crosby's Early Sweet, Rice	21.130	0	0	1	35	29	8	1	2	0	0	0	0	0	0	0	76	5
221	235	Red Clover, P. & W.	.173	7	20	30	7	6	4	2	1	0	0	0	0	0	0	12	77	3
222	236	Alsike " "	.056	40	20	13	0	2	1	0	0	0	0	0	0	0	0	0	76	2
223	237	Timothy, "	.033	0	30	38	27	0	0	0	0	0	0	0	0	0	0	0	95	3
224	238	Dewing's Blood Turnip Beet, Dunlap	2.21	0	0	0	19	35	16	3	6	0	0	1	1	0	0	9	81	5
225	239	" " " " Ferry	2.30	0	0	0	10	23	37	11	3	1	1	0	0	0	0	7	86	6
226	240	Long Smooth Parsnip, Dunlap	.388	0	0	0	1	8	9	12	7	2	2	1	0	1	0	50	43	
227	241	" Flat Dutch " Ferry	.392	0	0	0	1	5	10	16	7	8	2	3	2	0	0	37	54	11
228	242	Early Prize Head Lettuce, Dunlap	.150	0	14	2	13	9	10	4	4	5	8	0	1	0	0	22	70	6
229	243	White Head Lettuce, Ferry	.118	0	78	1	1	0	1	2	0	0	0	0	0	0	0	0	83	2
230	244	Stone Mason Cabbage, Dunlap	.341	0	10	16	7	3	4	3	3	0	1	1	0	0	0	0	48	
231	245	Late Flat Dutch " Ferry	.330	1	29	61	1	1	2	0	0	0	0	0	0	0	0	3	95	3
232	246	Long Orange Carrot, Dunlap	.095	0	8	15	23	2	6	3	0	0	0	0	0	0	0	0	57	6
233	247	" " " Ferry	.118	0	4	12	25	9	3	2	2	0	0	0	0	0	0	15	57	5
234	248	Purple Top Turnip, Dunlap	.200	3	10	21	14	3	4	2	0	0	0	0	0	0	0	0	57	5
235	249	" " " Ferry	.280	0	10	32	11	4	5	3	0	0	0	0	0	0	0	0	65	4
236	250	Phinney's Early Watermelon, Dunlap	3.600	0	0	0	0	0	3	38	10	1	0	0	0	0	0	48	52	8
237	251	Mountain Sprout " Ferry	4.512	0	0	0	6	20	56	0	4	0	0	0	0	0	0	10	86	6
238	252	Early Red Globe Onion, Dunlap	.368	4	16	10	2	0	0	0	0	0	0	0	0	0	0	15	32	
239	253	" Long Scarlet Radish, Ferry	1.412	1	54	6	3	3	1	0	0	0	0	0	0	0	0	0	68	2
240	254	Five varieties Radish, Rice	.948	7	68	6	1	1	0	0	0	0	0	0	0	0	0	0	83	2
241	255	Livington's Perfection Tomato, Ferry	.292	0	0	4	36	0	4	4	0	2	0	2	0	0	0	40	72	5
242	256	New Dwarf Champion " Rice.	.298	0	0	30	61	4	3	1	0	0	0	0	0	0	0	0	99	4
243	257	Tupple Curled Parsley, Ferry	.175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
244	258	Burple's Ruby King Pepper, Rice	.675	0	0	0	0	0	2	4	10	8	2	1	1	0	0	72	28	
245	259	Gregory's Early Mammoth Cabbage, Rice	.330	50	25	8	2	0	0	0	0	0	0	0	0	0	0	0	85	1
246	260	White Plume Celery, Rice	.040	0	0	0	0	2	10	7	3	1	0	0	0	0	0	28	23	

Results of Germination Tests—Continued.

Serial number.	Station number.	Description.	Weight of 100 seeds in grams.	Number of seeds sprouted each day. 1st	2d	3d	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	Sound seeds left.	Per cent sprouted.	No. of days required for one-half to sprout.
		Purchased of Charles Wilson, Houlton, Me.																		
247	261	Long Dark Blood Beet, Atwood	1.834	0	0	2	18	12	7	3	2	0	0	0	0	0	0	52	44	
248	262	Mountain Sweet Watermelon, Atwood	10.510	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
249	263	Student Parsnip, "	.410	0	0	0	0	0	0	1	0	0	2	0	0	0	0	94	3	
250	264	Golden Ball Turnip, "	.198	0	20	32	17	7	6	3	0	0	0	0	0	0	0	0	85	3
251	265	Skirving's Purple Top Turnip, "	.275	13	20	14	6	2	8	4	1	1	2	1	0	0	0	8	72	3
252	266	Early Scarlet Radish, "	.900	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	4	
253	267	English Broad Leaved Sage, "	.724	0	0	0	0	0	0	1	2	2	0	1	0	0	0	90	6	
254	268	Flat Dutch Cabbage, "	.285	1	74	13	3	2	1	2	0	0	0	0	0	0	0	0	96	2
255	269	Smooth Red Tomato, "	.330	0	0	0	0	1	3	4	3	5	5	2	0	0	0	8	23	
256	270	Curled Silesia Lettuce	.150	0	10	3	1	13	1	0	0	0	2	0	0	0	0	26	30	
		Purchased of A. H Fogg & Co., Houlton, Me.																		
257	271	Blood Turnip Beet, Rice	1.550	0	0	0	17	24	20	5	1	2	1	1	0	0	0	22	71	6
258	272	Long White Dutch Parsnip, Rice	.417	0	0	0	0	0	3	13	18	11	5	5	2	1	0	42	58	10
259	273	Simpson Lettuce, "	.164	0	63	3	10	4	2	1	0	0	0	0	0	0	0	14	83	2
260	274	Evergreen Sweet Corn, "	22.176	0	0	3	22	30	29	7	2	1	0	0	0	0	0	0	94	5
261	275	Wethersfield Red Onion, "	.341	10	32	39	7	4	1	0	1	0	0	0	0	0	0	3	94	3
262	276	Flat Dutch Turnip, "	.210	12	15	22	14	3	4	2	0	0	0	0	0	0	0	10	72	4
263	277	Early Scarlet Radish, "	.880	5	70	4	3	0	0	0	0	0	0	0	0	0	0	0	82	2
264	278	Henderson's Early Cabbage, "	.413	56	24	12	1	1	0	0	0	0	0	0	0	0	0	0	94	1
265	279	Short Horn Carrot, "	.125	0	0	10	23	6	5	2	0	0	0	0	0	0	0	20	46	
266	280	White Clover	.054	51	26	4	1	1	0	0	0	0	0	0	0	0	0	0	83	1
267	281	Alsike "	.062	36	12	10	4	3	1	0	0	0	0	0	0	0	0	30	66	4
268	282	Red "	.145	45	30	14	0	0	0	0	0	0	0	0	0	0	0	0	89	2

		Purchased of J. A. Miller, Houlton, Me.																		
269	283	Stowell's Evergreen Sweet Corn, Ferry	22.576	0	0	1	28	40	28	2	0	0	0	0	0	0	0	0	99	5
270	284	New Cory Sweet Corn, Rice....................	21.428	0	0	0	5	38	21	14	5	3	1	0	0	0	0	0	87	6
271	285	Dark Red Eclipse Beet, "	2.237	0	0	12	50	11	10	1	0	0	0	0	0	0	0	16	84	4
272	286	Mammoth Cabbage Lettuce, Rice	.173	0	81	5	4	1	0	0	0	0	0	0	0	0	0	0	91	2
273	287	New Volunteer Tomato, "	.337	0	11	65	13	2	0	0	0	0	0	0	0	0	0	0	91	3
274	288	Burpee's Ruby King Pepper, "	.666	0	0	0	0	0	1	8	5	5	2	1	2	1	0	75	25	
275	289	Blood Turnip Beet, Dunlap....................	1.450	0	0	0	20	24	15	8	3	0	2	0	1	0	0	15	73	6
276	290	Silver Leaf Beet, "	1.770	0	0	0	23	36	11	8	1	2	0	1	0	0	0	14	82	5
277	291	Winingstadt Cabbage, "	.312	0	0	4	2	2	2	5	3	2	2	2	1	0	0	75	25	
278	292	Purple Top Turnip, "	.304	80	2	2	3	2	1	0	0	0	0	0	0	0	0	0	90	1
279	293	Early Scarlet Radish, "	1.421	0	68	8	1	3	2	1	0	0	0	0	0	0	0	0	83	2
280	294	" Red Globe Onion, Dunlap..................	.323	3	17	15	1	0	0	0	0	0	0	0	0	0	0	12	36	
281	295	" Prize Head Lettuce, "	.168	0	9	7	22	27	5	2	0	6	4	0	0	0	0	0	82	5
282	296	White Smooth Parsnip, "	.418	0	0	0	0	4	8	9	7	5	3	1	0	0	0	63	37	
283	297	Blood Turnip Beet, Ferry.	2.120	0	0	1	6	30	33	7	9	0	0	1	2	0	0	11	89	6
284	298	Long Orange Carrot, "	.122	0	0	15	14	8	2	2	3	0	0	0	2	1	0	10	47	
285	299	Yellow Montanagny Turnip, Ferry.	.302	7	28	30	30	3	1	0	0	0	0	0	0	0	0	0	99	3
286	300	Strap Leaved Turnip, "	.308	73	10	4	1	1	0	0	0	0	0	0	0	0	0	0	89	1
287	301	Winingstadt Cabbage, "	.310	4	79	5	1	0	1	0	1	1	1	0	0	0	0	0	93	2
288	302	Crawford's Half Dwarf Celery, Ferry.............	.058	0	0	0	0	2	3	7	3	4	2	1	1	0	0	40	23	
289	303	Early Scarlet Radish, "	1.430	34	33	3	1	0	0	0	0	0	0	0	0	0	0	0	71	2
290	304	Peerless Watermelon, "	9.623	0	0	0	0	20	30	10	4	0	2	0	0	0	0	34	66	6
291	305	Long White Dutch Parsnip, "	.421	0	0	0	0	2	11	15	6	3	1	2	0	0	0	0	40	
292	306	Sweet Mountain Pepper, "	.660	0	0	8	20	15	5	3	5	5	2	3	1	0	0	0	67	8
293	307	Trophy Tomato, "	.314	0	54	29	3	1	1	0	2	0	0	0	0	0	0	0	90	2
		Purchased of J. F. Hacker, Fort Fairfield, Me.																		
294	308	Alsike Clover..........	.064	43	30	9	2	0	0	0	0	0	0	0	0	0	0	0	84	2
295	309	Red Clover..................................	.147	20	20	15	5	1	1	0	0	0	1	0	0	0	0	0	63	3
296	310	Timothy	.041	2	14	20	38	3	3	2	0	0	0	0	0	0	0	0	82	4
297	311	"	.041	0	9	30	44	6	2	0	0	0	0	0	0	0	0	0	91	4
298	312	Red Clover..................................	.150	0	4	9	9	4	2	1	0	0	0	0	0	0	0	0	29	
299	313	Timothy	.040	0	20	36	35	0	1	0	0	0	0	0	0	0	0	0	92	3
300	314	Ruta Baga Turnip, Ferry	.305	16	65	5	3	3	1	0	0	0	0	0	0	0	0	6	93	2
301	315	Purple Top " "	.302	0	28	17	5	2	3	4	2	1	0	0	1	0	0	12	63	4
302	316	Jersey Wakefield Cabbage, Ferry	.313	52	33	0	0	0	0	0	0	0	0	0	0	0	0	7	85	1
303	317	Winingstadt " "	.309	6	52	8	2	0	0	0	0	0	0	1	0	0	0	0	69	2
304	318	Blood Turnip Beet, "	2.213	0	0	28	43	15	2	1	0	0	0	1	0	0	0	0	90	4

Results of Germination Tests---Concluded.

Serial number.	Station number.	Description.	Weight of 100 seeds in grams.	Number of seeds sprouted each day.														Sound seeds left.	Per cent sprouted.	No. of days required for one-half to sprout.
		Purchased of J. F. Hacker, Ft. Fairfield, Me.—Conc.		1st	2d	3d	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th			
305	319	Dark Red Eclipse Beet, Rice	2.014	0	1	25	17	6	2	0	1	0	0	0	1	0	0	0	53	6
306	320	Drumhead Cabbage, "	.321	4	41	1	0	0	0	0	0	0	0	0	1	0	0	0	47	
307	321	Blood Turnip Beet, Dunlap	2.441	0	0	32	27	4	1	1	1	1	2	0	0	0	0	0	69	4
308	322	Red Globe Onion, "	.298	0	19	9	1	1	1	2	0	0	0	0	0	0	0	0	33	
309	323	White Smooth Parsnip, Dunlap	.402	0	0	0	3	21	9	8	1	2	3	0	0	0	0	0	47	

EXPERIMENTS WITH FORAGE PLANTS.

In the spring of 1888, about seventy varieties of grasses and other forage plants were sown in plots. Some of these failed to grow; others grew the first season and winter killed while a number proved to be duplicates. Those that grew more or less satisfactorily are below considered. Those that seemed promising will be further tested in larger plots under the most favorable conditions of soil and moisture and the yield per acre recorded.

GRASSES.

1. Brown Bent.............................. *Agrostis canina*
2. Red Top.............................. *Agrostis vulgaris*
3. Creeping Bent.............................. *Agrostis stolonifera*
4. Meadow Fescue.............................. *Festuca pratensis*
5. Tall Fescue.............................. *Festuca elatior*
6. Sheep Fescue.............................. *Festuca ovina*
7. Hard Fescue.............................. *Festuca dunuscula*
8. Wood Meadow.............................. *Poa nemoralis*
9. Kentucky Blue.............................. *Poa pratensis*
10. Rough-stalked Meadow.............................. *Poa trivialis*
11. English Blue.............................. *Poa compressa*
12. Fowl Meadow.............................. *Poa serotina*
13. Rescue Grass.............................. *Bromus unioloides*
14. Meadow Brome.............................. *Bromus pratensis*
15. Soft Chess.............................. *Bromus mollis*
16. Slender Foxtail.............................. *Alopecuris agrostis*
17. Rye Grass.............................. *Lolium perenne*
18. Tall Oat-grass.............................. *Arrhenatherum avenaceum*
19. Sweet Vernal.............................. *Anthoxanthum odoratum*
20. Timothy.............................. *Phleum pratense*
21. Velvet Grass.............................. *Holcus lanatus*
22. Orchard Grass.............................. *Dactylis glomerata*
23. Reed Canary.............................. *Phalaris arundinacea*
24. Crested Dogstail.............................. *Cynosurus cristatus*

CLOVER.

25. Alsike.............................. *Trifolium hybridum*
26. Red.............................. *Trifolium pratense*
27. White.............................. *Trifolium repens*
28. Crimson.............................. *Trifolium incarnatum*

MISCELLANEOUS.

29. Sweet Clover .... *Melilotus alba*
30. Honey Clover .... *Melilotus caeruleus*
31. Alfalfa .... *Medicago sativa*
32. Black Medic .... *Medicago lupulina*
33. Sainfoin .... *Onobrychis sativa*
34. Small Pea .... *Lathyrus sativus*
35. Hairy Vetch .... *Vicia villosa*
36. Birds-foot Clover .... *Lotus corniculatus*
37. Serradella .... *Ornithopus sativus*
38. Tarweed .... *Madia sativa*
39. Giant Spurry .... *Spergula maxima*

NOTES ON GRASSES AND FORAGE PLANTS.

1. BROWN BENT GRASS—This grass is sometimes called Mountain Red Top, on account of its growing naturally on hills and mountains, and is reported as being a slender grass six to twelve inches high. In the plot it grew about eighteen inches, which was of course due to the greater fertility of the soil. It could not produce a large crop of hay even on very rich ground, but is valuable as a pasture grass. It came into full bloom June 28th.

2. RED TOP—This is probably the most valuable of the Bent grasses. It made a good growth although the soil must have been rather dry for it, as it prefers moist land. It has a strong, erect stem, and is a good grass to sow on swampy ground with Fowl Meadow, to prevent the latter from lodging. It attained a height of nearly three feet, and sown with clover or other grasses would give a good crop of hay. It blossomed July 1st, a little later than the other Bent grasses.

3. CREEPING BENT—A grass described as growing to the height of twenty-four inches on wet land. Ours was only fourteen inches high, owing to dry soil, and was a fine grass, with thick bottom. It blossomed June 28th. It would be useless to sow on up-lands, but is said to produce a good crop on swampy meadows.

4. MEADOW FESCUE—This is a valuable grass for either hay or pasture It is one of the earliest to start in the spring, and comes to maturity in good season, June 21st being the date of full bloom. Unlike most grasses the stalks and leaves remain green till it ripens its seed. It grows on either dry or wet soil, gravel, loam, or clay,

and its long roots enable it to withstand droughts. To obtain the seed pure is a difficult matter, as it is often adulterated with Rye grass, hence one needs to exercise care in purchasing. It grew three feet high. This grass deserves a trial in Maine.

5. TALL FESCUE—Very much resembles the grass just mentioned, being a little larger. It has the same habits of adapting itself to any kind of soil. A chemical analysis shows it to be very nutritious. It has a tendency to grow in tufts like most of the Fescue grasses. Produces a large crop of hay on rich ground, sometimes growing four or five feet high, but in our plot measured three feet. Blossomed June 28th.

6. SHEEP FESCUE—Said to be an excellent pasture grass, especially for sheep. It grows in bunches, having a large mass of small nearly cylindrical leaves from the root, and a few slender stems, of which the highest measured sixteen inches. When sown thickly it forms a very dense bottom, which furnishes a good bite for stock, but is too fine for hay. Came into full bloom June 12th.

7. HARD FESCUE—Resembles Sheep's Fescue, being a little larger, and like it, grows on dry hills. What was said of that, will also apply to this species It grew eighteen inches high, and blossomed June 13th.

8. WOOD MEADOW GRASS—This grass grows in moist shady places, two feet or more in height. In the plot it was about eighteen inches high and rather slender. It blossomed June 28th. Not much of the seed sprouted, consequently the plants were scattered, and as the ground was hardly suitable for it, one could not tell what it would do under favorable conditions. It has not been cultivated much, probably on account of its growing best in the shade.

9. KENTUCKY BLUE GRASS—A great deal has been written concerning Kentucky Blue Grass, some claiming it to be the most valuable, others saying it is one of the most worthless of the tame grasses. It is certainly a nutritious grass, especially before blossoming, but deteriorates rapidly as it grows older. It is one of the first to blossom, June 12th being the date of full bloom, hence needs to be cut early, and therefore cannot be sown with many other grasses. Our tallest plants measured twenty-one inches, but it is often higher than this. It has an abundance of long leaves from the root.

10. ROUGH-STALKED MEADOW GRASS—As its name implies this is a grass growing in wet meadows, having a rough stem, by which it may be distinguished from most of its genus. It blossomed June

28th, and measured twenty-seven inches, which is below its natural height. It is recommended for shady pastures.

11. English Blue Grass—A grass found growing on dry, sandy or gravelly knolls, and hence of some value for dry pastures. It is sometimes called Wire grass as it has a tough, hard stem which is difficult to cut. The spike has a purplish or bluish tinge, and the leaves are a bluish-green, so that it well deserves the name of Blue grass. It grew larger than it is usually found in its wild state, being twenty inches high. Blossomed June 30th.

12. Fowl Meadow Grass—This species is well known to farmers who have swampy meadows. It produces a heavy crop of hay, often three tons or more to the acre. Unlike most grasses it keeps green long after blossoming. It has a tendency to lodge badly, but instead of decaying it sends up shoots from the joints, which keep the stalks green. It should be harvested before lodging, however, as it is then much easier to cut. This grass generally gives way in time to the coarser water grasses and sedges, and needs to be re-sown. It is perhaps the most valuable of our wet meadow grasses. It grew in dry soil thirty inches high, and blossomed June 30th.

13, 14, 15. Brome Grasses—The seeds of all these grasses were poor and but few plants were obtained. The cheat or chess, often found growing as a weed in grain fields, belongs to this genus. The only one that has any claim as a cultivated grass is the Rescue grass, which is grown for winter pasturage in the south. It would be of no value here. The farmer should treat them as weeds, and prevent them from getting a foot-hold in his fields, if possible.

16. Slender Foxtail—The Foxtail grasses bear some resemblance to Timothy, having, like it, a cylindrical spike. They grow naturally in moist bottom lands. This species has purplish heads and the stalks near the ground are of the same color. It blossomed early, June 13th, and made a good growth for dry soil, twenty-two inches. It is not generally recommended but we consider it worth a trial.

17. Rye Grass—A perennial grass cultivated for many years in Europe, and considered one of their best grasses, but in this country has not met with so much favor. It has numerous leaves from the root, and an erect, dry, wiry stem twenty inches high, with a long undulating spike, somewhat resembling our common Witch grass (*Agropyrum repens*). It blossomed July 3d.

18. Tall Oat Grass—This grass is said to often attain a height of six feet; in our plots it was a little over three. It bears a resemblance to our common oat, though is smaller in every way except in height. It will produce two crops in a season, and many declare it to be an excellant grass, while others say it is bitter, liable to smut, and difficult to eradicate. It needs to be tested farther before it can be recommended. Blossomed June 21st.

19. Sweet Vernal Grass—A common grass in old fields and pastures, and one of the earliest to blossom, June 13th being the date of our plot. It is fragrant when drying and gives a pleasant odor to new mown hay. It is too small for a hay crop, being less than two feet high. Our plants were only a foot high, owing to the seed being sown too thickly.

20. Timothy—Also called Herd's grass, and too well known to need any description. Is generally considered one of our best grasses, although a chemical analysis shows that there are many others more nutritious. The height varies greatly according to the fertility of the soil. Our plants were three feet. It blossomed June 21st. It should be cut early as it grows woody rapidly after blossoming.

21. Velvet Grass—A pretty grass with an abundance of velvety leaves from the root, and a soft purplish spike. Grows best on moist land, but will adapt itself to any soil. Said to be of no value as an agricultural grass as cattle do not relish it. Blossomed June 21st, and grew eighteen inches high.

22. Orchard Grass—A tall grass growing in bunches, and furnishing a large crop of hay when sown thickly or with other grasses. It starts quickly after mowing and produces a good aftermath. It blossomed June 13th, about the same time as Red clover, and these two sown together will give two crops of excellent hay in a season. It grew four feet high. It deserves to be grown more in this State.

23. Reed Canary Grass—This is a tall, coarse grass found in wet places; not much value as hay unless cut very early. It may be mown two or three times in a season, as it is a rapid grower. One plot produced a growth of leafy stems about two feet high, but did not blossom although allowed to grow till late in the season, the soil evidently being too dry. It grows four feet or more high, in swampy ground.

24. Crested Dogstail — A dry, wiry, light colored grass with slender stem and small spike. Not much value except in dry past-

ures. Grew in plot twenty-two inches high. Blossomed July 3d. The straw is used for braiding.

25, 26, 27. ALSIKE, RED AND WHITE CLOVER—These are well known and considerably cultivated all over the State. The first two make excellent hay, and the last furnishes good pasturage. The height, and time of blossoming is given to compare with the grasses. All in full bloom June 10th. The heights were twenty-four, thirty and twelve inches, respectively.

28. CRIMSON CLOVER—Also called Scarlet, French, Italian and Incarnate clover. Unlike the three above, it is an annual, and therefore cannot be used for seeding down. For this reason it is not cultivated very extensively in the north. It has more elongated heads than the Red clover, which are a bright crimson. It was sown June 1st, and blossomed September 1st, following. Height twenty-six inches.

29. SWEET CLOVER—Not a true clover, but closely connected. A tall, busy plant often found growing wild. Perhaps of some value as a fodder if cut when small. Blossomed July 3d; tallest plants, eight feet.

30. HONEY CLOVER—An annual, growing eighteen inches high, and having numerous heads of blue flowers, which furnish considerable honey to bees; of more value for this purpose than for a fodder.

31. ALFALFA OR LUCERNE—A deep rooted, erect plant, two to three feet high, growing best in a dry, sandy soil. It has a branching, leafy stem bearing a dense raceme of blue flowers. It must be cut while young, as it soon becomes woody. A number of crops can be obtained the same season, and it is said to produce an immense amount of rich fodder year after year. It stands drought well on account of its long roots which it sends into the ground twelve or fifteen feet deep. Two or three years are required for it to become well established, which perhaps accounts for its not being cultivated more extensively in the north. It deserves a thorough trial in Maine.

32. BLACK MEDIC—The seed of this was obtained under the name of Yellow Trefoil. It is a small, half trailing plant with heads of yellow flowers. It is not large enough to produce much fodder, and would hardly be worth cultivating. Blossomed June 25th; over one foot high.

33. SAINFOIN—This plant is said to grow well on poor, run out land, and in Europe is used for soiling to considerable extent. It

is a straggling plant from a hard, woody tap root, having pinnate leaves and a spike of handsome purple flowers. Under favorable conditions grows three feet high, but in our plot only fifteen inches. Blossomed June 13th.

34. SMALL PEA—The seed of this and of the next three plants was received from the Depaitment of Agriculture, and we give the description accompanying the seed:

"Extensively cultivated in Southern Europe, for its seed, which is eaten in the same way as the Chick Pea, but it is of superior quality; the pod is also eaten green and the whole plant is sometimes cut for forage, while the peas are much given to poultry."

It resembles the common pea, being smaller; twenty inches high. Planted June 1st, blossomed August 20th.

35. HARVY VETCH—"A native of Persia and the borders of the Caspian Sea, but is cultivated extensively in almost every quarter of the globe. Its roots are diuretic, while its seeds, in spite of their nutritious qualities, are not wholly destitute of poisonous ingredients."

Very much resembles our common vetch, (*Vicia Cracca.*) Grew about two feet high. Blossomed August 30th. Planted same time as one preceding.

36. BIRDS-FOOT CLOVER—"Is found in the greater part of Europe, in Northern Africa, Northern Central Asia, and in Australia The larger varieties form a very good ingredient in our pastures and meadows."

Our plants were fourteen inches high. They had a tap root, sending up numerous branches with bright yellow flowers. Blossomed June 25th.

37. SERRADELLA -"A native of Portugal, is a valuable agricultural plant, introduced in 1818, and particularly worthy of attention from the fact of its producing an abundant crop of excellent fodder where nothing else will grow to perfection. It is an annual."

This is a branching, leafy plant, having small, purplish flowers. We only obtained a few specimens, and these were scarcely a foot high. Planted June 1st, and blossomed August 27th.

38. TARWEED—This belongs to the Composite family, the same as our common dandelion and white weed. It is a stout, erect plant, three feet high, with numerous lanceolate leaves, and yellow flowers. The stem is covered with glandular hairs which exude a viscid substance making it exceedingly sticky, from which it has

received the name of Tarweed. When green it has a strong, heavy odor due to some volatile liquid which is dissipated in drying. It is an annual, and seeds itself if allowed to mature. Blossomed August 27th.

39. GIANT SPURRY—The following accompanied the seed:

"Grown to serve as pasture for cattle, imparting a fine flavor to mutton, and enriching the milk of cows. Its foliage is of a pleasant green color and delicate texture; it soon establishes itself, and possesses the recommendation of retaining its verdure in the dryest and hottest season"

This is very much like the common spurry, (*Spergula arvensis,*) which is a weed in crops, and seems to have the same habits. It continues to blossom and ripen its seeds all the season, thus producing an enormous quantity, which sprout and grow very readily. It doubtless has some good qualities, but once introduced it would be difficult to get rid of, and should, therefore, be treated as a weed. Blossomed July 25th, two months from sowing. Height fifteen inches.

REMARKS.

The hay crop in this State is our most valuable one. It can easily be increased in quantity, and improved in quality. Some of the best grasses and forage plants are scarcely cultivated in Maine, and it is the purpose of the Station to test their adaptability to our soil and climate, and call the attention of farmers to those that seem worthy of cultivation. We quote from two writers as follows: "The importance of introducing new grasses, and efforts to improve those already cultivated, cannot be over-estimated. It is not at all certain that we have the best kinds, nor that those we have are brought to the greatest degree of perfection. Doubtless they may be improved, as well as fruits and live stock."

"A dozen sorts, probably, cover nineteen-twentieths of all the meadow land from Maine to Texas. It can hardly be supposed that so limited a number meets in the best manner possible, all the wants of so great a variety of soil and climate. This is one of the pressing wants of our agriculture. A single new grass that would add but an extra yield of a hundred pounds to the acre, would add millions of dollars annually to the productive wealth of the nation."

When we remember that there are over three thousand different grasses, and a great many other plants valuable for hay and grazing, we can easily see the chances for improvement in this direction. Our experiments have not been carried on long enough to enable us to recommend with certainty, many new grasses. We would suggest the following for the purpose named:

HAY ON UPLANDS.

Timothy	*Phleum pratense*
Red Top	*Agrostis vulgaris*
Tall Fescue	*Festuca elatior*
Meadow Fescue	*Festuca pratensis*
Orchard Grass	*Dactylis glomerata*
Alsike Clover	*Trifolium hybridum*
Red Clover.	*Trifolium pratense*
Alfalfa	*Medicago sativa*

HAY ON WET MEADOWS.

Fowl Meadow	*Poa serotina*
Red Top	*Agrostis vulgaris*
Creeping Bent	*Agrostis stolonifera*
Tall Fescue	*Festuca elatior*

DRY PASTURES.

Brown Bent	*Agrostis canina*
Sheep Fescue	*Festuca ovina*
Hard Fescue	*Festuca dunuscula*
Blue Grass	*Poa compressa*
White Clover.	*Trifolium repens*

MOIST OR SHADY PASTURES.

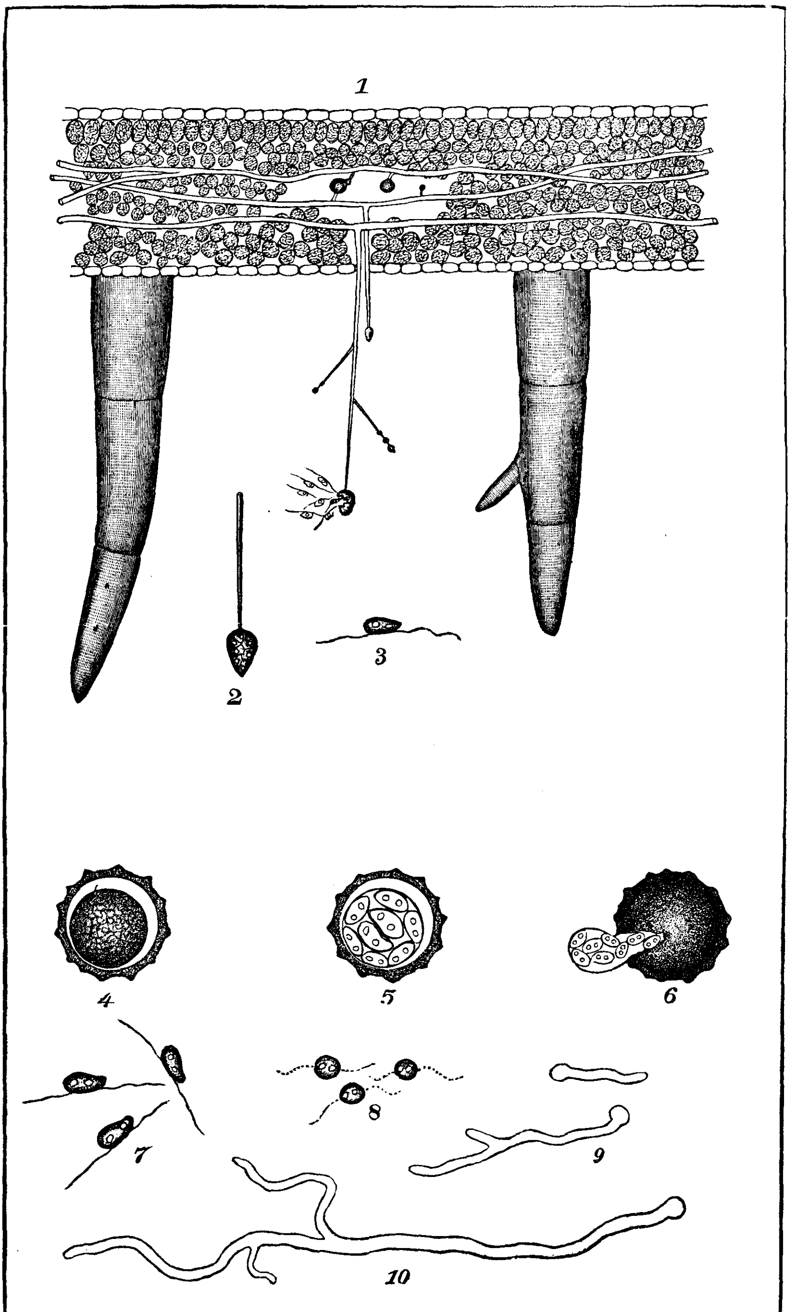
Creeping Bent	*Agrostis stolonifera*
Rough-stalked Meadow	*Poa trivialis*
Meadow Fescue	*Festuca pratensis*

Injurious Plants—Plants of Economic Importance Received for Examination in 1889.

	Common Name.	Scientific Name.	Depredations.
		PARASITIC FUNGI.	
1	Potato rot, rust, blight.	*Phytophthora infestans*	On potato vines and tubers.
2	Apple scab, or black spot	*Fusicladium dendriticum.*	On apple stems, leaves and fruit.
3	Bitter rot	*Gloeosporum versicolor*	On apples.
4	Scarlet rot		On apples.
5	Pear blight	*Micrococcus amylovorus, Bur.*	On pear twigs and leaves
6	Downy mildew, gray rot	*Peronospora viticola*	On grape leaves and fruit.
7	Powdery mildew	*Uncinula ampelopsidis, Pk.*	On grape leaves.
		WEEDS.	
8	Pigweed, or green amarantus	*Amarantus retroflexus, L.*	Weed in garden.
9	False flax, or gold of pleasure	*Camelina Sativa, Crantz*	Weed in fields.
10	Black bindweed	*Polygonum convoloulus, L.*	Weed in garden and fields
11	Rib grass, English plantain.	*Plantago lanceolata, L.*	Weed in fields.
12	Downy vetch	*Vicia Cracca, L.*	Weed in fields.
13	Wild pink	*Silene Pennsylvanica*	Weed in garden.
14	Fall dandelion.	*Leontodon autumnale, L.*	Weed in meadows.

REMARKS.

Besides the plants mentioned above quite a number of specimens of no special economic importance have been examined and reports made directly to the parties sending them. The potato rot was considered in an exigency bulletin in the summer of 1889. The subject is of so much importance, that article modified and extended, is incorporated in this report. The apple scab was very bad in Maine the past season. We considered this fungus in our report for 1888, but now add (through the kindness of Prof. Galloway) the results of some experiments conducted the past season under the auspices of the United States Agricultural Department. We are arranging to conduct some experiments this season upon apple scab with the copper solutions. A paper presented by the writer at the Norway Meeting of the State Pomological Society, upon "Some Injurious Fungi of Fruits," will appear in the report of that Society. It will in that way reach the fruit growers of the S ate and need not be repeated here. Of the weeds sent for examination the Rib Grass or English Plantain and False Flax or Gold of Pleasure, only need special consideration.



Phytophthora infestans, De Bary.

EXPLANATION OF PLATE.

This plate was used by Prof. C. H. Fernald, to illustrate an article on the potato rot, which appeared in the Agricultural Report of Maine, 1882, p. 210. The plate was kindly loaned by Mr. Gilbert. In using it, we are aware that the occurrence of *winter*, or *oospores* is doubted by many botanists. The writer having never seen them is not prepared to advocate either view, though analogy would strongly suggest their existence. The plate represents fairly well mycelium, conidiophores and condia.

1. Section of a potato leaf showing three *mycelium* threads running between the cells, and two *conidiophores* extending from them down through a breathing pore (stomate) on the under side of the leaf. One has two lateral branches with *conidia* at the ends, while on the top of the main stem is borne a conidium from which zoospores are escaping.

[The figure is wrong in representing the terminal spore as the first to mature. The young conidia are formed at the ends of the branches. The lateral are the first to mature.]

2. Conidium showing swarming spores within.

3. A zoospore much enlarged and provided with cilia.

4, 5 and 6. Represent winter spores (oospores) claimed to have been seen by Mr. W. G. Smith, but doubted by most botanists.

7. Three zoospores swimming through water.

8. Three zoospores becoming spherical and losing the cilia.

9 and 10. The zoospores germinating and producing mycelium.

THE POTATO ROT.

PHYTOPHTHORA INFESTANS, DE BARY.

(*Peronospora infestans*, *Mont.*)

The potato rot, blight or rust as it is variously called in Maine, was very bad in this State the past season. Many letters asking information regarding the nature of this disease and its remedies, were received at the Station. To meet the case a short exigency bulletin was hastily prepared. Below we give for permanent record a fuller and better considered account of the disease and its treatment.

ORIGIN AND HISTORY.

This disease has been known in America over fifty years. It has spread to all the potato growing countries of the world, causing more damage to the Irish potato than all other diseases combined. It is common on the wild potato from which our cultivated potato was derived. The wild potatoes are supposed to have been the original source of the disease. The disease also affects the tomato. For an excellent account of the history óf Potato Rot, the reader is referred to "Diseases of Field and Garden Crops," by W. G. Smith, MacMillan & Co., London, 1884.

PRIMARY CAUSES.

The *primary* cause of the potato rot, blight or rust, is a fungus parasite. It is as definite a plant as the potato, though much more simple in its structure and lower in the scale of vegetable life. It finds in the potato plant the conditions favorable for its growth and attacks it, producing the disease. It reproduces its kind, especially in the summer, by organisms called spores, which are as necessary for its continuance and extension as the seed of higher plants. The disease cannot spread except these spores are present any more than the potato can multiply without tubers.

[The disease can be produced in healthy plants by infecting them with the spores of this fungus. Plants protected from infection by the spores are exempt from the disease. This parasite is always present in plants suffering from the potato rot. There are other rots, wet and dry, of various kinds, not due to *this* fungus which are sometimes confounded with it. The true potato rot may under different conditions be wet or dry.]

SECONDARY CAUSES.

There are several *secondary* causes which modify the disease when present. Moisture and heat favor the growth of the fungus. The disease is worse on heavy and poorly drained lands. The atmospheric conditions, the nature of the soil, the methods of culture, vitality of the plant, and the variety of the potato, have no power to originate the disease. They can only favor or impede its progress.

CONDITIONS OF GROWTH.

Warm weather and moisture at the time the summer spores are ripe and dropping, will cause them to germinate, therefore the disease is usually worse in hot, moist seasons. Should it be dry at the time the spores are ripe they soon die and the disease does not spread. The fungus seems to require a sufficient time to perfect itself before producing spores. It would produce spores earlier in early plantings and probably mature faster in early varieties. We often see early potatoes affected, while later varieties contiguous are exempt. Also early varieties exempt when later in the season the slower growing varieties alongside become diseased.

The fungus is most active when the temperature is between 60° and 70° F. At lower temperatures than 40° its development is arrested, but it can survive a much lower degree. At 80° F. and upward the spores are gradually killed. Extremely hot weather would be unfavorable to the germination of the spores. The disease does not appear in Maine until about August 1st, and sometimes later, and often not before early varieties are ripe and harvested. If the source of infection is in the early potatoes when planted the disease appears earlier. If in later varieties it develops apparently later. The disease might spread from an early infected variety to a contiguous, uninfected field of later varieties, though there is reason for believing that the proper stage of development of the potato plant is necessary for infection.

DESCRIPTION.

Mycelium—The plant body of this fungus is composed of slender, jointless, transparent threads, which permeate the stem, leaves and tubers of the host plant, running between the cells. The mycelium does *not* produce lateral branches (haustoria) for obtaining nourishment from the cells of the host plant.

Conidia—The mycelium sends, during the summer months, slender branches (*conidiophores*) through the stomata or breathing pores of the under side of the leaves. The conidiophores are at first simple, but finally produce a few lateral, irregularly placed branches. They are attenuated at the apex and enlarged at the point where the conidia are located. The conidia or *summer spores* are borne on these branches. They are eliptical or oval bodies twenty-seven to twenty-nine micromillimetres in length, with a terminal projection at the base. The conidia are at first single at the end of the branches but finally become lateral by the outgrowth of the tip of the branch. Several spores may be produced in succession. These conidia may under proper conditions develop germ threads directly, which penetrate the breathing pores of the host, producing a new plant. More commonly the conidia produce *zoospores*. The contents of the conidia breaks up into several masses, which are finally liberated by a rupture of the wall at the small end. These minute, jelly-like (protoplasmic) bodies have the power of moving about with a jerky motion, like small animals, by means of two slender cilia or hairs attached to one side of the spore. On account of this power of motion they are called *zoospores*. The zoospores soon come to rest, lose the cilia, assume a rounded form and develop a thin membraneous wall. Under favorable circumstances they send forth germ threads which penetrate the breathing pores of the potato leaves and become new plants.

Zoospores—These are egg spores, resting spores, or winter spores as they are variously called. They are supposed to develop within the stem, leaves and tubers of the host plant and perpetuate the species. Though they are well known in related species, there is a difference of opinion regarding their occurrence in the potato rot.

The species has wonderful power of perpetuating itself. Some believe as winter spores in the stem, leaves and tubers; others regard the mycelium perennial in the stored tubers, and the seed the means of infection; others, (the writer belongs to that class,) do not believe the preservation of the mycelium in seed potatoes adequate to account for the continuance and spread of the disease. The writer believes there is some source of infection left behind in the field when the potatoes are gathered. The mycelium may live over winter in potato tops and in the few tubers left in the ground.

The *zoospores* if they ever occur, may not ordinarily be produced and may not be always essential to the continuance of the disease. The known occurence of oospores in related species, would in our estimation be stronger evidence of their existence in the potato rot, than the fact that they have not been seen by botanists, evidence that they do not ever occur.

Prof. Humphrey (Massachusetts Experimental Station bulletin No. 6, 1889, p. 19), says: "The fungus doubtless survives the winter by the hybernation of the threads in potato tubers, but this method alone seems hardly certain enough to constitute the sole reliance of the plant."

He also says "that the existence of *winter* spores has never been satisfactorily proved."

Prof. G. W. Smith of England, claims to have found these spores in the leaves, stems and tubers, and figures them. The relatives of this fungus, the downy mildew of the grape and others are known to produce winter spoıes, and by analogy, we would expect them to occur in the potato rot.

Prof. Scribner says: "The mycelium is perennial in the tubers and if these, containing this mycelial growth are used for seed, they are almost certain to carry infection to the new crop."

He does not apparently recognize any other means of survival.

We are inclined to believe that there is some means of continuing the disease in the soil after the crop is harvested. Whether this is by *resting spores* in the tops, leaves, rotten and small potatoes left on the ground, or whether the *mycelium* lives over winter in the tops and ungathered potatoes, is an open question. If the mycelium will live in the harvested potatoes we see no reason why it may not survive in the small potatoes and tops left on the ground. If potatoes left in the soil grow the next spring certainly the hardier fungus would probably survive. This matter is of fundamental importance. A definite knowledge of the winter conditions of this fungus is essential as a basis for intelligent application of preventive measures. A careful study of the possible winter conditions is of the greatest importance. It will probably be found finally that it has all the resources claimed.

LIFE HISTORY.

Whatever way the plant is infested, the mycelium or threads grow with it, enter the new shoots and finally penetrate the leaves. When the plant or fungus or both have sufficiently grown, which occurs during the summer and fall months, fruiting branches are developed on the threads. These find their way through the breathing pores of the leaves, and bear the summer spores, which are developed in great numbers and blown by the wind on other plants. These spores germinate, with favorable conditions, and develop new threads, or they produce several oval shaped spores which have two vibrating hairs, by means of which they move about in water, and finally coming to rest also produce threads. These threads enter new plants and spread the disease. The spores develop rapidly and germinate quickly, so that from a few diseased plants a large patch, under favorable conditions of moisture and heat, may be destroyed in a single day. The fruiting stalks and the mycelium from the germinating summer spores, stop the breathing pores of the plant, preventing a proper circulation. This causes rapid decay of the tissues of the plant, which turn black, becoming slimy and ill-scented. The development of the summer spores, causes the leaves on the under side, to present a grayish mildewy appearance. Some of the summer spores fall upon the ground and are washed into the soil by rains, reach the tubers and infest them. It is supposed that the threads of the fungus go down the stems after killing the leaves, and finally reach the tubers. It is known that "potatoes covered with from one to three inches of earth are pretty certain to become diseased if the fungus is on the tops, while those planted four inches deep are more rarely infested." Prof. Scribner argues from this, that if the spores reach the tubers through the soil, those near the surface would be most affected. Would not the tubers near the surface be affected first, by mycelium descending the stem? The roots bearing them come off higher up. Are not the conditions near the surface more favorable for the rapid growth of the fungus, and possibly the infection near the surface greater from this cause? Unless the tubers are harvested before they are infected they begin to rot in the ground, and the loss may amount to fifty per cent. of the crop. If any of the harvested potatoes contain the fungus, the disease will spread in the pits or cellar, from potato to potato. Potatoes harvested and stored damp, are likely to become infected from the germination of summer spores which fall upon them while being harvested. This completes the round of life.

For cuts and explanations see pages 144–5.

REMEDIES.

The methods of treatment are direct and preventive. From the fact that the parasite is internal and only appears at the surface while producing summer spores, the methods must be largely preventive.

DIRECT METHODS.

Any means by which the growth of the *summer spores* can be checked, would prevent the spread of the disease from plant to plant during the summer season, and prove beneficial.

The application of copper compounds to destroy the summer spores, has been quite extensively tried the past season at several of the experiment stations and elsewhere, with satisfactory results. We would recommend them for careful trial in Maine.

SOLUTIONS.

No. 1—Mix one quart of 22° ammonia water (hartshorn) with three ounces of carbonate of copper. Stir rapidly until a clear liquid is produced. When ready to use it, dilute to twenty-two gallons with water. Apply with a spraying apparatus or force pump.

No. 2—Dissolve two pounds sulphate of copper (blue stone) in hot water, dissolve and add two and one-half pounds bicarbonate of soda. When cool, add one and one-half pints of commercial ammonia water. Dilute to twenty-two gallons with water. Apply as stated above.

No. 3—Dissolve six pounds copper sulphate in sixteen gallons water. Shake four pounds of fresh lime into six gallons of water. When cool mix the above solutions slowly and thoroughly and apply as stated above.

Any one of the copper compounds prepared as stated above will do, though the first two are easier prepared and applied. If 26° ammonia is used add one-third more water. Paris Green in water (one pound to eighty gallons) could be added and applied at the same time for the potato beetle. London Purple is regarded by some as preferable to Paris Green and if used should be added one pound to 100 gallons.

REMARKS.

Use a force pump with brass fittings to apply these mixtures as copper compounds corrode iron. The nozzle should have a fine spray that will cover the foliage well and not drench it. The Vermorel nozzle sold by Thos. Sommerville & Sons, Washington, D. C., price $1.50 will be found the best, if recipe No. 3 is used. The Nixon Nozzle (Nixon Nozzle & Machine Co., Dayton, Ohio) or any other nozzle giving a fine spray will answer the purpose, to apply the others. Make the application immediately after a rain, or when fair weather is expected. Repeat if the mixture is washed off by a hard rain. Apply about the time the disease usually appears or anticipate it, or watch the field and spray *immediately* on the *slightest appearance* of the disease.

PREVENTIVE METHODS.

The following preventive measures are equally applicable, whether the theory of winter spores is adopted or rejected. The presence of the mycelium in decaying potatoes, or in the stems, leaves and tubers left in the field, would make it advisable to destroy all potato refuse.

1. Burn the tops and leaves in the fall after the crop is gathered. This is based upon the belief that winter spores are developed in the stems and leaves, or that the mycelium may possibly hybernate in them.

2. Gather all the small potatoes. As the mycelium hybernates in stored tubers, and possiby winter spores also occur in them, they would no doubt survive in potatoes left on the ground.

3. Select seed for planting, from fields or localities exempt from the disease the previous season. Great care should be exercised in selecting good seed. It is believed by some that diseased tubers are the *principal* means of infection.

4. Rotate the potato crop. This is based upon the belief that the means of infection survives the winter in the potatoes, stems and leaves left in the soil.

5. Burn all decayed potatoes taken from the cellar, or bins and all other potato refuse, do not throw them on the compost heap, as the fungus retains its vitality and is spread far and wide with the manure.

6. Plant early in the season and those varieties that mature early. This is based upon the belief that the fungus does not mature until the warm summer months, and therefore early plantings and early varieties would escape the disease from outside infection.

7. If cut seed is used, the surface should be allowed to dry, for when placed in the ground, the fungus if present, would find ready entrance to the tubers through the freshly cut surface. This is based upon the belief that the means of continuing the fungus occur in the soil.

8. If varieties less subject to the attack of the rot can be found, select them for growing.

9. Potatoes affected should be dug immediately and marketed, as the disease rapidly spreads to the tubers in the ground, and is almost sure to spread in the bin if they are stored.

10. Thoroughly dry potatoes before storing them, for, if damp, summer spores lodged upon them will germinate and develop the disease in the pit or cellar.

11. Store in a dry, cool place and keep dry, as warmth and moisture favor the growth of fungi.

12. Sort the potatoes in the cellar occasionally, and remove the infected ones, as the disease will spread from tuber to tuber.

If a dry place is not obtainable, then dust the potatoes with dry air slaked lime at the rate of one bushel of lime to twenty-five of potatoes.

14. Plant on a sandy loam, or a well drained soil, as the moisture of a heavy or poorly drained soil favor the disease.

15. Plant in narrow patches running at right angles to the prevailing summer winds. This is based on the fact that the disease usually starts from a few infected plants and the disease is spread by the wind.

16. It has been recommended to soak the tubers for twenty-four hours in a solution of copper sulphate, six ounces dissolved in water enough to cover a bushel

17. It has been shown that the fungus is destroyed by keeping the tubers for a few hours at a temperature of 105° to 110° F., a degree of heat that does not injure them for seed. This is a promising method, as it would thoroughly disinfect the seed as source of the disease.

18. Deep covering of seed and deep covering in cultivation have been recommended. It is believed that deep planting is unfavorable to the fungus, and that the summer spores can not reach deep covered tubers so readily.

19. Do not go through an uninfected patch after walking through an infected field, the spores will be carried on the clothing and spread the infection.

20. Do not plant early and late varieties contiguous.

APPLE SCAB.

Fusicladium dendriticum.

[For plate showing stages of this disease, see Maine Pomological Report, 1889, page 95.]

Fig. 1. Apple affected by the scab.

Fig. 2. Leaf of apple affected by the scab.

Fig. 3. Section through a portion of a scab spot on the fruit, showing the growth of the fungus; greatly magnified.

Fig. 4. Spores of the fungus greatly magnified; four of them germinating.

Experiments were conducted the past season with fungicides, upon the apple scab, in Michigan and Wisconsin by Professors Taft and Goff under the auspices of the United States Department of Agriculture, and through the kindness of Prof. Galloway we are able to record the following results:

These gentlemen experimented with several compounds, but the copper salts were so much superior to all others, that they alone deserve consideration.

They recommend spraying just as soon as the buds begin to swell. In their experiments they sprayed seven times during the season, making the last application about August 10th. In ordinary seasons four or five applications would be enough. They recommend the following:

Ammoniacal Carbonate of Copper Solution.

1. Dissolve three ounces of carbonate of copper in one quart of 20° ammonia water and dilute to thirty-two gallons.

Modified Eau Celeste.

2. Dissolve two pounds copper sulphate in hot water, and in another vessel dissolve one and one-half pounds bicarbonate of soda; mix the two and when cool, add one and one-half pints 20° ammonia water and before using dilute with water to thirty-two gallons.

We give below a copy of table showing the results of these experiments:

	Prof. Goff's Experiments.					Prof. Taft's Experiments.					
	Applications.	Free from scab—per cent	Slightly scabby—per cent.	Badly scabby—per cent.	Cost per tree—cents	Applications.	Free from scab—per cent.	Slightly scabby—per cent	Badly scabby—per cent.	Cost per tree—cents.	Total yield—pounds.
Potassium Sulphide	7	30.04	48.55	21.41	37	7	25.5	74.3	.2	39	1,615¼
Sodium Hyposulphite ...	7	43.24	42.78	13.98	29	7	23.6	75.4	.89	23	1,648
Sulphur Powder	7	32.72	54.31	12 97	31	6	17.6	81.2	1.1	31	1,435¼
Am'l Copper Carbonate...	7	75.02	23.35	1.63	38	7	51.2	48.6	.16	49	2,112¾
Eau Celeste	-	-	-	-	-	7	68.8	31.0	.2	60	1,675½
Sulphur Solution	3	42.9	48.99	8.11							
Unsprayed..		23.34	53.89	22.71	-	-	12.5	85.7	1.8	-	769¼

"*Results* — The copper solutions remained persistently on the leaves, even resisting heavy showers, which washed off all traces of the sulphur compounds, and when the leaves fell in October traces of copper could still be seen on them."

"At time of harvesting Professor Taft picked all the apples on the trees and assorted them into three lots, of first, second, and third quality. The first class contained those free from scab, the second those slightly scabby but not distorted or under size, the third those that were distorted or under size. Those in each class were counted and the percentage which they formed of the whole estimated."

"At Ithaca, Wis., the apples were not all picked, but a market-basket holding about one and one-half pecks was first filled with apples from the lowest branches of one of the trees. Next a similar basketful was picked from the branches that were just the height one could conveniently reach, taking care to pass clear around the trees in both cases. After this a basket of one-half a bushel was filled from the tallest branches of the tree. The apples were then poured upon an assorting table; and the baskets filled and emptied again in the same manner and from the same tree, after which the contents of the six basketfuls were assorted into three qualities as in the preceding case."

"It is evident from the tables that the sprayed trees, especially those sprayed by copper compounds, producing a much larger percentage of healthy fruit than the unsprayed. The greatest difference between the perfect fruit on sprayed and unsprayed trees under Prof. Goff's charge was 51.68 per cent. and the least 6.7 per cent. The greatest difference in those under Professor Taft's charge is 56.3 per cent. and the least 5.1 per cent., the two results being essentially the same."

Besides the tabulated results there were others which are of great importance but cannot be estimated in exact figures. A scabby apple is much smaller than a healthy one, and in many cases, while the apples could not be placed in class one, the scab had so been held in check that the fruit had obtained a greater size than it otherwise would. Professor Taft gives the difference in weight between perfect and scabby fruits as varying from .037 to .002 pound for each apple, and says the scabby apples are ten per cent. smaller than the perfect ones, making a difference of nearly a bushel per tree in size alone, besides the fact that the apples that are badly scabby are unmarketable. "From the combined effect of the two causes," he says "we lost on some trees a barrel of apples."

"The cost of the chemicals and labor expended varied but slightly in the two cases, but both gentlemen were obliged to buy chemicals in small amounts, and the cost per tree would be greatly lessened by treating a large orchard and buying materials in quantity. Professor Taft used large trees requiring three gallons each for each application, while Professor Goff used three gallons for the two trees, but Professor Goff estimates the labor higher than Professor Taft, and this makes the figures nearly alike. Both these estimates, however, are for seven applications. In an average season, and with the copper solutions, four or at most five applications will probably be sufficient. It is likely that in a large orchard with average sized trees, when the chemicals were purchased by the quantity the expense could be reduced nearly one-half. The expense of the ammoniacal solution in particular would be reduced by purchasing the copper carbonate instead of preparing it from the sulphate."

In Mr. Goff's calculations the cost for labor in making the treatments amounts to more than half the expense.

It seems probable that it would be profitable to make the first application earlier than was done this year, and there is no reason why this application, or the next should not be combined with London Purple, or some other insecticide, and the tree protected from insects and fungi at the same time. Mr. Hatch closes his report thus:

"What we now need is to determine the correct amount of the copper mixture to use, the times best suited to its application, and what combinations to make with insecticides, and a new era in fruit culture will be inaugurated."

FALSE FLAX OR GOLD OF PLEASURE.

Camelina Sativa (Crantz.)

This weed may be known by the following description: Pod, pear shaped, pointed, swollen, flattish parallel to the broad partition that divides the pod into two cells; valves with one nerve. Seeds numerous, oblong and some larger than a flax-seed. Flower, small, yellow. The plant is an annual, has lance-shaped, or arrow-shaped leaves and a large margined pod. Introduced from Europe, where it is used somewhat for the oil contained in the seeds, known as Oil of Pleasure. The stem yields a fibre sometimes used for making sacks, rough paper and brooms. We call attention to this weed as it has appeared in the State and though perhaps not so bad as the black mustard, yet it belongs to the same family and has the same habits and if allowed to spread will add one more annoyance to the farmer. Below we copy a letter, regarding this weed that appeared in the *Maine Farmer*, which may be interesting:

Mr. Gilbert, Dear Sir: I enclose a weed taken from a field of oats on the farm of Lincoln Sprague in South Presque Isle. The field consists of about two acres sown with oats raised by himself. One-half of the piece was sown with a quantity of Bradley's superphosphate. On the half sown with the phosphate the oats are full of the weed, while on the other half the weed is not to be found. It is a new weed in this section. Please tell me the name of the weed. I would like to know at the same time if foul seed is one of the ingredients used in manufacturing superphosphate.

Very respectfully,

Presque Isle, July 27th. H. H. COOK.

[Will Prof. Harvey examine and report to *Maine Farmer*?]

Z. A. GILBERT.

Z. A. Gilbert, Dear Sir: The weed which you enclose for determination belongs to the mustard family (cruciferae) and is known to botanists as *Camelina sativa*, Crantz. The common name is False Flax or Gold of Pleasure. The name Wild Flax is in allusion to the fact that it is a weed in flax fields and was supposed by the ignorant to be degenerate flax. The plant has been grown for the seeds, which yield an oil superior to rape seed oil for burning. The stems also yield a coarse fibre which is suitable for sacks, brooms and rough packing paper. The plant is a native of France, introduced with seed to this country, where it has gained only the reputation of a detestable weed. The plant seeds profusely, and a few scattering plants allowed to go to seed would the next season produce an abundant harvest. The best way to get rid of it is careful cultivation in some hoed crop. The plant being an *annual* would be exterminated if not allowed to seed. It does not seem possible that the seed could have been introduced in Bradley's phosphate as suggested by Mr. Cook. He could satisfy himself on this point perhaps by noticing whether the weed occurs in other fields where Bradley's phosphate was used. It is more probable that a few seeds were introduced last season from some source, and the plants escaped notice, and seeding so abundantly have apparently come suddenly the present season. Their being confined to one side of the field may be explained readily by supposing that the plants which produced the seed for this season's crop grew upon that side of the piece, and that became a centre of distribution, which happened to be the same ground on which the phosphate was used. We should like to know the history of the field, upon which the weed grew for the last three years, and whether the weed is found elsewhere. Look especially about the railroads, as they bring many weeds in ballast and upon freight, and even the cars themselves transport seeds which the winds have blown upon them. The packing material thrown out by merchants is often the source of introduction of vile weeds. A phosphate might introduce into a field the seed of a weed which had accidently got into it during transportation, but it would be unjust to hold the phosphate responsible.

F. L HARVEY,

Botanist for the Station.

Orono, Maine, August 2d, 1890.

RIB GRASS OR ENGLISH PLANTAIN.

Plantago lanceolata, L.

This weed belongs to the order *Plantaginaceae* (Plantain family) and may be known by the following description:

Root living from year to year; stem grooved, angular, nine inches to two feet high; leaves hairy, narrow, three to five ribbed and in a cluster at the root. The flowers small, whitish, borne in a thick short spike at the end of the long flower scape. The pod opens at the top by means of a lid and allows the two oblong boat shaped seeds to escape. These seeds are smaller than clover seed and may be distinguished by the brownish color, oblong shape and hollow or groove on the inner face. They look like a diminutive boat. Attention is especially directed to this weed, as it is being introduced into the State in clover seed. Complaints have been received of fields overrun with it, that were seeded to clover. The seeds of the plantain being smaller and duller colored are liable to escape notice, being hidden by the bright yellow color of the clover seed. Great care should be exercised by farmers in purchasing clover seed, so as not to introduce this detestable weed. We hear complaints of its occurrence in other states. Being a perennial it is a hard weed to exterminate. It is hardy and will cover the ground with a mat of leaves. Cultivation in a hoed crop would be the best way to control it.

Accompanying this report is an envelope containing New York Red clover seed, adulterated with about ten per cent. of rib grass seed, (*Plantago lanceolata*, L.) This seed was purchased at a prominent seed store in Maine and was highly recommended. We distribute the material that farmers may learn to distinguish the seed of rib grass and avoid it.

INJURIOUS INSECTS.

The past season has been remarkable for the injurious insects that appeared in unusual numbers.

FOREST TENT CATERPILLAR.

The forest tent caterpillar was especially abundant in the forest along the Canadian Pacific in the vicinity of Sebois, where it occurred in such great numbers on the railroad track as to grease the rails and impede the movement of trains. It fed principally on the poplar, but when its favorite food was wanting, repasted upon the foliage of the oak, cherry, maple, willows, elm, gray birch and other trees. In the Penobscot valley it was unusually plentiful causing much annoyance and considerable damage to orchard and shade trees. They transformed in abundance and many eggs have been laid and unless they meet with mishaps the pest will be plentiful in 1890. (History shows that they are not abundant many years in succession, as parasites increase and check them). Crushing with the hand, burning with a torch, and applications of kerosene or strong soap suds to the caterpillars when in bunches were the methods resorted to to destroy them This winter some have carefully removed from the apple trees, all the clusters of eggs they could find.

THE CODDLING MOTH.

The coddling moth did much more damage apparently than usual. Probably the insect was no more abundant, but it being a shy bearing year the effect was more noticeable.

When the trees set much fruit, some of our orchardists regard the coddling moth a blessing, as they do the proper thinning. The apples affected by the first brood all drop, and in a good year enough are usually left. The greatest damage is done by the second brood. The caterpillars have insufficient time to mature before cold weather checks their work, but they have so far progressed that the calyx of the apple is badly eaten. The worms are not large enough to transform and probably many of the second brood in Maine perish. The work of the second brood in Maine does not affect the core, only a portion around the calyx being damaged. The apples are blemished, which injures them for market. This season three-fourths of the apples from some sections showed the work of the second brood coddling moth.

Answers to questions sent out by the State Pomological Society to fruit growers, indicate that from 10 per cent. to 50 per cent of the apple crop in Maine is damaged by this insect. We regard it the most injurious insect to the apple in the State. Though when not too abundant it may prevent over bearing, yet it would seem that it has already far exceeded its sphere of usefulness in that direction and should, at least, be checked. It can easily be managed by spraying with Paris Green, or London Purple, and there is no reason why orchardists should suffer from its ravages. Especially should the matter receive attention when the trees show light bloom and a short crop is inevitable. The subject of spraying and spraying apparatus is considered elsewhere in this report.

VARIOUS OTHER INSECTS.

The fall canker worm and the white marked tussock moth were reported from several localities and appear to have been much more abundant than usual. They were feeding on the foliage of apple trees. The May beetle was reported as doing much damage to grass lands in some parts of the State. The above insects will be consider more fully at some future time.

THE APPLE MAGGOT.

Trypeta pomonella, (Walsh).

Order Diptera, Family Trypetidae.

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Davis—Ohio Farmer, Nov., 1889 (records occurrence in plums and cherries in Mich.)

Trans. Me. St. Pom. Soc'y.

1882—p. 101, Extracts from Prof. Comstock's paper in U. S. Agr'l Rept., 1882, p. 195. Supplementary remarks to above by S. C. Harlow.

1883—p. 30, Hon. Robt. H. Gardner; p. 43, T. S. McLellan; p. 61, Hon. Z. A. Gilbert.

1884—p. 70, L. H. Blossom.

1887—p. 9, remarks by the Secretary, D. H. Knowlton; pp. 84–85, Prof. Carl Braun; p. 101, P. M. Augur.

1888—p. 26, Pres. Chas. S. Pope; p. 56, Prof. Maynard; p. 114, Questions to fruit growers by Sec'y Knowlton; p. 117, remarks by Committee on Lists of Fruit.

The above transactions also occur in the Maine State Agricultural Reports of the corresponding years.

HISTORY AND DISTRIBUTION.

Both the fly and the maggot of this species appear to have been observed many years before Walsh published his original description in the *American Journal of Horticulture*, December, 1867. Walsh states that he bred the flies from maggots found in wild haws (thorn apples or thorn plums, as they are variously called), five or six years before his description appeared. The flies and maggots were known in the Eastern States several years before 1867, and at that date their ravages upon cultivated apples claimed serious attention in New York, Massachusetts, Connecticut and Vermont. To Walsh belongs the credit of showing that the maggots affecting cultivated apples were the same as those he found in haws; and that the beautiful fly known in the cabinets of eastern entomologists, was an undescribed American species of trypeta and the perfect form of the apple maggot.

Prof. Cook records its occurrence in wild haws in Michigan, Illinois and Wisconsin. Prof. Comstock bred it from a species of haw (*Cratægus*) growing upon the agricultural grounds at Washington. We find no reference to its having been found elsewhere in haws. We have not found it in haws in Maine. The published statements regarding its universal distribution in haws are not based on *observation*. There are no positive observations of its feeding upon wild crab apples (Pyrus.). Walsh says it feeds "*probably* upon our native crabs." Comstock and Lintner write me they did not record its occurrence in crab apples from personal observations. The wild crab apples are hard during the time the flies are on the wing, and would not appear to us to be a proper nidus for the maggot. The writer lived twenty years in the Mississippi valley where crab apples are common, and did not see trypeta. Prof. Cook has not found it in crab apples, but write us that Trypeta has been found the past season (1889) in Michigan, infesting plums and late cherries. In considering the history and distribution of this insect outside of Maine we can do no better than take extracts from Walsh, Comstock, Lintner and Cook.

In 1866 Walsh had knowledge of its occurrence in Massachusetts, Connecticut, New York and probably Vermont.

In New York it was prevalent at the Oneida community; North Hempstead, L. I., and occurred generally through the Hudson river country; in Massachusetts at East Falmouth. Its occurrence in Vermont in 1867 uncertain. In July 1867 Walsh bred the flies from maggots received from Connecticut, Massachusetts and New York.

Comstock in 1881 records its occurrence in New Hampshire, where, according to Mr. N. W. Hardy, it had infested the early varieties in the towns of Hancock and Dublin for the last six years. He had personally observed it for several seasons in one of the orchards of Cornell University, N. Y., infesting a few varieties.

Lintner writes in 1885: "The most serious account of its injuries have been received from Vermont. In New Hampshire in a few localities it has ruined entire orchards, (Rept. Comm. Agr'l for 1881,

p. 190)." * * * "Mr. L. L. Whitman writes from North Auburndale, Mass., I had hundreds of bushels of the finest fruit rendered worthless by the apple maggot last year." "From Franklin, Delaware county, N. Y., larvae have been reported." Personally Prof. Lintner captured the flies occasionally at Schenectady, N. Y., from the 3d to the 27th of July.

Prof. Cook in 1884 writes: "Last year I received specimens from Delavan county, Wisconsin, with the information that it was doing great damage. This year the enemy has attacked us on our own ground. I know from personal observation that in Michigan in Ingham and adjoining counties it has wrought considerable mischief."

The following predictions made by Walsh in 1867 are almost prophetic. "There can be but little doubt that the descendants of the improved and highly civilized apple maggots in the East, will, in process of time and by slow degrees, spread gradually to the West, or they may be suddenly introduced in a barrel of Eastern apples into some point at the West, and thence radiate in all directions and colonize the country."

We find no mention of its occurrence in Maine in any publication outside of the State. In the State it is referred to in the agricultural and pomological society reports, in newspaper accounts and in a recent bulletin issued by the Experiment Station at Orono.

The pest was undoubtedly introduced in Maine in early fruit shipped from adjoining states. Mr. T. S. McLellan, (Maine State Pomological Society Report, 1883, p. 43) says: "Some five or six years since, I noticed that the earliest sweet apples we received from the south were infested with a minute worm, which had thoroughly perforated the fruit. Three years since, I noticed my earliest sweet apples were similarly affected, and last season all my sweet apples and most of my pleasant tart apples, such as the Haley, Hurlbut, Nodhead, Primate and Porter were more or less infested." Our observations confirm this as we have the past season found early apples, shipped from Boston and exposed in the Orono and Bangor markets, literally alive with Trypeta larvæ.

Mr. McLellan also refers to its occurrence in the northern part of Somerset county at that time.

Mr. Harlow (Maine State Pomological Society Report 1882, page 104) says: "This insect seems to have increased to such an extent in our State within a few years as to cause serious alarm among fruit growers." The above would indicate that the pest was, in 1882, well established in Maine.

Mr. S. R. Sweetser of Cumberland Centre, writes: "That in August, 1880, he first noticed the flies on King Sweets and the same season the larvæ were found in Talman's Sweets."

Mr. D. H. Knowlton (Maine State Pomological Society Report, 1887, page 9) says: "In some parts of York, Cumberland, Sagadahoc, Kennebec and Androscoggin counties the insect has already become a great pest and its increase may well be regarded with alarm."

Mr. Augur (Maine State Pomological Society Report, 1887, page 101) says: "We have been exceedingly troubled with the apple maggot; so much so that it has broken our confidence in some varieties, so that we have hardly dared to sell them, we have found them so generally affected."

Mr. Sweetser, who has been much annoyed by this pest, writes: "That his apple crop was poor this season (1889) and badly affected with maggots. That his neighbors, who have not been troubled with the fly much before, complain that their apples are badly affected this year." Reports from many places show that the pest has done much damage in the State this season.

Mr. Charles S. Pope (Maine Pomological Report 1888, page 26) says: "This troublesome insect is now found in several counties in the State and is doing much damage to fruit. The insect seems to work mostly in fruit grown in sheltered places, around buildings, or in places otherwise protected from the cold winds. So far as our observation extends they are not working very much in the orchards of the State, except as noted above."

Mr. D. H. Knowlton (Maine Pomological Report 1888, page 117) says: "Its ravages, though extending over a large part of the State, seem to be confined mainly to sheltered areas and have not yet generally injured the fruit grown in the larger orchards."

The observations of the writer so far as they go confirm the above statements.

The writer has examined many varieties of apples during the past two seasons from various parts of the State and his observations show that the pest is on the increase, becoming gradually more widely distributed, doing greater damage where it occurs and constantly extending its depredations to new varieties and new orchards.

Through correspondence, personal observation, the examination of many varieties of fruit from many localities of the State, and through questions sent to fruit growers by the State Pomological Society, we glean; that the pest does the most damage in the western part of the State, and is widely distributed in Oxford, Lincoln, Somerset, Franklin, Androscoggin, Kennebec, Cumberland, Knox, Waldo, Sagadahoc and York counties.

The writer has found it in the Penobscot valley at Stillwater, Veazie and Bangor, and the towns of Charleston and Corinth, in Penobscot county and at Bucksport in Hancock county. In the answers to the Pomological Society questions it is reported from forty-four localities in the State. We have no knowledge of its occurrence in Piscataquis and Washington counties.

Mr. W. P. Gerrard of Caribou, Me., writes us that apples from Plymouth, Levant, Garland, Corinth, and Dexter, and other towns in Penobscot county, sold in Aroostook, are often badly bored by maggots, but he has not seen it in Aroostook grown apples.

INTRODUCTION.

Since the introduction of the apple maggot in Maine, eight or ten years ago, it has done enough damage each year to attract the attention of fruit growers It has been considered in the reports of the State Pomological Society almost every year for the last eight. Accounts of its ravages have frequently appeared in the public prints. During the last four years the writer has received many letters regarding it.

Its ravages have gradually increased. Each year it has extended its depredations further, until it is now nearly State wide in its distribution. It has gradually spread from variety to variety until a large per cent. of the varieties of apples grown in Maine are known to be affected by it.

Its distribution is so wide and its annual depredations so great, that it seriously threatens the fruit interests of the State and, therefore, a consideration of its life history is a matter of State importance.

When the Experiment Station was organized two years ago, and an entomologist appointed, it was decided to make a careful study of this insect.

To thoroughly investigate an insect the first step necessary is to make out its complete life history. With a knowledge of its life changes the weak points are made known and advantage can be taken of them in devising methods to hold it in check or destroy it.

Knowing that prominent entomologists who had written about *Trypeta pomonella*, differed much upon several points in its life history, and also aware that its eggs and egg laying habits were *entirely* unknown, plans were laid to carry out a series of careful observations, embracing a study of the whole life of the insect and an investigation of the subject so far as possible in all of its bearings.

It became apparent at once from the nature of what had been written, that it would be impossible to glean the true from the false, and therefore hazardous to accept any statement, however noted the authority, without a careful verification.

During the last two years, under the most favorable circumstances, we have carefully reviewed all the published statements, accepting such as were verified and rejecting what appeared untenable.

The material at our command has been ample. Hundreds of infested apples of many varieties have been inspected. Maggots by the thousand, hundreds of pupæ, thousands of eggs, taken from the apples and from the ovaries of the females, and over two hundred flies, bred or captured about the trees, and have been examined. From these examinations we have found reason to correct many statements, confirm others and add much that is new especially about the eggs and reproduction of this insect.

We have been materially helped in our investigations by the aid and encouragement of others. In fact, without the assistance so cheerfully given by many, our work would have been impossible. We desire especially to thank Mr. Charles S. Pope, Mr. J. W. True, Hon. Z. A. Gilbert, Mr. D. H. Knowlton and Mr. S. R. Sweetser, members of the Pomological Society, for specimens sent, observations made and kind encouragement in the work. We are greatly obligated to Mr. L. H. Merrill, of the Experiment Station for photographic work, to Professors Riley, Comstock, Lintner and Cook for answering questions, loaning literature or aiding in the bibliography of this insect, and to Professor Riley for use of cuts. Professor Jordan has taken a personal interest in following the researches. By his liberal policy the work has been advanced and this report so fully illustrated. Many points, not of especial economic importance, but of zoological consequence, have been incorporated in this report, it being the present policy of this Station to record in its bulletins all the results of research, both technical and practical.

We feel gratified that circumstances have enabled us to make these important investigations. It cannot be hoped that the work is entirely free from error, but an endeavor has been made to faithfully record what the eyes have seen. The cuts illustrating this report, so far as they are original, were made by the writer, or photographed from microscopic preparations made by him, and may be regarded, as to outlines, reasonably correct. The drawings of the male and female flies were modified from Professor Comstock's cut in the United States Department of Agricultural Report, 1881–2. We have also included *unchanged* from the same plate the excellent figures of the pupa, jaw system, cephalic and caudal spiracles, and a plate illustrating pomace flies.

The work is humbly submitted as a contribution to the life history of this insect, with the hope that it may aid somewhat in an intelligent struggle with this serious pest.

SKETCH OF WORK, 1888–9.

The investigation was commenced under great difficulties. The way had to be felt step by step. At the time we began work Trypeta was unknown to us about Orono. The complaints were mostly from the Western part of the State. The material for study had to be sent by mail or express from the infested district.

Work began July 5th, 1888, upon the Benoni, a sub-acid, early autumn variety. The apples at that date were about three-fourths of an inch in diameter. Observations were continued that season until November 6th. Though this variety was regarded by some as an unlucky choice, and that an early sweet apple would have been better, yet the results show it served the purpose well. We selected this variety because it was badly affected in 1887, and because it was an autumn variety and would enable us to continue the investigation later in the season. Though this variety was made the basis of regular observations many other varieties were incidentally examined.

Fifty-two lots of apples, embracing several hundred specimens of many varieties, were regularly examined in 1888. These studies referred largely to the maggots, pupæ and the flies. In 1889 an investigation of the eggs and the egg laying habits was carried on in the laboratory and field. We spent a week in Cumberland county in July, 1889, studying the flies and their egg laying habits.

Observations were made and recorded upon the following points:

(*a*) *Larvæ:* First appearance in fruit; time required to mature; date of first maturity; conditions affecting rate of growth; time they first leave the fruit; nature of exit; time the larvæ remain in late fruits; first and latest pupæ formed; where the larvæ spend the winter; number of larvæ in a single fruit; presence of larvæ in hanging fruit, marketed fruit, windfalls; presence of larvæ in imported fruit; varieties affected, number and kinds; distribution in the State.

(*b*) *Pupæ:* Depth they go into the ground to transform; their occurrence in decayed fruit, on the surface of the ground, about grass roots and in apple barrels and bins; time required to transform; will they transform uncovered in dry jars under ordinary conditions? Will they transform in bins and barrels kept in damp cellars? Will earlier pupæ transform earlier in the spring? The time late pupæ transform.

(*c*) *Flies:* Number of broods; time of appearance in confinement and in nature; time they are on the wing in nature; relative number of males and females; feeding habits; time of life; copulation; nature of the ovipositor; method of laying eggs; puncture made by ovipositor; nature of internal reproductive system of female; male genitalia; what depth of earth will prevent the flies from transforming.

(*d*) *Eggs:* Number laid; time of laying; method of laying; position in the fruit; distribution in the fruit; development in the ovaries of the female; relation of codling moth to Trypeta work.

The larvæ, pupæ and flies were carefully compared with published descriptions and corrections made. For microscopical examination many slides were mounted, of the eggs, abdomens of females and males, the ovipositor, male genitalia, wings of the flies, feeding apparatus of the larvæ, the larvæ, entire, and portions of the apple peel showing larvæ exit holes and the punctures of the ovipositor.

To illustrate this report photographs and measurement drawings were made. From the photographs some outlines were obtained for pen and stipple drawings. These drawings are found in their proper places. Methods of capturing the flies, and also experiments with insecticides were tried. Incidentally the presence of other apple insects was recorded.

WORK IN PROGRESS.

We are still at work upon the following questions: Will early formed pupæ transform earlier in the spring? Early and late maggots have been allowed to transform and the time of emergence of the flies will be noted. What depth of earth will prevent the flies from appearing! Pupæ have been put at various depths in sand and the greatest depth which they emerge will be recorded. Will pupæ found in barrels and bins in cellars transform? Pupæ uncovered with earth, have been placed in open vessels and will be examined for flies.

Number.	Apples examined.	Variety.	Locality.	From whom obtained.	Date examined.		Trypeta entrance holes.	Trypeta larvæ seen.	Size of trypeta larva in fraction of inches.	Trypeta with codling moth	Codling moth	Plum weavel punctures.	Effective plum weavel punctures	Ash-gray pinion	Miscellaneous unknown.	Perfect fruit	Affected fruit.	Remarks.
					Month.	Day												
1	9	Benoni	Manchester. .	Charles S Pope.	7	5	-		-			6	3	2	1	4	5	Fruit ¾ inch.
2	12	"	"	"	7	9	-		-		-	2				10	2	
3	12	"	"	"	7	14	-		-			4	2	-		10	2	Egg of plum weavel found, oval, white, .07 in. x .043 in.
4	10	"	"	"	7	17	-		-	-		2	2			8	2	Egg found.
5	12	"	"	"	7	24	-		-	-		1	1	1		10	2	
6	5	Greening	New Gloucester. .	W. H. Jordan. .	7	30	-		-	-		8	3			2	3	
7	5	Nodhead	" ...	" ..	7	30	-		-		2	13	11	-	1	1	4	Badly affected, four plum weavel larvæ and a codling moth in same fruit.
8	6	King of Tompkins	" ...	" ..	7	30	-		-		1	13	9	-	2	2	4	
9	6	New York Sweeting,	" ...	" ..	7	30	-		-		4	4	4		-	1	5	Three codling moths in one fruit.
10	6	Gravenstein.	" ...	" ..	7	30	-		-	-	-	14	10	1			6	Badly affected.
11	6	Early Harvest.	" ...	" ..	7	30	-	-	-		5	2	1	2		2	4	Codling moths, 1 stem and 2 blow end.
12	5	Baldwins..........	" ...	" ..	7	30	-		-	-	2	6	2	-	-	2	3	Codling moth larva full grown.
13	6	Cathead	" ...	" .	7	30	-		-	-	1	11	6	-	2	1	5	Two plum weavel larvæ dead.
14	6	Bellflower..........	" ...	" ..	7	30	-		-		2	6	2	-		2	4	
15	6	Benoni..........	" ...	J. W. True. ...	7	30	-	-	-			7	7	2			6	Windfalls.
16	8	"	" ...	"	7	30	-		-	-	-	11	3	-	-	1	7	From tree
17	6	Franklin Sweet	North Greene.....	Z A. Gilbert...	8	2	-		-		3	-	-		-	3	3	
18	11	Benoni............	New Gloucester,..	J. W. True.....	8	6	4	4	.03	-		-	-	2	-	5	6	First trypeta larva found.

19	6	"	Manchester.......	Charles S. Pope,	8	10	–	–	–	-	3	16	-	-	-	-	-	Codling moth left fruit.
20	12	"	New Gloucester...	J. W. True. ..	8	14	48	5	.06 to .1	1	4	-	-	-	-	-	12	The most of this lot laid aside to transform.
21	6	Red Astrachan....	Manchester......	Charles S. Pope,	8	18	–	-	–	-	3	10	2	-	-	2	4	Codling moth full grown, two in one apple, one in cheek.
22	11	Benoni	New Gloucester..	J. W. True.....	8	21	125	7	.11	-	-	2	-	-	-	-	11	Trypeta punctures mostly on pale cheek.
23	4	Franklin Sweet	Manchester.......	Charles S. Pope,	8	23	9	2	.08	-	2	-	-	-	-	-	4	
24	3	Tetofsky	Farmington... ...	D. H. Knowlton,	8	24	Many	2	.25	1	2	1	1	1			3	First full-grown trypeta
25	12	Red Astrachan....	Manchester......	Charles S. Pope,	8	28	"	17	.25	1	1	-	-	-		2	10	Entrance holes numerous. Three trypeta larvæ in one fruit.
26	6	King Sweet	"	"	8	31	"	21	.25	-	-	-	-	-	-	-	6	Exit holes first observed. Seven trypeta in one fruit.
27	6	Fameuse	"	"	8	31	15	10	.08 to .15	-	-	-	-	-		-	6	
28	6	Munson Sweet	"	"	8	31	80	14	.25	-		-	-		-	-	6	Two of these laid aside to transform.
29	7	Diana	"	"	8	31	67	20	.13 to .25	5	5		-	-			7	Exit holes of trypeta.
30	6	Summer Sweet	"	"	9	6	15	7	.03 to .13	3	3	-		-	-	-	6	Larvæ just hatched 1-16, ¼, ½ grown.
31	20	Benoni (windfalls)	New Gloucester...	J. W. True.....	9	12	Many	25	.25	2	2	-	-	-	-	-	20	Pupa found in fruit. 10 apples with exit holes and no larvæ. 9 pupæ in the box.
32	10	" (trees)	" ...	" ...	9	6	"	19	.25	-	-		-	-	-	-		Six in one fruit, one larva, one-half grown.
33	23	" "	" ...	"	9	20	"	52	-	-	-				-	-	23	This lot laid aside Sept 6th. 52 pupæ in box Sept. 20th and fruit not greatly changed.
34	12	Red Astrachan.....	" ...	"	9	7	–	1	.25	-	1	6		-	-	-	7	Entrance punctures in only one.
25	5	N. Y. Sweets	" ...	"	9	7	Many	16	-	-	-		-	-	-	-	5	These all showed exit holes.
36	6	Sops of Wine	" ..	" ...	9	7	"	3	.13	-	-		-	-		-	3	
37	2	Sweet Unknown	Oxford Co., S Fair Exhibition......	D. H. Knowlton	9	15	"	5	.06 to .25	-	-		-	-	-		2	Larvæ ¼, ½ and full grown.
38	1	Unknown Tart.....	Oxford Co., S Fair Exhibition......	"	9	15	"	2	.25		-	-	-	-		-	1	
39	1	Red Striped Sweet Unknown	Lincoln County...	"	9	15	"	3	.13	-	-	-	-	-	-	-	1	
40	1	King Sweet	" ...	"	9	15	"	1	.13	-	-	-		-	-	-	1	
41	2	N. Y. Sweet..	" ...	"	9	15	"	4	.08	-	-	-	-	-	-	-	2	
42	2	Unknown..	S. Androscoggin...	"	9	15	"	2	.08	-	-		-		-	-	2	
43	1	N. Y. Sweet	Kennebec County,	"	9	15	"	1	.06	-	-	-	-	-	-	-	1	
44	2	Unknown Red Tart,	"	"	9	15	–	3	.16	-	-	-	-	-	-	-	2	
45	1	Red Astrachan.....	"	"	9	15	Many	3	.13 to .25	-	-		-	-	-	-	1	One-half and full grown.
46	1	King Sweet	"	"	9	15	"	3	.25	-	-	-		-		-	1	
47	1	Early Harvest . ..	Franklin County..	"	9	15	–	-	–		-	-	-	-		1		
48	2	Winthrop Greening,	"	"	9	15	Many	8	.08	-	-	-	-	-	-	-	-	Badly railroaded. Two dead larvæ. Surface riddled with punctures.

Tabulated Record of Work, 1888—Concluded.

Number.	Apples examined.	Variety.	Locality.	From whom obtained.	Date examined. Month.	Date examined. Day.	Trypeta entrance holes.	Trypeta larvæ seen.	Size of trypeta larva in fraction of inches.	Trypeta with codling moth.	Codling moth.	Plum weavel punctures.	Effective plum weavel punctures	Ash-gray pinion.	Miscellaneous unknown.	Perfect fruit.	Affected fruit.	Remarks.
49	1	Fameuse	Franklin County..	D. H. Knowlton,	9	15	Many	1	.06									
50	2	Early Harvest	Cumberl'd County,	"	9	15	"	3	.08									
51	2	King Sweet........	" "	"	9	15	"	4	.25									
52	6	High T. Sweeting...	Manchester	Charles S. Pope,	11	6	"	4	.16	-	1	-	-	-	-	-	-	Codling moth only one-half grown, probably second brood.

DISCUSSION OF OBSERVATIONS—LARVÆ—HOW DO THE MAGGOTS ENTER THE FRUIT.

Early in 1888 we noticed small punctures through the skin of apples and found they led to minute channels in the flesh. By carefully following these channels we found the larvæ of Trypeta. We also worked the other way, found the very young larvæ in the flesh, traced their route backward and in several instances was able to follow it to these characteristic openings. These openings were found to be distributed over all parts of the fruit; blossom and stem ends, and cheeks, but more abundantly on the cheeks, and more frequently on the pale or shaded side of the apples. All the flies observed ovipositing were in the shade at the time the eggs were laid. This is natural, as the skin on the shaded side would be softer. In highly colored apples these punctures are hard to detect. In light colored apples they can be plainly seen with the naked eye. They are not readily detected, except by practice, from the brownish rust spots naturally found on fruit. This is probably why they have not been before observed.

HOW LONG DOES IT TAKE THE LARVÆ TO MATURE.

In 1888, in Benonies, we found maggots one-eighth grown (August 6th). They could not have been hatched more than a week or so, as they were so small and the channel short and near the surface. By the 14th they were found one-fourth grown. By the 21st they were one-half grown. By September 12th they were found in abundance full grown, and had commenced to vacate the fruit. The above observations were made upon apples taken from the same tree.

In 1889, in Early Harvests, the minute larvæ but a short time hatched were observed about the tenth of July. The maggots left the fruit and entered the pupæ state by August 10th. From the above, we conclude that under *favorable circumstances* they mature in from four to six weeks, and soon leave the fruit. Observations on several other lots in 1888–9 confirm the above conclusions.

ARRESTED DEVELOPMENT OF LARVÆ.

In the fall of 1888 a lot of apples which had been on exhibit at the State Fair was received for examination. Though it was the middle of September, the larvæ were small and many of them dead. We learned that some of the apples had been kept in cold storage and all in cool places. We suspected arrested development. We had come to believe from the examination of many apples, that somehow the maturity of the larvæ and the ripening of the variety were somewhat coincident. Had noticed that the larvæ grow much faster as the fruit softens. To test the effect of cold storage a *portion* of a lot of Early Harvests collected July 9th, 1889, were placed in an ordinary ice chest. The remainder of the same lot was kept in a box under ordinary conditions. They were first inspected August 10th, and the larvæ from those kept under ordinary conditions had emerged, and the pupæ were found in the box. None had emerged from those in the ice chest. Those in cold storage were cut and examined from time to time, the last being opened September 15th, and larvæ were still in them.

In 1888 we found larvæ half grown November 6th. In 1889 Mr. Briggs found a half grown larvæ December 1st. We found one December 25th, half grown, in a King Tompkins. Mr. S. R. Sweetser showed a larva at the Pomological Society meeting at Norway, February 4th, and sent the writer larvæ about February 15th. If the eggs in these cases were laid at the time of killing frosts, October 10th, then the eggs remained unhatched longer than the usual time, or the larvæ in some cases are from two to five months reaching maturity. Cold seems to check development. The larvæ grow faster as the fruit softens. May not the occurrence of Trypeta larvæ in late winter fruit be from eggs laid late in the fall, which from cold are tardily hatched and from the effects of cold and the hard tissue of winter apples are a long time in reaching maturity? May not cold storage arrest the work of Trypeta larvæ in fruit and prevent its rapid deterioration?

ARE TRYPETA LARVÆ FOUND IN WINDFALLS?

The examination of numerous specimens taken from the ground has shown conclusively that the maggots are found abundantly in windfalls. We have never seen exit holes in apples hanging on the trees and believe that the maggots remain in the fruit until it drops or is gathered. The presence of the maggots seems to hasten the maturity and dropping of the fruit. Larvæ are found abundantly in marketed fruit from Massachusetts, which shows, that the larvæ will remain a long time after the fruit is harvested. Any very young larvæ will remain in the decaying apples until they are a mass of corruption. We received a lot of windfalls from Mr. True, shipped about

September 6th. They were not examined until September 12th when in twenty of them we found twenty-five full grown maggots and several pupæ in the box. Hanging fruit picked from the same tree at the same date was full of younger maggots. From twenty-three specimens put in a box, fifty-two pupæ had emerged by September 20th. This shows that the apples having the older larvæ matured and dropped earlier.

WHEN DO THE LARVÆ BEGIN TO LEAVE THE FRUIT?

The larvæ begin to mature about the first of August, in the early varieties and soon leave the fruit and enter the pupæ state. In the summer and early fall varieties, they may be found of all ages, during the summer and fall emerging when mature. The larvæ hatched from eggs laid late in the season may be stored with the fruit and emerge any time during the winter, or remain sometimes by arrested development in the fruit until February. Maggots may vacate fruit when the food supply is abundant and it is occupied by younger larvæ of several ages. They leave the fruit through circular openings a little larger than the maggot. Several of these are sometimes found in the same fruit.

TRANSFORMATION OF LARVÆ.

In 1888, August 8th, we found the first Trypeta larva about one-third grown in Benonies and laid some of the apples aside in a box over sand and left the larvæ to enter the ground. From time to time through August, September and October we laid others aside but did not keep the lots separate, not then thinking that the early larvæ might transform earlier in the spring. The jars and boxes were kept in a room where there was a fire most of the time and where it did not freeze. The sand was somewhat moist when put in the boxes but as gauze was put over them the moisture soon evaporated so the sand was practically dry. About the first of May we moistened the sand in some of the jars and left it dry in others. Two or three lots of pupæ were left in jars and not covered with sand but not one fly came from these. In 1889, August 10th, we put some pupæ in a box without sand and examined them December 1st and all were dead. One box was examined, to see how deep the larvæ had burrowed to transform, and fourteen pupæ were found from one-half to one inch below the surface in loose sand. One or two were noticed to transform at the surface under decayed fruit. A few were also found in the shriveled fruit in the pupæ state. The flies began to emerge first from the jars which had been moistened. Below is a record of the time of appearance of the flies.

Date.	No.	Wet sand.	Dry sand.	Date.	No.	Wet sand.	Dry sand.
May 23.......	2	+		June 25....	3	-	+
June 4.......	1	+		June 27...	3	+	
June 7.......	3	+		June 27....	1	-	+
June 15......	4	+		July 4....	2	-	+
June 19......	2	+		July 4.....	2	+	
June 20......	2	-	+	July 5.....	1	-	+
June 22......	5	+		July 7.....	2	-	+

The time of emergence covered about six weeks. The flies were at once transferred to a large box with a glass top in which fresh apple leaves were kept and apples with fresh cut surface. Some syrup made from white sugar was put in occasionally and they ate of it greedily. The flies appeared very quiet and often remained for a long time in the same place on a leaf, the side of the cage or upon the cut surface of the fruit. None of them lived over three weeks. None were noticed copulating.

WHERE DO THE LARVÆ GO TO TRANSFORM?

The depth to which they go in the ground to transform was determined by putting infested apples in boxes over loose sand, and examining later for the pupæ. Our observations confirm those of Comstock and Cook, that, under the most favorable circumstances, they do not burrow over an inch. The larvæ, being footless and weak, have but little power to penetrate hard soil, and hence find the most favorable places for development in sandy locations. In orchards kept in sod they do not find favorable circumstances for burrowing and undoubtedly enter the pupa state about the grass roots and are subjected to more mishaps. Even where they have loose sand to burrow in, they do not always enter the ground, as we have found pupæ on the surface of sand under decayed fruit. They are sometimes found in the fruit in the pupæ form during the summer months, and quite frequently in stored fruit. If infested fruit is left in a box, barrel or bin, the most of the larvæ will leave the fruit, and the pupæ will be found in the bottom of the receptacle.

Mr. Sweetser sent us a lot of Spitzenbergs and Hubbardstons in December, 1889, and we found many exit holes, a few pupæ and occasionally a larva. We asked Mr. Sweetser to examine the barrels in which the apples were stored, and he sent us eighty pupæ.

Mr. Henry S. Smith of Monmouth, Me., says: "I swept up and burned large quantities of pupæ from where I sorted Nodheads and Talmans on the cellar floor. The apples had been in barrels until put up for market in December and January."

We have had a great many larvæ leave the apples and enter the pupa state in the bottom of the boxes and jars containing them.

EGG-LAYING HABITS OF THE FLY.

When do the flies lay their eggs?—The published views on this point are that the eggs are not laid until late summer or mid-autumn. Comstock says: "According to my observations and all published accounts the apple maggot does not occur in the apple until the latter part of the summer." Lintner says: "During the latter part of the month (July) or in August it deposits several of its eggs upon an apple near the calyx end." Perkins says: "As the maggots do not eat the apples until well advanced toward maturity it is obvious that the eggs are not deposited on the fruit until the end of summer, and from that time to mid-autumn." Our observations do not warrant the above conclusions. The eggs begin to be laid in Maine, on the earlier varieties, by July 1st, and probably earlier in the states farther south. Ovoposition continues until the flies die in the fall by killing frosts. We found numerous small Trypeta larvæ in Sweet Boughs and Early Harvests by July 9th. Comparing their size with newly hatched larvæ they must have been a few days old. Allowing for the time required to hatch it would make the time of egg laying July 1st or earlier. Larvæ found in early imported fruit from Massachusetts were more mature than in the above, which would mean earlier egg laying in Massachusetts.

They are found in abundance in half grown apples. The channels made by the *young* larvæ are largely healed by the growing tissue and might lead to the view that "they do not eat the apples until well advanced toward maturity." They are there, nevertheless, ready to rapidly grow when the pulp softens. As the fruit matures, the channels no longer heal, and being larger, become apparent. The close observer will find plenty of larvæ before the large yellow channels made by the adult can be seen. We had pupæ in considerable numbers the last season by August 10th. The fact that maggots of all sizes can be found from early in July until cold weather shows that ovoposition continues through the season. This is confirmed by an examination of females taken about the middle of September. In them were found plenty of mature eggs and others in varying stages of development.

EGGS AND REPRODUCTIVE SYSTEM.

Discovery of the eggs in the apple and also in the ovary of the female, completes our knowledge of the life changes of Trypeta. The researches of 1888 made us familiar with the entrance punctures. These were again found in the first lot of apples examined early in July, 1889. The first puncture examined contained one egg inserted vertically beneath the skin, and entirely concealed in yellowish, withered tissue. It was described and figured. The second apple revealed another egg, which was photographed. A third egg was transferred to a live box in apple juice and watched. In about fifteen minutes a motion was observed in the end opposite the pedicil. Soon the shell burst irregularly, the head of the larva protruded and in less than a minute it had crawled out A careful examination under high power proved it to be the larva of Trypeta. We went the next day to Cumberland Centre to study the insect at home. Caught several pairs copulating, and made a careful microscopical examination of the reproductive system. Found eggs in great numbers, which agreed exactly with those found in the apples. During the season hundreds of eggs were taken from the females and many temporary and a few permanent slides prepared and additional photographs made. We believe no one will dispute our claim to discovery of the eggs, as nothing has heretofore been written about them.

NATURE OF THE REPRODUCTIVE SYSTEM.

We find no record of a histological examination of this part of the insect. The oviduct leading into the ovipositor is short and soon divides into two quite long convoluted tubes, one on each side, leading to the ovate ovaries, which nearly fill the abdominal cavity. Each half ovary contains about twenty-four chains of eggs, each chain having at least seven eggs attached together, in different stages of development which would make the number of eggs at least 336. As many as eleven stages in the development of the eggs were observed. As many as seven stages were frequently seen attached and we are not prepared to say but what the loose forms seen in the reproductive passages were also detached parts of the chains, which would increase the number of eggs to 528. Nor are we prepared to say but what the pear-shaped unsegmented body at the other end of the chain might develop still others. See Pl. II, Figs. 4-10. We actually counted forty-eight chains in several insects and each chain had at least seven eggs, which would make 336 eggs as the minimum number. The chains of eggs were mounted and drawn to scale and are shown Plate II, Figures 4-10. The developmental stages of the eggs show conclusively that oviposition is necessarily extended over considerable time.

Discovery of the Ovipositor as a sharp instrument, fully capable of making a puncture through the skin of an apple, is a very important observation. The ovipositor has been described as truncate and blunt by Loew, Lintner and Perkins and incapable of making a puncture. All references to the ovipositor we have seen undoubtedly refer to the last abdominal segment, the ovipositor and sheath retracted within it apparently never having been seen. The ovipositor is shown (Plate II, Figures 1 and 3) to be a sharp instrument fully capable of making an incision. Out of over fifty flies only a few died with the ovipositor extended, and in cabinet specimens it is usually retracted within the sheath. We have several slides showing the ovipositor extended, also cabinet specimens showing it finely. Some may claim this discovery for Walsh, as he says the insect oviposits through the skin of the apple, but he examined apparently only one female, and we doubt his having seen the ovipositor. All eminent entomologists since his day have discredited him no one ever having described or figured the ovipositor, therefore, credit should be given to the one who first describes and figures the instrument and observes it do its work.

Confirmation of Walsh's statement that *the female punctures the apple to lay her eggs* is exceedingly interesting, for, as Prof. Riley writes us, "It is opposed to everything which we know regarding the egg laying habits of *Diptera*." This has been denied by all prominent entomologists since Walsh's time. By witnessing the ovoposition ; finding the eggs in the characteristic punctures ; observing one hatch and proving it to be Trypeta, and by finding the same eggs in the ovary of the female that we found inserted beneath the skin of the apples, the position of Walsh is sustained beyond cavil. By means of a jeweler's glass on the eye we witnessed the process of ovoposition several times. The fly would run about over the apple nervously for a short time as though selecting a suitable place, then coming to rest, elevated the thorax behind and turned the abdomen nearly at right angles to the thorax. The legs were spread out as though to brace the insect. The sharp brownish ovopositor was then plainly protruded, and by repeated vertical motions inserted into the apple. So far as we could see, the ovipositor pierced the skin the first plunge and the continued probing was to enlarge the hole. We could not see the egg escape, as the opening to the oviduct was concealed below the skin of the apple. The process occupied a half minute or so. In all the cases we observed, the insect oviposited in the shade. The puncture cannot be easily seen at first, but soon the adjacent tissue changes to brown and shrivels, showing the opening plainly with a brownish areola around it. We marked around one puncture as soon as it was made and examined it five days later, finding the shell of the deserted egg and in a channel close by leading to it the young larva.

RELATION OF TRYPETA TO OTHER INSECTS.

The published views on this question are: (*a*) That the eggs are deposited directly in holes made by other insects; (*b*) That they are deposited on the surface of the apple near the calyx end, the hatched larvæ entering the holes made by other insects, especially those of the codling moth; (*c*) There is an implied view expressed by Prof. Perkins "that they are deposited on the outside, hatch there, and the young larvæ early bore through the peel and enter the fruit. Hundreds of apples have been found infested by Trypeta with no evidence of codling moth work or the work of any other insects, and no external openings excepting the small punctures made by the Trypeta fly. The finding of Trypeta eggs beneath the peel of apples in these characteristic punctures settles this question beyond dispute, and warrants the conclusion, that *the work of Trypeta is entirely independent of other insects*. This is important, for there was a hope that the destruction of the codling moth would check this pest by destroying its means of entering the fruit.

INSECTS SOMETIMES MISTAKEN FOR TRYPETA.

The term *apple worm* is often vaguely applied to any sort of larva infecting the apple. The name *apple maggot* is frequently incorrectly given to the true apple worm, the caterpillar of the codling moth. While in some parts of the country the true apple maggot, the larva of Trypeta pomonella, is called the "*railroad worm*." The larva of the codling moth is usually in Maine correctly called the apple worm, but sometimes it is confounded with the apple maggot. The term maggot is restricted by entomologists to footless larvæ of two-winged flies. The larvæ of the codling moth have legs and spin cocoons and are correctly called caterpillars.

There should be no trouble in distinguishing the apple maggot and its work from the codling moth and its injuries. The apple maggot or "railroad worm" tunnels the pulp of the fruit, filling it with brownish channels, while the codling moth caterpillar usually enters the calyx, works about the core and finally leaves the fruit through a direct channel from the core to the cheek.

Apple worms spin cocoons which are placed under the loose bark of trees or elsewhere *above ground* and from which moths ("millers") come forth. Apple maggots go into the ground to spend the winter and from their pupæ two-winged flies, (described below) and related to the house fly, mosquitoes, and crane flies, come forth. The apple worm is larger and has sixteen legs, a broad black head with a black patch behind it, and is usually pinkish in color. The apple maggot is smaller, footless, tapering to a small head, and greenish white or slightly yellowish in color.

The apple maggot deposits its eggs in the fruit while on the trees and is found in the hanging, stored and marketed fruit, and in the windfalls. In apple pomace and decayed fruits, other maggots are frequently found in great numbers. These are generally the larvæ of *pomace flies*, which work in apple and other fruit refuse and do no injury. We have never seen or heard of *Trypeta flies* laying their eggs in apple refuse, and any worms found in such material may be considered as the larvæ of other insects. These pomace flies are plentiful in Maine about decaying apples, apple pomace, crushed fruit, vinegar barrels and apple driers, and are often a nuisance. We took three species of pomace flies about apple trees in Cumberland county early in July, the two species considered by Prof. Comstock (U. S. Agr'l Rept., 1881–2, p. 198) and another undetermined species. These flies are smaller than Trypeta, light brown or yellowish, and have clear wings and red eyes. The pupæ and maggots are smaller and more slender than those of Trypeta. The maggots change to the pupæ state within or about the decaying fruit. We have taken more than a hundred pupæ from a single decayed apple, and from a single apple have bred nearly a hundred of the vine-loving pomace flies. Their time of transformation is short. Many broods appear in a season. That the pomace flies may be readily distinguished, we give (Plate IV) a copy of Mrs. A. B. Comstock's excellent drawing, taken from United States Agricultural Report, 1881–2, Plate XVI. For a more detailed account of the pomace flies the reader is referred to the above named Report, p. 198.

Varieties Known to be Affected by Trypeta Pomonella.

Variety.	Flavor. Sweet.	Sub-acid.	Acid.	Time of maturity.	Remarks.
Alexander			×	Autumn	Sparingly infested.
American Golden Russet				Winter	" "
Bailey Sweet	×			"	" "
Baldwin			×	"	" "
Benoni		×		Autumn	Badly "
Canada Baldwin			×	Winter	Sparingly "
Cat-head		×		Autumn	" "
Colvert		×		"	" "
Danver's W Sweet	×			Winter	" "
Derby Pippin		×		"	" "
Diana		×		Autumn	" "
Duchess of Oldenburgh			×	"	" "
Early Harvest		×		"	Badly "
Esopus Spitzenburgh		×		Winter	" "
Fall Jenneting		×		Autumn	" "
Fall Pippin		×		"	Sparingly "
Fameuse		×		Winter	" "
Franklin Sweet	×			Autumn	Badly "
Garden Royal		×		"	" "
Golden Ball		×		Winter	Sparingly "
Golden Russet		×		"	" "
Golden Sweet	×			Autumn	" "
Gravenstein		×		"	Badly "
Greening R. I			×	Winter	Sparingly "
Grime's Gold Pippin		×		"	" "
Haley		×			" "
High Topped Sweeting	×			Autumn	Badly "
Hubbardston Nonesuch		×		Winter	Sparingly "
Hurlbut		×		Autumn	Badly "
Irish Peach		×		"	Sparingly "
King Sweet	×			Summer	Badly "
King Tompkins County		×		Winter	Sparingly "
Lady's Sweet	×			"	" "
Maiden Blush	×			Autumn	" "
Mexico	×			"	" "
Mother		×		Winter	Badly "
Munson's Sweet	×			Summer	" "
New York Sweet	×			"	" "
Nodheads		×		Winter	" "
Northern Spy		×		"	" "
Paradise Sweet	×			"	" "
Pearmain		×		"	" "
Penankee		×		"	Sparingly "
Porter		×		Autumn	Badly "
Pound Sweet	×			Winter	Sparingly "
Primate		×		Summer	" "
Pumpkin Sweet	×			Autumn	Badly "
Ramsdell's Sweet	×			Winter	Sparingly "
Red Astrachan		×		Summer	Badly "
Ribston Pippin			×	Winter	Sparingly "
Rolfe		×		"	" "
Russell		×			Badly "
Sherwood's Favorite		×		Autumn	" "
Snow		×		"	" "
Somerset		×		"	Sparingly "

Varieties Affected—Concluded.

Variety.	Flavor. Sweet.	Flavor. Sub-acid.	Flavor. Acid.	Time of maturity.	Remarks.
Sops of Wine..................		×		Summer....	Badly infested.
Sweet, or Yellow Bough.....	×			"	" "
Tetofsky....................	×			"	" "
Talman Sweet	×			Winter.....	" "
Twenty Ounce...............		×		Autumn....	
Wagner......................		×		Winter.....	
Wealthy......................		×		"	" "
Westfield's Seek-no-further..		×		"	
William's Favorite..........		×		Summer....	" "
Winthrop Greening..........			×	Autumn....	" "
Yellow Bellflower...........		×		Winter.....	" "

No pains have been taken to make an exhaustive list of apples affected by *Trypeta*, but in pursuance of work upon this insect, the writer has found it in most of the varieties named. The list has been extended by several members of the Pomological Society. Probably other varieties grown in the State are infested. The list is full enough to convince anyone that Trypeta works in a wide range of varieties, and is not fastidious, but gratifies sweet, sub-acid and acid tastes and indulges in summer, autumn and winter fruits.

Varieties sparingly or not at all affected in some parts of the State are badly infested in other places. In the table, the terms sparingly or badly infested, refer to the writer's knowledge of the frequency of Trypeta in the State and will of course not be correct for any given locality.

SPREAD OF TRYPETA FROM VARIETY TO VARIETY.

Trypeta has been in the orchard of Hon. Samuel Libby of Orono for the last three years at least, but has confined its depredations to a single Benoni tree. They are not scarce on that tree as the writer has taken as many as three larvæ from a single apple. Within twenty-five feet is a Wealthy, fifty feet a Red Astrachan and sixty feet a Nodhead, all varieties badly infested in other orchards in the State, but not a single maggot has been detected in any of them.

The same is true in Mr. Webster's orchard on the other side of the river, where Trypeta has for several years feasted upon Golden Russets, while several other varieties equally inviting have been exempt. Last season the Golden Russet did not bear and the fly transferred its depredations to another variety near by. Within 100 rods of Mr. Webster's orchard, across the river from it, is another orchard where early sweet and sub-acid varieties are grown, yet Trypeta has not been detected.

Mr. Atkins says "That in Bucksport some trees of a variety will be infested while other trees of the same variety in the same orchard are exempt."

The slowness with which this pest spreads from tree to tree, variety to variety in an orchard, and from orchard to orchard, has been noticed by Comstock and others, and when any attempt has been made to explain it, it has been by saying the insect is *fastidious* in its tastes. It is probably true, taking the whole State or country, that the pest is worse upon summer sweet and sub-acid varieties, but it does not confine itself to these. The long list of varieties we publish, which are infested shows a wide range of occurrence in sweet, sub-acid and acid, summer, autumn and winter fruits. The history of this insect in Maine shows that it was first introduced from adjoining states in early imported fruit. It has gradually spread from the early varieties until neither sweet, acid, sub-acid, early or late apples are exempt from its attacks.

The larvæ from early apples enter the pupa state earlier and emerge earlier in the spring, or from the earlier apples there would be generated an early race of flies. These would appear under ordinary circumstances when the early apples were ready to receive the eggs, and before other varieties were far enough advanced, and the early apples would continue to be infested from year to year. If the early apples did not bear, or from arrested or accelerated development the flies appeared earlier or later than their accustomed variety, they would be forced to find a new nidus for their eggs. Let us suppose this to be a later variety; then, as this variety matures later, the larvæ would enter the pupa state later, and appear the following spring a later race of flies. Our observations show that the flies are on the wing from early July until frosts; that the flies continue to emerge for a long time, or that there are several races of flies appearing at different times. A mild winter might force the late pupæ and convert them again into an early race, which will explain the disappearance of larvæ from a later variety and their appearance in an earlier variety.

In some orchards the flies appear later and affect the later varieties worse than the earlier. This may be because the later fruits were first affected and the flies have continued in them, or the location of the trees or the nature of the soil may give unfavorable conditions for early development. The above facts illustrate the erratic habits and wonderful adaptability of Trypeta, and must impress us with the fact that we have a formidable pest with which to contend.

We believe that each tree usually produces the flies that infest it. The flies were thick early in July on Early Harvests, but at that time none were found about the trees of later varieties. Later in the season the fruits of the fall and winter varieties became infested. The Trypeta fly is not adventurous, does not roam about to gratify the requirements of a fastidious appetite, nor does it stay so closely at home because it is over particular about what it eats. It is rather, easily pleased, contented with what is set before it, be it *wild haws* or *Early Harvests*. It clings from year to year to the variety chance has thrown in its way, and does not abandon it, until by over-increase or want of bearing, it is forced to find another nidus for its eggs.

In Illinois though common in wild haws it has not until recently spread to cultivated fruit. It probably left the haws n the East because in the settlement of the country the wild haws were cu.. In Michigan it has been forced to infest wild plums and cherries. These things do not show fastidiousness but adaptability in a wonderful degree. Certainly an insect contented in wild haws would revel in any kind of a cultivated apple. The fact that the pest has spread in our orchards slowly to apples of all flavors and times of maturity shows an alarming power of adaptation to new food and surroundings. It shows that if deprived of the softer and earlier varieties it is still equal to the emergency. Adaptable, contented, the perfect embodiment of the sentiment "be it ever so humble there is no place like home."

GENERAL DESCRIPTION.

Perfect insect a two-winged fly somewhat smaller than the house-fly. Readily recognized by its general black color; yellowish head and legs; dark feet; greenish, prominent eyes; white stripes on each side of the thorax in front of the wings; white spot on the back and upper part of the thorax; three white bands across the abdomen of the male and four across the abdomen of the female, and four black bands across the wings, resembling the outlines of a turkey. See Plate I, Figures 1 and 2.

TECHNICAL DESCRIPTION.

Perfect insect (*female*)—Maximum length, 6 2 mm. (.245 in.) ; minimum length, 5 mm. (.205 in.) ; average length of ten specimens, 5.8 mm. (.228 in.) Maximum spread of wing, 12.5 mm (.5 in.) ; minimum, 10.8 mm. (.43 in.) ; average of five, 12.15 mm. (.48 in.)

Head—Light brown or pale rusty red; space between the eyes in front and the antennæ, darker; front of the face and hind orbit of the eye more or less tinged with white, the latter bearing a row of black bristles; antennæ, .5 mm. long; (.02 in.) three jointed; the first joint shortest; second joint having numerous short, thick, black bristles on the inner face; third joint as long as the other two, oblong, rounded at the end, flattened on the inner face, pubescent. Arista, dark brown, slender, more than twice the length of the joint; frontal bristles black. Mouth large, broader than long; palpi and proboscis pale yellow and pubescent. Eyes prominent, length 1 mm. to 1.25 mm. (.04 in. to .05 in.); breadth .45 to .50 mm. (.018 in. to .02 in.) ; green with reddish brown, greenish and steel blue reflections in life, but dull and greenish black in cabinet specimens.

Thorax—Maximum length 2.75 mm. (.11 in.) ; minimum length 2.25 mm. (.09 in.)

Black. A white stripe on each side in front of the wing, involving its base and the humeral callosity. Thoracic dorsum with four narrow silvery or bluish gray longitudinal stripes arranged in pairs. The pairs separated by a median broad black space. Stripes of each pair separated behind by a narrow black line, confluent in front, the inner stripes shorter. Scutellum, elevated, flat, white above with black sides and base. Bristles of the thorax and scutellum black. Balancers three jointed, outer joint black, prominent, irregularly triangular, basal joints brownish.

Abdomen a little longer then broad. Length, 2.2 to 2.3 mm. (.088 to .092 in.) without the ovipositor. Black, ovate, composed of seven segments. First and second segments rapidly widening. Second segment widest. Sixth segment abruptly narrowed, shorter than the fifth, and apparently rudimentary and represented below only by a narrow sternite. Seventh segment truncate at the end when the sheath and ovipositor are retracted but sloping into the sheath when it is protruded. Posterior portion of the second, third, fourth and fifth segments (occasionally the sixth) broadly banded with white.

Ovipositor—Length, 1.33 mm. (.053 in.); breadth .33 mm. (.0133 in.) at the middle where it enters the sheath, broadest at the base, tapering from where it leaves the sheath to a sharp point somewhat curved (usually upward) at the end. (See Plate II, Figure 1.) Brownish, hornlike, bearing a median groove below, which is covered by two flaps which extend half way from the sheath to the point. These flaps are covered by a shorter median one. From beneath the flaps the eggs escape. In specimens mounted in balsam the oviduct and ovipositor show within the sheath to its base.

Sheath of the ovipositor .67 mm. by .233 mm. (.027 in. by .009 in.); oblong, largest at the base, then narrowing, widening again in the middle, narrowing again and at the lower end widening into a terminal ring. Truncate at the end. Beautifully marked above and below by oblong tubercles arranged in about fifteen oblique rows, beginning at the base of the sheath and sloping backward each way from the median line above and below. The rows from above and below meet each way on the sides at an angle. A triangular space on the sides at the base and above not involved. The tubercles become smaller and less conspicuous toward the sides. See Plate II, Figure 1.

Legs about 3.75 mm. long (.15 in.) Femora and tibiæ about equal, 1.5 mm. (.06 in.) Tarsi shorter, .75 mm. (.03 in.) Femora black with yellowish distal and proximal ends. Front pair lighter, with hind sides more or less dark. Proximal joint of all the tarsi and tibiæ clay yellow. Distal joints of tarsi *all* clothed with dark hairs, making the feet *all* more or less black. (See Plate I, Figures 1, 2 and 3.)

Wing—4.5 mm. to 5.5 mm. long (.18 in. to .22 in.), 2 mm. to 2.5 mm. (.08 in. to .10 in.) broad, hyaline, traversed by four black cross bands. Base of the wing clear; first band beginning at the sinus of the basal lobe, sloping backward and joining the second band about the middle of the posterior margin. Second, third and fourth bands confluent in front and diverging backwards. The dark bands are arranged so as to resemble the outlines of a turkey, the band toward the body representing the neck and head, the second the body, the third the legs and the fourth the tail. The whole surface of the wing covered with minute hairs, those on the bands black, the others clear. Margin of the wing all around and the subcostal vein armed with bristles. (See Plate 1, Figures 1–2.)

Perfect insect (*male*) — Same general color as the female but smaller; length 4 to 5 mm. (.16 to .20 in.); five instead of seven segments to the abdomen, second, third and fourth segments *only* banded with white. Wings shorter and narrower and not spreading so much behind when the fly is at rest; abdomen of the same general shape but smaller. See Plate I, Figure 2. Copulatory apparatus 3 mm. (.12 in.) long, yellowish brown; the penis coiled and with the auxiliary organs usually folded under the abdomen in a broadly oval cavity which extends forward to the middle of the fourth segment. The genitalia are shown Plate II, Figure 2.

NOTES.

The eyes are sometimes variegated with brownish and greenish patches. The fifth abdominal segment is occasionally narrowly banded with white. Sometimes the white abdominal stripes in places involve the whole width of the segment. The coloring at the angle of meeting of the first and second proximal bands in the wings is quite variable, from hyaline through faint dusky shades to black. The black bands are quite variable in brightness. They seem to be brighter in the males.

Eggs--Length (.8 to .9 mm.) (.032 to .036 in.); breadth (.2 to .25 mm.) (.008 to .009 in.); white in the oviducts, but light yellow when taken from the fruit; fusiform and about four times as long as wide; pedicelate at the end; pedicel about one-twentieth of the length of the egg, longer than broad and rounded at the end; pedicelate end broadest and abruptly sloping into the pedicel; other end more sloping. The shell of the egg at the pedicelate end, for one-fourth of the length, is pitted with irregular hexagonal cells, the borders of which are raised and lacerated, giving a roughened or spinose appearance to the surface; sculpture most prominent near the pedicel and gradually lost in the general surface which is smooth; the spinose portion is darker. The larva is placed in the egg with the head away from the pedicel and the end containing the head is inserted into the apple. Ovaries double and saccate, occupying most of the abdominal cavity; each side containing twenty-four chains, each chain at least seven eggs in different stages of development. Perfect eggs and stages of development are shown on Plate II, Figures 4-9.

Larvæ—Length, 7 to 8 mm. (.28 to .32 in.); breadth, 1.75 to 2 mm. (.07 to .08 in.) When full grown usually yellowish white. When younger and sometimes when full grown tinged with greenish; footless; the body composed of fourteen segments. Ninth, tenth and eleventh segments widest, narrowing rapidly toward the head, which is small, pointed and emarginate. The body slopes slowly backward to the last segment, which maintains its size one-third of its length, and then abruptly slopes to one-half its thickness. The lower and posterior half is nearly vertical behind, giving the larva a docked appearance (see Plate I, Figure 3.) From the lower part of the first segment are protruded a pair of black, curved, parallel hooks, the *rasping organs*, by means of which the maggot tunnels the fruit. These hooks are attached to a black chitinous framework (see Plate III, Figures 1a and 1b), the crest of which shows plainly from above through the first three anterior segments and gives the impression of a black spot back of the head. To the unaided eye the hooks and chitinous framework appear as two small black spots headward. When the first three segments are retracted the head appears somewhat blunt, and the hooks do not show. On the dorsal surface on each side, at the union of the third and fourth segments, are two yellowish brown tubercles, the anterior openings of the breathing organs and called the *Cephalic spiracles*. See Plate III, 1a and 1b. These tubercles can be seen by the unaided eye, but their structure cannot be determined. When magnified, they appear funnel-shaped with the border of the funnel expanded into a double row of about twenty cylindrical projections. At the base of the funnel is a short bulbous enlargement. Leading backward from each spiracle to the last segment of the body is a tube or air passage (trachea) which terminates on the sloping surface of the last segment, in the caudal spiracle. One of the caudal spiracles enlarged is shown Plate III, Figure 1c. At the junction of the fourth and fifth segments and the junction of the next to the last and last segments are branch tubes connecting the tracheæ.

Pupæ—Length 4.2 to 5.2 mm. (.17 to .21 in) ; breadth 2 to 2.6 mm. (.08 to .1 in.) Pale yellowish brown. When the maggot assumes the pupa state it does not shed the larval skin. The maggot contracts, assuming an oval form. The head segments are entirely retracted so that the tubercles of the cephalic spiracles project in front. The posterior end contracts but the caudal spiracles remain in view and the larval segments are easily made out. The true pupa is found within this shrunken larval skin, or in the language of the Entomologist the pupa is *coarctate*. The pupa is a little more than twice as long as wide and barrel shaped, the ends sloping about equally. The larva is about four times as long as wide and the head end is very sloping and pointed. The pupa is only twice as long as wide and equally sloping at the ends. Otherwise the resemblance between it and the pupa is apparent. There is quite a variation in the size of pupæ, some are much longer and thicker than others and may be of females, as the female flies are much larger than the males. See Plate III, Figure 2.

LIFE HISTORY.

In early seasons, under favorable conditions, the flies in Maine begin to emerge about July 1st, and earlier in the states farther south. They continue to emerge all summer and are on the wing in abundance until the middle or last of September and occasionally in October. Early frosts check them. The flies lived three weeks in confinement and will probably live longer in nature. They begin to deposit their eggs in the early fruit by July 1st or earlier and egg laying continues while the flies are on the wing. The earlier races of flies affecting the earlier varieties, and the later races the fall and winter fruit. Each female is capable of laying, at least, between three and four hundred eggs, which are inserted from time to time, one in a place, by means of a sharp ovipositor through the skin of the apple. The eggs being successively developed in the ovary of the female, after the manner of the eggs of the barn-yard fowl, the season of egg laying extends over considerable time. The eggs are vertically inserted into the pulp of the apple, with the end opposite the pedicel, which contains the head of the maggot, pointing toward the core. The eggs are deposited in all parts of the apple, usually upon the cheeks, sparingly near the calyx and stem ends, and more abundantly upon the pale or shaded side of the fruit. The time required to deposit the eggs is about one-half minute. By means of the sharp ovipositor a characteristic puncture, .33 mm. (.0133 in.) diameter, is made through the skin of the apple. These punctures can be detected by careful observations with the naked eye, but a pocket lens is necessary to see them well. They appear as brownish specks, and have not been before distinguished from the brownish, rusty spots common on apples. Under the glass they appear as circular or oblong openings, surrounded by a brownish border, and somewhat shruken by the shriveling of the tissue beneath. They may be numerous on the same apple. The eggs hatch in four of five days under favorable conditions and the minute larvæ begin at once to work in the pulp of the apple. They have no true apposable jaws, but the head is provided with two black curved hooks, situated above the mouth, with which they rasp the pulp of the fruit rapidly by means of a vertical movement of the head. They live upon the juice of the particles of apple thus detached which is sucked into the mouth. The pulp is rejected and turns brown. They can burrow their length in soft fruit in less than a minute. The channels made by the young larvæ, while the fruit is still growing, are largely healed and neither they nor the minute white larvæ are liable to be detected by the naked eye or by the casual observer. As the larvæ grow and the fruit matures, the enlarged channels do not heal, but turn brown and the presence of the maggots is then readily detected. These channels meander through the whole fruit even the core. They often cross each other, enlarge as the larvæ grow, and in the last stages of trypeta work run together, producing large cavities. Finally they involve the whole fruit, rendering it a worthless mass of disgusting corruption, held together by the peel.

In the early stages of trypeta work there is no external evidence that the fruit is infested, excepting the punctures made for the insertion of the eggs. By these punctures the presence of the maggots can be detected. In advanced trypeta work brownish trails, where the larvæ have come to the surface, can be seen through the skin. Apples marketed with no suspicion of their being infested are frequently found hopelessly involved, honey-combed and worthless. Apples apparently sound when gathered, may by the presence of eggs or young larvæ, afterwards become hopelessly involved. The newly hatched larvæ are a little shorter than the eggs and could not be readily detected in the white pulp of the apple without a pocket lens. They attain their growth, under favorable circumstances, in four or five weeks, but their development may be arrested by cold insufficient food, hardness of the fruit, &c., for a great length of time. They remain ordinarily in the fruit but a short time after they are mature. They often leave it and go into the pupa state when there is an abundance of nourishment and the fruit is still occupied by younger larvæ of various ages. If the fruit is kept cold, though full grown, the larvæ remain longer or may even change to the pupæ state within it. We have never seen the exit holes in hanging fruit and believe the maggots do not drop, but go into the ground from the fallen fruit. Their presence causes the fruit to mature earlier. Fruit picked from the trees may contain larvæ and often stored or marketed fruit is alive with maggots. The exit openings are characteristic irregular holes about 2 mm. (.08 in.) in diameter surrounded by a brownish border. They look as though the maggots had gnawed a hole for the head, and had then forced the body through, leaving a lacerated border. They may occur anywhere on the apple but are more frequently found where the brown larvæ trails show through the skin. They begin to appear in the early apples about the first of August and may be found until frost in the windfalls and in the stored fruit as long as the larvæ remain.

It would seem that the development of the larvæ is so nicely timed that they are not mature until the fruit is ripe. Their development is slower in late and hard fruits. A dozen maggots may infest the same apple though a single one is enough to render it worthless. The maggots have been found in numerous varieties, early and late; sweet, acid and sub-acid, extending from early in July through August, September, October, November, December, January and February. The larvæ usually leave the apples and go into the ground an inch or less and soon change to the pupæ state. The pupæ are occasionally found within the fruit in windfalls and quite frequently in stored fruit. Sometimes the larvæ change on the surface of the ground under decaying fruit. On grass ground they probably change in the debris about grass roots. In the bottom of boxes, bins and barrels where infested fruit is stored, pupæ may be found in abundance.

Our observations show that if the pupæ are kept in a warm room, in a box or bottle, and not covered with earth, they will not hatch. In the cellar and cool storerooms, where apples are usually kept, it may be different. The pupæ remain in the ground a greater or less length of time, depending on when they enter the pupæ state, soil, location and season. They can be forced by favorable, or retarded by unfavorable circumstances in the laboratory, and this is probably true in nature. Specimens kept by Professor Comstock in a warm room all winter, began to emerge May 28th, and continued to appear until July 6th. (He does not say when they entered the ground.) The specimens we transformed, entered the ground in August, September and October; and came forth as flies from May 23d until July 7th, or they finished appearing about the time the first ones appear in nature. This shows forcing. Dr. Goding records the remarkable instance where late larvæ found in fruit in January went into the pupæ state and appeared by February 1st. This would indicate that the late larvæ appear earlier, which is contrary to our experience. Possibly it may be unusually rapid transformation due to forcing. The appearance of the flies again the following summer completes the life history.

REMEDIES.

Trypeta is an unusually hard insect to destroy. The eggs are laid under the skin of the apple; the larvæ spend their time in the fruit and the pupæ are safely concealed in the ground, within the shrunken skin of the larvæ, therefore, they are well protected from destructive parasites and none are known to infest them. The flies do not seem to be enticed by sweetened poisonous substances and cannot to any extent be trapped. The eggs are so safely lodged in the apple beyond the reach of poisons applied by spraying that there is no hope in this direction. The only chances left are to destroy the larvæ and pupæ. The larvæ are found abundantly in windfalls, and the pupæ in bins and barrels where fruit has been stored. *Destroying windfalls would prevent the maggots going into the ground, and burning refuse from bins and barrels would dispose of those in stored fruit. These methods are practical, easily applied and should be rigidly enforced.*

There are some *hopeful* and *helpful* features in our struggle with this pest. The history of its work in other states shows that its ravages have natural limits. Though bad enough it has not apparently gone on from bad to worse but has kept within certain bounds. Flies as a class are delicate insects and are liable to many mishaps and great variation in abundance from year to year. Trypeta seems to be confined largely to sheltered locations and sandy soil and does not from its nature spread rapidly from tree to tree, variety to variety, orchard to orchard.

To *discourage* us is the fact that a new supply of the pest is yearly brought into the State in imported fruit and every railroad town is liable to become a generative center for the pest. Again, unscrupulous orchardists at home, to save loss, knowingly market infested domestic fruit. Infested fruit may be marketed without knowing it. In both cases it is apt to be dumped on the ground and spread the pest. The sale of fruit from one part of the State to another is liable to hasten the spread of the flies.

All things considered, we firmly believe the ravages of this insect can be controlled, if we avail ourselves of the known means to check it. Below is a detailed consideration of useless, preventive and direct methods of coping with the pest.

USELESS METHODS.

1. Spraying early in the season when the apples are small would do no good as the flies are not on the wing until July, when the early fruit is fully half or two-thirds grown, and too large to spray with safety. Spraying, even if safe, would do no good as the eggs are inserted under the peel, and the young larvæ in them protected by a shell are beyond the reach of poisons. The apparent decrease of Trypeta after spraying, mentioned by Mr. Augur in Pomological Society Report, page 101, 1887, must be accounted for by another and independent cause.

2. In confinement the flies are very fond of sugar, yet about the trees, when other flies of several species were regaling themselves on apple juice, we did not see a single Trypeta fly feeding. Sweets poisoned with arsenious acid and corrosive sublimate, and placed on paper in shallow pans in the trees failed to atttract them.

3. Sticky fly papers seem to be useless. We exposed several sheets in the branches of a tree where the flies were thick, for three days, and only took a *single* Trypeta fly.

4. It has been suggested "that a practical way to defeat the work of this insect in great measure is to raise little early fruit." We have no confidence in this method. It is not a remedy What fruit growers want is a way to check the pest and save them the invaluable luxury of early fruits. Would it not be much better to save the trees and for two years carefully destroy the windfalls and with them the pest? Those who first suggested this method believed the pest confined its ravages to the early fruits. To cut down the early fruit trees would not destroy Trypeta. Experience of Maine fruit growers, and our own observations, show conclusively that the insect works badly in late and winter fruit, and is known to infest most of the varieties grown in the State. If deprived of the early varieties, a want of food supply would make it worse in the later fruits. We believe that cutting down our fruit trees would "defeat the ends of this insect," but what the profit if in our revenge upon it we at the same time sacrifice our fruit. There is no lazy way to check Trypeta. It will have to be done by a direct, squarely fought battle. We firmly believe we have in the careful destruction of the windfalls the means of destroying the pest.

The Trypeta is not like la grippe, spreading over a state in a day, but it goes slowly from tree to tree, variety to variety, orchard to orchard. The checking of the pest then is largely an individual matter, to be worked out independently in each orchard. We sincerely hope the fruit growers of Maine will give the destruction of the windfalls and the disposal of refuse from apple barrels and bins a fair trial, before passing these methods idly by as "impracticable to any extent."

5. The destruction of our early fruit trees, excepting a few to be left as traps, has been suggested. If we raised no early fruit the early flies would do no harm. The destruction of the larvæ from these trap trees would not lessen the ravages of the later appearing races of flies upon late fruits. Destroying the early fruit would force many of the early appearing flies to find a nidus for their eggs in the later fruit; thus increasing the number of later appearing flies, and their effects upon later varieties. This method is based upon the erroneous belief that Trypeta works only in early fruits.

PREVENTIVE MEASURES.

1. Keep the orchards in grass and in the fall or spring burn under the trees to destroy the pupæ that are about the grass roots.

The experience of fruit growers so far as we know, is to the effect, that orchards in grass are less affected. This is reasonable because the maggots are weak and cannot enter the ground under such conditions and would be forced to remain above ground about the roots and would be more subject to mishaps. Burning the grass would certainly destroy many.

2. If the orchard is in cultivation, deep spading or plowing in the fall or spring would probably destroy them. The maggots go into the ground less than an inch. The flies are weak and could not reach the surface from any great depth. The above two remedies are based upon the supposition that the maggots have been allowed to go into the ground. If the windfalls have been gathered carefully as they should be none would be left to enter the ground, and these preventive measures useless.

3. Orchards on sandy soil and in sheltered places with a southern exposure are worse affected. In planting orchards such conditions might be avoided.

4. Prevent by legal enactment the importation of foreign fruit from localities known to be infested. The pest was undoubtedly introduced into the State by importation of apples, and each year

there is a new invoice from Massachusetts in *imported early fruit*. We saw in the Orono market, July, 1889, a barrel of early sweet apples from Massachusetts literally alive with nearly full grown *Trypeta maggots*.

They may be found in Bangor or in any other railroad town in the State when early foreign fruit is exposed for sale. Is an act to prohibit the importation of early fruits practical? We protect our game by an act. Infected cattle are destroyed by law. Is the protection of our game and cattle more important than the protection of our fruit? We have no means of accurately telling the annual loss to fruit growers by this pest, but it must be considerable in the State. To many it amounts to from 10 per cent. to 75 per cent. of the crop. There are only a few entrance ports and early fruit could be readily inspected, and if found infested confiscated and destroyed or the importation of early apples could be *entirely* prohibited. If fruit growers, knowing the facts, are contented to allow their interests to be so jeopardized and make no effort to prevent it, they should without complaint bear the consequences. It is a matter of State interest for the pest is almost State wide in its occurrence. As a State, we can much better do without early foreign fruit than suffer the loss of our home products. No matter what methods are adopted to check this pest, they will prove more or less futile, if each year in all the railroad towns of the State maggots by the hundreds are thrown upon the ground in worthless infested foreign fruit.

DIRECT METHODS.

1. The flies are very stupid although they appear otherwise. When resting on the leaves or apples they can readily be taken with a small insect tube or bottle. By placing the mouth of the tube cautiously over them, they are not disturbed, and soon crawl inside. We took thirty this way from a single tree in an hour and a half. Making no allowance for mishaps and supposing a fly lays three hundred eggs and one-half of the flies are females, the progeny of a single fly the third season would be capable of laying nearly seven million eggs. The killing of even a few flies would materially lessen the number and help hold the pest in check.

2. Destroy the windfalls as soon as possible after they drop. This method has been recommended by every Entomologist who has written on the subject, as the best way to cope with the pest. It is based upon the positive knowledge that the maggots do not leave the fruit

until it drops, and are found abundantly in the windfalls. These maggots if not destroyed enter the ground and appear three hundred-fold stronger the following season for the work of destruction. To destroy the windfalls makes dead maggots of them and dead things can not reproduce. It is common to not gather the fruit of infested trees but allow it to drop and decay on the ground. *This is a bad practice, as it is the best way possible to multiply the pest.* It is a present loss of time and expense to destroy worthless fruit, but it will pay well in the end.

Two methods of destroying the windfalls suggest themselves: (*a*) hand picking; (*b*) allowing sheep or hogs the orchard.

(*a*) The windfalls may be collected and fed to stock in the yard or pasture. If carried to stock and thrown on the ground in quantities greater than are immediately eaten, there is danger that the maggots leave them and go into the ground. This might be avoided by feeding no more than are eaten clean, and storing any accumulated fruit in a tight box or bin, and, finally, destroying the refuse. Every provident orchardist should gather the windfalls as a matter of economy. They are as good as No 3 apples which are largely fed to stock. If not profitable to feed they should still be destroyed to prevent the increase of insect pests and fungi which they harbor. Gathering the windfalls for the express purpose of checking Trypeta has been tried and found effectual. The making of cider from maggoty apples might be profitable, and would afford those who drink it both meat and drink at the same time, though it would not, if known, make a very appetizing potion. We might as well save the trouble and expense of manufacture and eat the infested apples at once, or as Walsh has tersely expressed it, "Eat the devil as to drink his broth." If not needed to feed stock they could be thrown into pits dug in convenient places in the orchard and after frost the refuse covered with a foot or two of earth. It would be better to gather the windfalls every day and make thorough work of it. A boy could do it. If gathered every day it would not take much time. If impossible to gather every day, twice a week would destroy many but would take longer to check the pest. In early varieties the gathering should begin by July 15th, and from late varieties as they begin to ripen and drop.

(*b*) Allowing enough sheep or swine in the orchard to eat the windfalls would involve less time and expense and insure probably a more immediate destruction. They should be turned in each day for time, or kept in the orchard all the time from July 15th until the apples are gathered. It is some trouble and expense to destroy the windfalls. A troublesome pest necessarily involves time and trouble, and to exterminate Trypeta will require determined and thorough action.

Thorough and universal destruction of the windfalls is the most hopeful method, and fruit growers are urged to give it a thorough trial for two years.

3. Destroy the refuse from apples stored, marketed or used for home consumption. This is based on the fact that marketed fruit early and late is often alive with maggots. That pupæ in abundance are found in the bins and barrels where fruit has been stored. The chances that these larvæ find the conditions for development are much less than with those that go into the ground from the windfalls, but the pest may be spread through infested marketed fruit thrown on the ground.

(*a*) Infested early apples, foreign and domestic, in market places are a fruitful source of the pest, and fruit dealers should be required to burn or bury all apple refuse and not throw it on the ground.

The maggots are not able to crawl out of a box and the refuse from market places, could be thrown into a tight box or barrel and the maggots prevented from going into the ground. The refuse could occasionally be buried a foot or so deep.

(*b*) The maggots in stored apples soon leave them and go into the pupa state in the barrels or bins. If marketed without sorting, the pupæ go with the fruit in the barrel and may spread the pest. The sorting floor should be swept if pupæ are found on it, and the refuse burned. In bins and barrels in the cellar the pupæ probably retain their vitality and if not burned the flies emerge in the spring. As a precaution the bins should be carefully swept and the barrels shaken into a tight vessel and the refuse burned. Apple refuse from home use, known to contain maggots, should be destroyed and not thrown on the ground.

The writer's observations so far seem to indicate that the perpetuation of Trypeta from year to year is largely if not wholly due to the transformation of maggots that go into the ground, and that we have comparatively little to fear from the larvæ found in winter fruit picked and stored after frosts.

The pupæ found in barrels in December and placed in a jar in the cellar, without dirt, have not transformed. Some of the same lot put in earth December 25th have not yet changed. Maggots allowed to emerge from apples and transform in a box without dirt have not changed to flies. These facts would seem to indicate that pupæ exposed in open barrels for any length of time will not transform. Again, many of the larvæ in hard winter fruit die and do not reach maturity. It is not uncommon to find winter fruit full of the old trails of half-grown larvæ and the maggots dead in the channels, and the apple in a fair state of preservation. The subject needs further investigation, and the writer is at work upon it. Meanwhile it is best to destroy all pupæ found upon sorting floors or in bins or barrels.

The careful destruction of the windfalls and pupæ from stored fruit is, with little trouble or expense, within the control of the fruit grower, and amounts to making an effectual trap of all trees infested.

The remaining sources of Trypeta, domestic and foreign marketed fruit, are not so easily controlled. Fruit growers should be careful not to market infested fruit, and try to control the importation of early fruits. Great importance attaches to a knowledge of the pest and its habits, so that its first appearance in an orchard will attract attention and lead to prompt action against it.

CRITICAL REMARKS UPON THE ANATOMY OF TRYPETA.

Walsh, in the original description says the eyes are *black*, and no one seems to have corrected this error. The eyes fade in cabinet specimens and are dark, but even in these they have a decidedly greenish tint. The eyes are greenish in life, and in varying light give green, rusty brown and beautiful steel blue reflections. They are rarely varigated with brown patches. Walsh says: "The tip edge of the four basal segments (of the abdomen) white above." He seems to have overlooked the first basal segment which is not at all white. The facts are, that in *both male* and *female* the white bands begin on the *second* basal segment and in the male involve the second, third and fourth, and in the female the second, third, fourth, fifth and occasionally the sixth. Loew makes the same mistake and says indirectly that there are only five segments to the female abdomen, while there are really *seven*. (See Plate I, Figure 3.) Walsh and Loew seem to have examined only a *single* female. Comstock apparently overlooked the basal segment of the female abdomen, as he says, the white bands "are borne by the *first* to the fourth segments inclusive." The sixth segment of the female abdomen is apparently represented only by the *tergite*. The segment being very narrow at the sides and below. The seventh bears the sheath and ovipositor contained within it. Walsh lets the reproductive system so severely alone, that it is certain he did not see the ovipositor, or he would have considered so important an organ. From Loew's account it would appear that he mistook the last segment of the abdomen for the ovipositor, and described that segment for it. The abdomen of the male as figured by Comstock is shriveled or distorted. We have before us twenty-five males and all show the ovate form broadest at about the second segment. If there is any difference the male abdomen is broader in proportion to its length than that of the female. Prof. Lintner also calls attention to the correct form of the abdomen.

The basal lobes of the wings are more prominent and rounded than shown in Prof. Comstock's figure and the caudal margin sinuous, the sinuses being located where the second and third black bands touch the margin. The outline of the outer black bands of the wings are not curved and continuous (as shown in Comstock's figure) but quite irregular as shown in the corrected cut of the wings, Plate I, Figures 1 and 2. There is also a subcostal vein above the one that is armed with spines, which is not shown in Comstock's figure, and to this the cross vein in front of the second black band joins and is not attached to the second subcostal as shown in Comstock's figure.

Walsh says: "The tips of the four hind paws tinged with dusky." This statement usually applies to all the paws. Walsh, in describing the larva says: "That at the base of the first segment behind the head the spiracles are located." Comstock says: "There are at the union of the first and second segments pale brown tubercles, the cephalic spiracles." Comstock's figure represents them so located. If Walsh regarded the head as one segment, then his vague statement would imply that he believed the spiracles located between the second and third. After examining many specimens, both alive and dead, we feel confident there are three segments in front of the spiracles as shown in Plate I, Figure 3. Prof. Comstock's figure of the full larva shows it at *rest* with the head and first segments telescoped and the anterior third of the body thickened. When fully extended the maggot is much more pointed in front. The hooks are less blunt than shown by his figure. The cut of the larva given in Saunder's Fruit Insects is entirely misleading.

Prof. Comstock is the only one who has seriously studied the anatomy and histology of this insect since Walsh's time, and though we have not confirmed some of his observations, yet his paper is really the only contribution to the anatomy and histology of Trypeta pomonella up to this time, since the original description by Walsh, though others have contributed to a knowledge of its habits and distribution.

CRITICAL REMARKS UPON THE LIFE HISTORY OF TRYPETA.

The first reference we find to the notion that codling moth work bears any relation to Trypeta, occurs in Walsh's First Annual Report, 1868, where Mr. W. C. Fish is quoted as follows:

"I have found that in most cases the fruit had been previously perforated by the larva of the codling moth before being inhabited by the apple maggot"

Walsh evidently did not endorse this, as he says: "The eggs are inserted by the ovipositors of the flies into the flesh of the apple," a statement which our observations confirm, though we are at a loss to know upon what data Walsh affirms so positively, as he did not describe the eggs, ovipositor, or make record of having witnessed oviposition Walsh says Trypeta "never penetrates to the core," a statement not warranted by our observations, as maggots have frequently been found in the core, and sometimes the core almost eaten, as shown in Plate III, Figure 5. Walsh says Trypeta "*probably* feeds upon our native crabs" It should be noticed that he does not make record of having found it in crab apples.

The statement restricting the appearance of the flies to July is partial knowledge rather than error and the result of limited observations. The other statements recorded by Walsh our observations have confirmed. We did not know about an article by Prof. Riley—*American Agriculturist*, July, 1872—until too late to consider it here. We have not seen the article, but the work of Trypeta is figured and means against the insect advocated. Passing by the writings of Loew, Packard and Glover, who record nothing new upon the habits of Trypeta, we come to Prof. Comstock's Report. The statement that crab apples are infested by Trypeta is not based upon observation. Prof. Comstock writes us he has not observed Trypeta in crab apples, nor are we able to find any one who has. The conclusion seems to be wholly founded upon Walsh's statement of probability recorded above. It is also to be doubted whether

Trypeta occurs throughout the country where haws grow. We have not found apple maggots in haws in Maine, nor in Arkansas where the genus Crataegus is represented by a large number of species, nor in Iowa, but abundantly in Northern New York. The conclusions reached by Prof. Comstock, that Trypeta is "fastidious," and confines its ravages to a few varieties of fruit and is "much more apt to infest early apples" are not warranted by our observations. We find it attacks a wide range of varieties early and late, acid, sub-acid and sweet, and affects the early varieties not from fastidiousness but because the early races of flies are most abundant and appear when the early fruit is in proper condition to receive the eggs.

The statement: "We seldom see the Trypeta until about the first of September, and never in green fruit," quoted by Prof. Comstock from a letter written by Mr. Hicks and left unchallenged, is incorrect. Prof. Comstock endorsed this view as follows:

"According to my observations and all published accounts, the apple maggot does not occur in the apple till the latter part of the summer."

The eggs are laid in half grown fruit as early as July 1st, and maggots occur in abundance in July before early fruit has commenced to soften, and pupæ commence to be formed by August 1st. The statement that "in the autumn when the larvæ are full grown, they leave the apple and enter the ground," expresses only a part of the truth. Larvæ are transforming from August 1st until the middle of October from maggots found in apples in the orchard, but large numbers of young larvæ are stored with fruit and enter the pupa state in the bins and barrels, transforming sometimes as late as December, January or even February. The statement that the insect remains in the pupa state during early summer would not apply to the early appearing races of flies found on the wing by July 1st.

The contributions to the habits of Trypeta made by Prof Comstock and not recorded by Walsh that our observations have confirmed, are that the larvæ go about one-half inch into the ground to transform and that in confinement the flies emerge earlier than in nature. Prof. Comstock seems to have studied the histology of Trypeta rather than its habits, and his contributions in that direction are important.

Prof. Comstock suggests two remedies: destruction of the windfalls and grafting the trees into later varieties and leaving a few early fruit trees for traps. We endorse the first, but the second we do not, as it is based upon the erroneous belief that Trypeta works almost exclusively upon early apples.

Prof. Cook rejects Walsh's position that the eggs are inserted in the flesh of the apple and erroneously says "the flies seek a nidus for their eggs *on* the apple." Again, "Several eggs are often laid *on* a single fruit." He incorrectly restricts the appearance of the flies to July, the occurrence of the maggots to September and early October, and pupation to early October. Again, he incorrectly says, Trypeta "is only found in the apples in early fall, and as it prefers soft, mellow fruit it is much more destructive to fall apples. I have found a few in winter fruit. From the fact that it only attacks fall fruit, it is, on the whole far less to be dreaded than the codling moth larva." The maggots occur in apples from early July until February, and attack early fruit, and in Maine several winter varieties badly, and it tunnels the whole fruit rendering it worthless. Its occurrence in time and its range in varieties being about the same as that of the codling moth and its work much more destructive, for these reasons *alone* we would regard it a worse insect. But its range over the country being much more limited and in a State its occurrence less universal, the damage done by it at present is less than the injury by codling moth larvæ. Prof. Cook has added the western localities, Michigan and Wisconsin, to our knowledge of the geographical distribution of Trypeta in cultivated fruit, and also recently has detected the apple maggot in plums and cherries in Northern Michigan.

Prof. Lintner perpetuates the errors of those who have written before him, by restricting the appearance of the flies to July, the egg laying to late July and August, the first appearance of larva so late as September the pupation so late as autumn. He also advocates the view that the eggs are deposited *upon* the apples, and the novel view that they are placed "near the *calyx* end, where the fruit *may* have been already burrowed by the apple worm." It is not certain from this statement what method of entrance into the fruit by the larva is advocated, but it may be implied that the larva from eggs laid in apple worm holes enter that way, and the others when hatched crawl to apple worm holes or bore directly through the peel where they are located. It makes but little difference now, as both are known to be wrong.

Prof. Lintner evidently did not observe a fly with the ovipositor extended, or he would not have rejected Walsh's statement, and said the "blunt ovipositor could not pierce the peel" of the apple. Prof. Lintner corrects the error that Trypeta is confined to early fruits, and recognizes its wider sphere of action. Prof. Lintner, under the head of "Desiderata in the Life History of Trypeta," mentions several points which need to be determined. The questions asked by him are all considered in this Report.

The statement made by Walsh, Comstock and Perkins, that Trypeta has not been found in cultivated apples in Illinois needs correction. In *Orchard and Garden* (October 1889, page 192) Mr. A. B. Cordley records its occurrence in Illinois. The following statements made by Prof. Perkins have not been confirmed: "The eggs must be deposited upon the apple. The ovipositor is too soft and blunt to pierce the skin of the apple. The maggots do not eat the apples until well advanced toward maturity. The eggs are not deposited on the fruit until the end of autumn."

Prof. Perkins expresses doubt about the eggs being locally placed on the apple and implies that the larvæ gnaw through the skin when hatched, or sometimes enter codling moth holes. He also gives facts disproving Comstock's position that Trypeta is chiefly found in early apples. He also adds Vermont localities to our knowledge of its distribution and suggests several important lines of research which were undertaken by the writer and are considered in this Report.

Mr. A. B. Cordley in the article referred to above records the occurrence of Trypeta in plums and cherries in Northern Michigan and also speaks of Trypeta having been found in Illinois. The article seems to have been written to report the above facts as nothing else is new, and many of the errors of previous writers are reiterated.

Mr. G. C. Davis in *The Ohio Farmer*, November 9th, 1889, records the same facts reported by Cordley but adds nothing new and leaves all the errors of previous writers unchallenged. He, however, makes the novel and reasonable suggestion, that Trypeta may have acquired the habit of feeding on cultivated apples "because cultivated apples became more plentiful or thorn apples less numerous."

In Maine Agricultural Experiment Station Bulletin, No. 2, (Second Series), Prof. Harvey records the following new facts regarding the life history of Trypeta:

(*a*) The discovery of the eggs; the number of eggs the female deposits; that the eggs are inserted from *time* to *time*, *one* in a place, by means of a *sharp* ovipositor, through the skin of the apple; that the eggs are deposited in the fruit *before it is ripe* and in early fruit early in July; the time required for the eggs to hatch.

(*b*) That the larva becomes full grown in from four to six weeks; that they leave the apple through characteristic openings in the skin, and on grassy ground probably hybernate about the grass roots; that the larvæ are stored in fruit and leave it and go in the pupa state in the bins or barrels; that they occur in the fruit earlier and during a longer time than before recorded.

(*c*) That the flies are on the wing longer than before recorded; that the later races of flies affect the later fruit.

Additional new facts will be found recorded in this Report and some of those recorded in the above Bulletin modified and extended.

The Abstract of Maine Agricultural Experiment Station Bulletin, No. 2 (Second Series), which occurs in *Station Record*, Vol. I, No. 2, page 73. is incorrect in the following particulars:

It ignores the writings of Walsh, who should have received credit for the first account of the larva, pupa and flies, and implies that the credit should be given Prof. Comstock. Again, it gives Prof. Comstock the credit of describing and figuring the insect in *all* its stages. Prof. Comstock does not claim this honor, as he says (U. S. Agricultural Report, 1881–2, page 196): "I will now give an account of each of the stages of this insect, excepting the egg, which has not been observed." Prof. Comstock did not discover any of the stages of this insect, and the flies and larva were first figured by Walsh. Comstock first figured the pupa and his cuts of the fly, larvæ and pupa and anatomical details of the larva are original. (Prof. Riley may have given an original figure of the pupa in *American Agriculturist*, July, 1872.) To the writer belongs the credit of discovering the eggs which are first described and figured in this Report. Again, the abstract implies that Prof. Harvey has simply confirmed the results of investigation by Prof. Comstock and has added nothing new regarding the life history of Trypeta. Credit should have been given for the facts spoken of above, which were recorded in Bulletin No. 2 for the first time. Again, the abstract gives Prof. Comstock the credit of discovering the remedial measures suggested by him, and makes the writer confirm his conclusions. Prof. Comstock advocates only two methods: destruction of windfalls and growing only later fruits and the leaving of a few early trees for traps. The first method advocated was not the result of Prof. Comstock's observations, but those of Mr. Isaac Hicks of Long Island. Prof. Comstock says: "The more practicable ways of lessening the injuries caused by this pest are those suggested in the letters quoted above."

The writer has only confirmed the first of these methods but rejects the second. The second method is based upon the erroneous belief that Trypeta mostly confines its depredations to early fruit. The observations of other Entomologists and those of the writer show that this is not the case. The statement that Prof. Harvey confirms the results of investigations of Prof. Comstock in this and several other particulars is incorrect.

The above review of the literature on Trypeta shows how correct observations may be discarded for a long time and surmises and theories based upon incomplete or erroneous observations be reiterated and perpetuated.

It also suggests the importance of careful work on the part of Entomologists that their writings be as free as possible from errors and that great care should be taken to keep theories and surmises distinct from facts obtained by careful research.

NOTES ON OTHER INSECTS.

While studying Trypeta, observations were incidentally made upon other insects. The late appearance of codling moth larvæ in apples, examined in 1888, would suggest that the eggs of the spring brood may be deposited on apples after they are considerable size. This would have an important bearing upon the proper time to spray with arsenic solutions. It might be better to wait until apples are as large as marbles than to spray when they are only the size of peas as is done in Maine. Codling moth larvæ, one-half grown, were found in apples in November, 1888. In 1889 we noticed much insect work in stored late apples, which appeared to be that of half grown codling moth larvæ. It would seem that there is a second brood of this insect in Maine, but that the larvæ are only about half grown when frost appears and they probably perish. The second brood cannot be reached by spraying and considerable damage is done by it. The fact that but few apples affected by the plum curculio were noticed after August would indicate that this insect works early in the season and that the apples affected drop early. The cuts were quite abundant early in July, showing this insect does considerable damage to the apple. A large number of the punctures were abortive, no larvæ being found in them, while frequently dead larvæ were noticed in the channels made by them. Only a small per cent. matured and transformed. This would seem to show that this insect does not find in the apple the most favorable conditions for its development. Its injuries are not confined to the apples in which the larvæ matures but all apples stung either drop or are poisoned. Those that do not drop are dwarfed and growth in the vicinity of the punctures arrested. This insect was considered in Report for 1888. Considerable work, supposed to be that of the ash-gray pinion was observed the past season. The larvæ of this moth eats holes into the sides of apples.

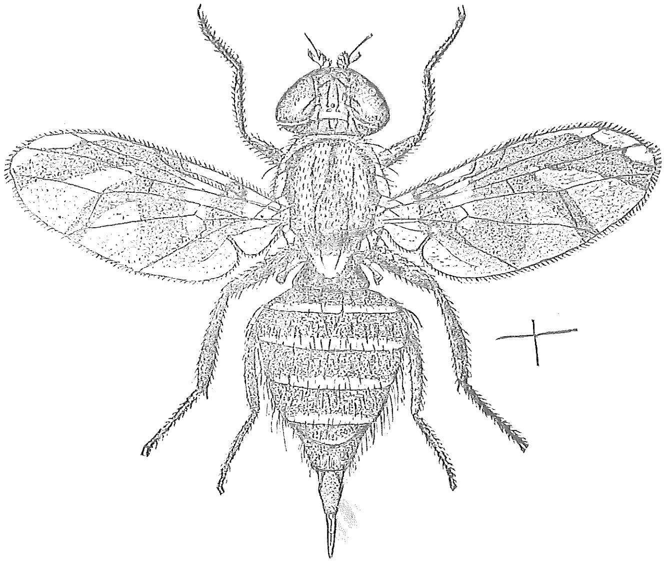


Fig. 1

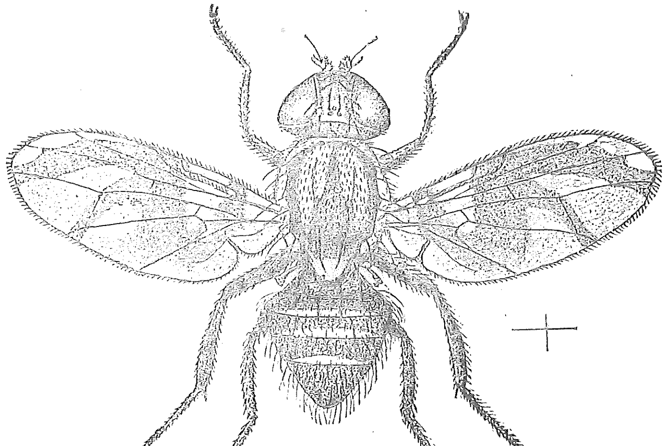


Fig. 2.

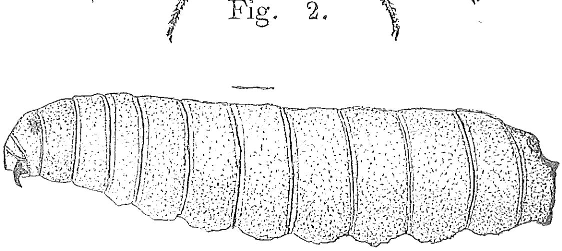


Fig. 3.

PLATE I.

APPLE MAGGOT—*Trypeta pomonella*, Walsh.

EXPLANATION OF PLATES.

These plates were prepared by the Moss engraving process. Where a short line occurs by a figure it indicates the natural size of the object.

EXPLANATION OF PLATE I.

Figure 1. The female fly of the apple maggot (Trypeta pomonella, Walsh) magnified about eight times. Modified from a drawing made by Mrs. A. B. Comstock and found in the United States Agricultural Report, 1881-2, Plate XIV. The abdomen is entirely original and shows the ovipositor extended, and also the sheath. The black bands and basal lobes of the wings are also modified to agree with the writer's observations.

Figure 2. The male fly of the apple maggot (Trypeta pomonella, Walsh) magnified about ten times. The abdomen original. The bands and basal lobes of wings modified as stated under Figure 1. The genitalia are not shown, being retracted beneath the abdomen.

Figure 3. The larva of the apple maggot (Trypeta pomonella, Walsh) magnified about twelve times. A side view of the maggot with the head extended and the hooks protruding, original and showing three segments in front of the spiracles to agree with the writer's observations.

EXPLANATION OF PLATE II (ORIGINAL.)

The Apple Maggot (*Trypeta pomonella*, Walsh.)

Figure 1. Last abdominal segment, sheath and extended ovipositor (female) magnified about thirty times.

Figure 2. External genital apparatus of male (enlarged).

Figure 3. Last abdominal segment, sheath and ovipositor from below, magnified about thirty times.

Figures 4 to 9. Eggs in different stages of development. Figure 4 shows eggs as found attached in the ovary.

Figure 8. Shows the reticulated markings on the egg shell at the pedicellate end of the egg.

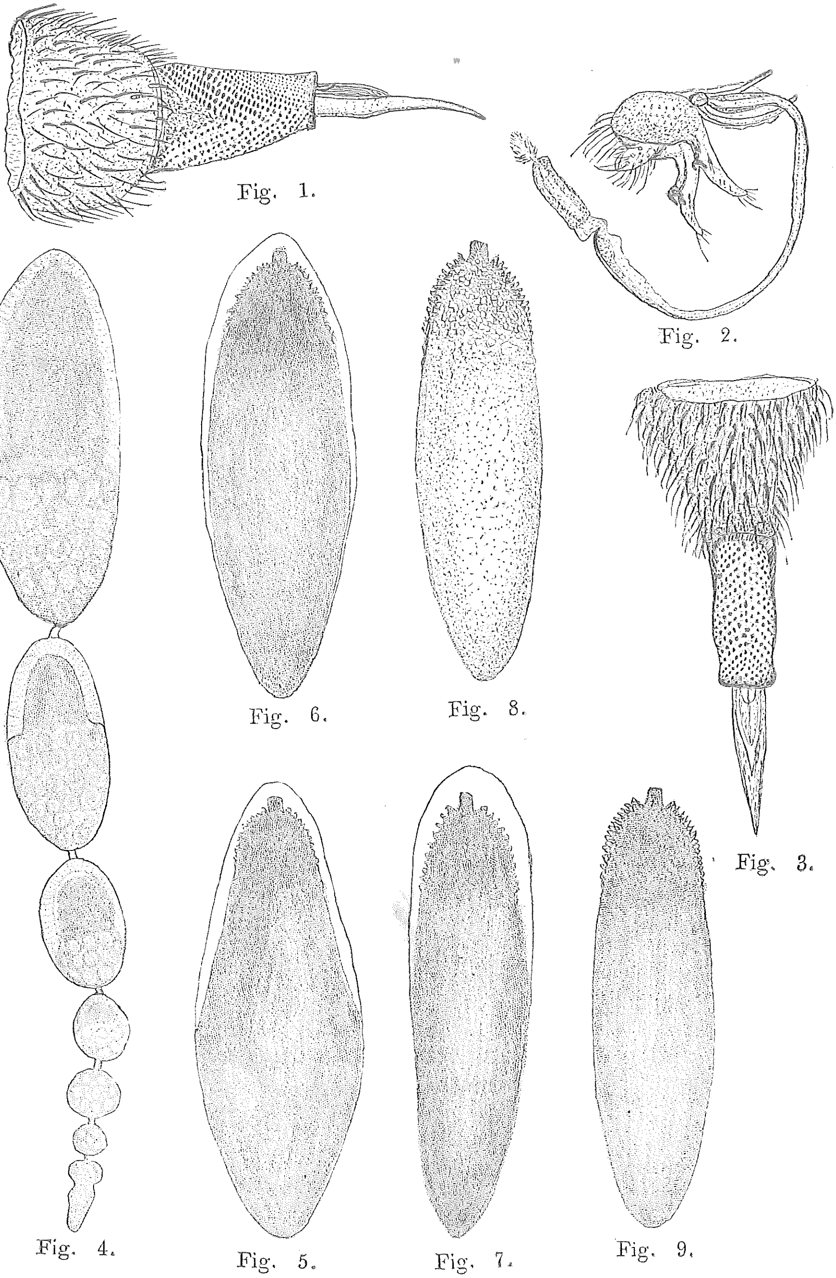
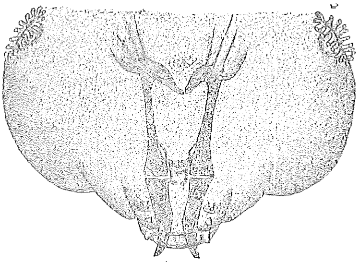


PLATE II.

APPLE MAGGOT—*Trypeta pomonella*, Walsh.



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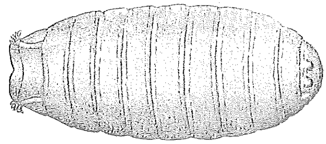

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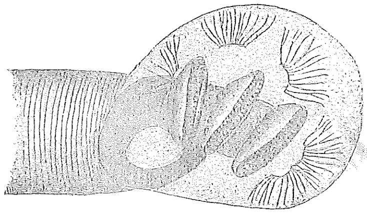

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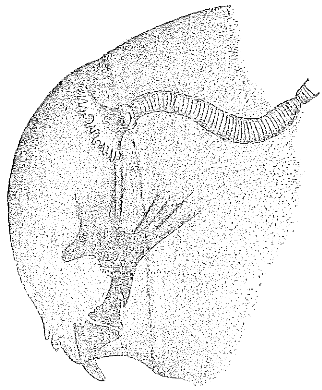

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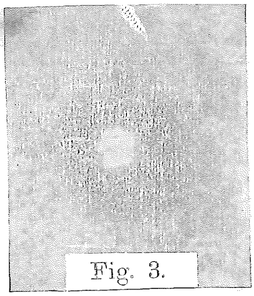

Fig. 3.

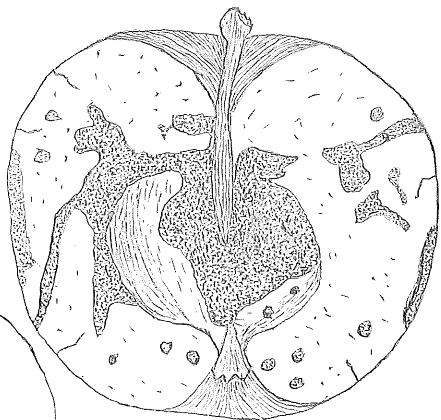

Fig. 5.

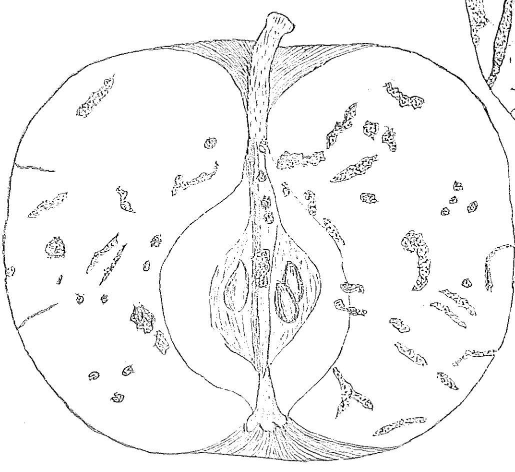

Fig. 6.

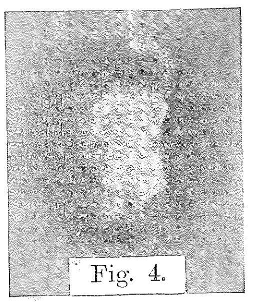

Fig. 4.

PLATE III.

APPLE MAGGOT—*Trypeta pomonella*, Walsh.

EXPLANATION OF PLATE III.

(*Trypeta pomonella*, Walsh.)

Figures 1a, 1b, 1c and 2 are copied from Mrs. A. B. Comstock's admirable drawings in United States Agricultural Report, 1881-2, Plate XIV.

Figures 3 and 4 were photographed by Mr. L. H. Merrill from slides prepared by the writer.

Figures 5 and 6 are original.

Figure 1a. Side view of anterior end of larvæ, showing jaw system, portion of trachea and cephalic spiracle.

Figure 1b. Anterior end of larvæ viewed from above, showing jaw system and spiracles.

Figure 1c. Enlarged view of caudal spiracle showing the three transverse slit-like openings and the four groups of bristles.

Figure 2. Dorsal view of the pupa, magnified about ten times.

Figure 3. Portion of apple peel showing the puncture made by the ovipositor of the female, magnified about thirty times.

Figure 4. Portion of apple peel showing exit-opening of larva, magnified about five times.

Figure 5. Cross section of High Topped Sweeting showing advanced work of full grown larvæ, natural size.

Figure 6. Cross section of a Winthrop Greening showing the work of half grown larvæ, natural size.

EXPLANATION OF PLATE IV.

(After Comstock.)

(*Drosophila Ampelophila*, Loew.)

Figure 1. Adult.

Figure 2. Ventral aspect of puparium.

Figure 3. Lateral aspect of puparium.

Figure 4. Tarsus of prothoracic leg of adult male; 4a, tarsal appendage.

Figure 5. Cephalic spiracle.

Figure 6. Lateral aspect of cephalic end of larva.

Figure 7. Egg.

Figure 8. Larva.

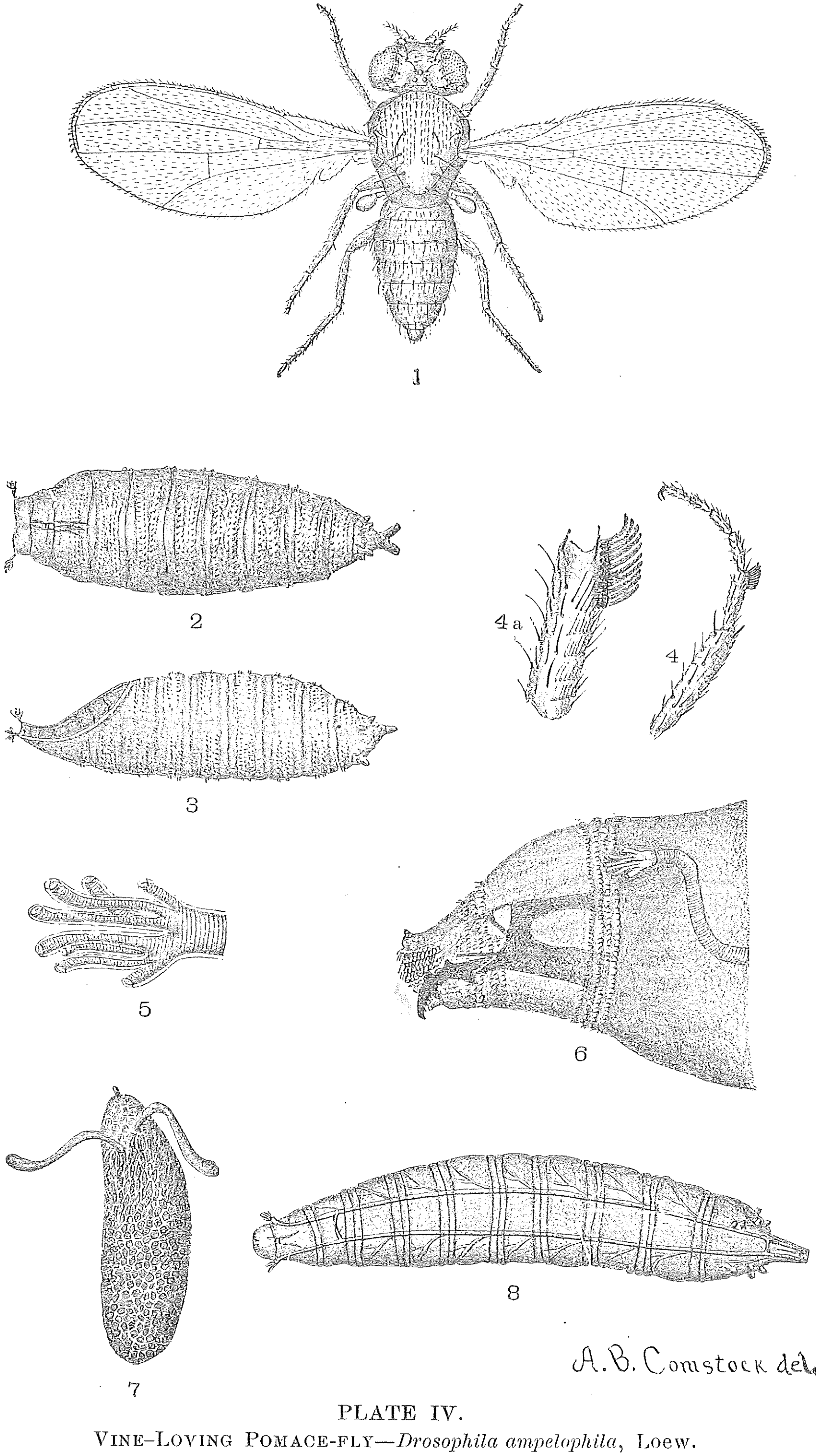

PLATE IV.
VINE-LOVING POMACE-FLY—*Drosophila ampelophila*, Loew.

INSECTICIDES.

The necessity of using insecticides needs no argument. There are so many insects that feed upon vegetation, and do much damage to forests, orchards, field and garden crops, that it has become necessary to destroy or hold them in check. The use of poisons that will insure wholesale destruction at a moderate cost is the only practical method of coping with them, therefore insecticides have come rapidly into use within a few years. It is important that all orchard owners should become converts to this policy so as to insure universal application of this method. It would be better if some other way could be found, as the use of poisons is attended with more or less danger to man and stock. There is yet considerable prejudice against the use of poisons, and many are deterred from using them, especially in orchards in grass or in pastures, for fear of poisoning stock. The wholesale use of Paris Green upon potatoes has made us familiar with poisons and demonstrates that the danger is small when properly used. It should, however, always be remembered that too great care cannot be exercised with poisons, and the following precautions should be carefully observed:

1. Insecticides should be carefully labeled *Poison* and kept out of the reach of children.

2. Never handle poisons with the bare hands. Oil the hands as a precaution and cover any sores with court plaster. Light leather gloves would be advisable.

3. While spraying, keep to the windward of the trees. Wash thoroughly after spraying work. Keep children out of the orchard while such work is going on.

4. The trees should not be sprayed until there is much dripping, but as a precaution stock should be kept out of the orchard for a week or two after spraying. The amount of poison that gets on the grass in properly conducted experiments is not enough to poison stock, but proper precaution is advisable. Prof. Cook sprayed in the ordinary way, and then cut and fed the clover under the tree to a horse without producing symptoms of poisoning. The amount of poison put on an apple tree for codling moths is so small that if it all remained, no poisonous effects would be noticed by eating an ordinary amount of the fruit. The usual formula for spraying trees is one pound Paris Green to eighty gallons of water and three gallons to a large tree. This would make 26.3 grains of the poison per tree. Now

supposing half of it fell upon the fruit and half on the leaves and branches, and the tree bore ten bushels of apples, this would make 1.3 grains to a bushel of fruit. There are about 200 ordinary sized apples in a bushel. This would leave only seven one-hundredths of a grain to an apple, which is much less than a poisonous dose. Considering that the poison is applied when the fruit is small and long before harvest, and that the rains would wash much of it off, the danger of poisoning is small.

5. In dusting vegetables or plants with dry poisons care should be taken not to inhale them. See that the dry dust is not carried by the wind to berries, vegetables or fruit soon to be gathered. It is best not to plant berries or vegetables near orchards or shrubbery that have to be sprayed.

CONDITIONS.

To have insecticides work properly the material must be good and the application properly made.

1. As there is considerable adulterated material on the market it is best to procure poisons, even at a higher price, from reliable firms who will warrant their goods.

2. Great care should be exercised in properly mixing the material. When it is only held in suspension and not soluble in water it should be kept thoroughly stirred while being applied.

3. The application should be by an even fine spray and with force enough to reach every part of the tree.

4. If the material seems to burn the leaves it is too strong and should be diluted.

5. The proper time to spray is of great importance. It should be done so as to kill the insect or fungus when it is in the proper stage of its life to be reached by the poison.

6. If a hard rain follows the spraying it should be repeated. Several applications are often necessary during the season.

COMMON INSECTICIDES.

The injurious insects that can be destroyed by the application of insecticides are of two kinds: Those provided with biting jaws for eating the foliage of plants, and those provided with sucking apparatus and living upon the juices of plants. Those having biting jaws take the substance of the leaves into the stomach and can be killed by poisoning the leaves. Those living upon the juices can be reached only by the application of substances which act externally; stopping the breathing pores, irritating the skin, producing offensive odors or acting as mechanical barriers. The poisons in common use that act internally, applied in the form of a powder or in suspension, are Paris Green, London Purple and white arsenic. Those used externally in the form of a powder are hellebore, pyrethrum, sulphur, lime, plaster, ashes and dirt. Those applied in the liquid form are kerosene emulsion, whale oil soap and sulphur, strong soap suds, tobacco decoction, bisulphide of carbon, benzine, gasoline and coal tar.

APPENDIX.

Annual Report of the State Pomological Society.

1889-90.

FARMINGTON, June 1, 1890.

HON. Z. A. GILBERT,

Secretary Maine Board of Agriculture:—

I have the honor to transmit herewith for publication in the annual report on the Agriculture of Maine, the transactions of the Maine State Pomological Society for the year 1889-90.

Yours respectfully,

D. H. KNOWLTON, *Secretary.*

MAINE STATE POMOLOGICAL SOCIETY.

Transactions for the Year 1889-90.

It has been a source of pleasure to the writer, as he has hastily reviewed the work of our Society, to note how faithfully its early officers devoted themselves to the interests of fruit culture in this State. Since its organization in 1873, it has been the principal organized agency in the promotion of fruit culture. It has brought fruit growers together, it has spread out before the public beautiful displays of fruits and flowers ; but the chief work of the Society has been in the dissemination of a practical knowledge of fruit raising. This knowledge is twofold in its character ; on the one hand it has aimed at the raising of fruit as a home luxury—a luxury which every man who controls a foot of ground owes to himself and family ; on the other hand it has been the object of the Society to recognize and promote the raising of fruit in our State as one of the most profitable of our agricultural industries. In the early days of our Society there were only local markets for our fruit, the surplus going, as a rule, only so far as Boston and surrounding towns. To-day, in extent and importance, fruit raising has become one of the leading features of Maine farming and not alone are our apples sought for in our home markets, but foreign buyers seek them for shipment to the cities of the old world.

The year 1888 was not generally regarded as a profitable apple year in the State, and yet a small orchard under the shadow of Mt. Blue, where twenty-five years ago few men would have ventured to set trees at all, the industrious owner received over $400 for his apples, and the 1889 crop will net him more than this. Along side this farm are thousands of acres of land which are used only as sheep pastures and woodlots. In another section of the same county, not many years ago a gentleman bought ninety acres of old, rocky pasture and woodland for $400, paying down $75 for the same which represented his assets at the time. On this land there were about seventy worthless old apple trees. Not over five or six acres of the land had ever been plowed, and a large portion of it is so rocky and steep it never can be. Here he began his work as an orchardist, and he has followed it up faithfully. Under his manipulation he has developed one of the most productive fruit farms in the State. For the past ten years he has been thriving and well he may, for car load after car load of fruit has been taken from that $400 lot of land From the inferior fruit he has produced enough evaporated apples to meet all the expense connected with his orchard. He has erected new buildings, a large fruit house and paid all his bills. In 1888–9 there was a large surplus of evaporated apples in the markets and prices were low, but our friend had money enough, and so he kept right on evaporating the Nos. 2 and 3 apples, until he had in the store house two years' crop (about twelve tons) which found a market from nine to twelve cents per pound. Yet there are some who claim evaporating fruit in Maine does not pay. The 1889 crop of fruit will net this enterprising farmer not less than $3,000, and the reader may draw his own conclusions.

These are only instances with which the writer is familiar. There are others quite as notable in the State; but that to which we wish to call especial attention is the grand opening orcharding in Maine offers to the capitalists. Thousands of dollars have been sent to Florida and California to be used in fruit raising, but the facts clearly show that Maine orcharding will pay larger dividends. These instances are given here as illustrative of organized orcharding which is referred to in sections of this volume.

The general work of the Society the past year has been similar to that of former years. As early as the dates for the annual fair were determined, and other matters connected with it could be arranged, a special circular was issued to Maine fruit growers. The object of this circular was to furnish advance sheets of the Society's revised fruit list, and in addition to this, several important announcements were made relating to the fair. This circular was deemed of sufficient importance to be published entire by the *Maine Farmer* and *Lewiston Journal*. Something of this sort issued annually is of great assistance to fruit growers and at the same time reminds the public of the work the Society is doing. It also suggests that the Society deserves the active co-operation of all interested in the welfare of the State. If its membership could be doubled, its usefulness could largely be increased.

So far as possible it is the intention of the officers of the Society to make its work aggressive, firmly believing the industry it represents to be in its infancy. With this in view they have had a wide correspondence with fruit growers and the officers of other societies. They have also by all means possible endeavored to advance sound business principles in growing fruit and in preparing the same for market. They realize the importance of establishing a reputation for Maine apples in the markets of the world, and with this in view, they have urged the growing of the best varieties in the best manner and the most careful packing of the fruit before it leaves the farm. Should their ideas prevail, they believe the buyer would need no other guaranty than that the fruit he was buying was grown and packed by an honest Maine fruit grower. The officers have also endeavored to cultivate pleasant, social intercourse among fruit growers at their various public gatherings. The results have been very gratifying

The present volume is arranged similar to that of the previous year, so that as far as possible the business transactions are placed together, the papers and discussions offered at the meetings being arranged not in the order of presentation but rather with reference to their subjects.

It would be of great assistance to the officers of the Society if the fruit growers of Maine would send them items of interest relating to fruit culture. The possibilities of this industry are not yet understood by the public, nor are they fully comprehended by our farmers. Information sent to the Secretary, stating the results of fruit growing would be very helpful, for as yet we have had no statistics bearing on fruit culture. It is also a pleasure to the officers of the Society to hear from those who desire information upon fruit subjects, for they are frequently able to render the inquirers a valuable service.

D. H. K.

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Committee on New Fruits.

D. H. Knowlton, Farmington; L. H. Blossom, Turner; J. W. True, New Gloucester.

Committee on Revision of Fruit List.

D. H. Knowlton, Farmington; D. J. Briggs, South Turner; D. P. True, Leeds Centre; Henry McLaughlin, Bangor; E. W. Dunbar, Damariscotta.

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
*Atherton, H. N..............Hallowell
Atherton, Wm. P..............Hallowell
Atkins, Charles G.............Bucksport
Atwood, Fred..................Winterport
Averill, David C..............Temple
Bennoch, John E...............Orono
Boardman, Samuel L............Augusta
Briggs, D. J..................South Turner
Briggs, John..................Turner
Burr, John....................Freeport
Butler, Alonzo................Union
Carter, Otis L................Etna
Chase, Henry M........North Yarmouth
Chase, Martin V. B............Augusta
*Clark, Eliphalet.............Portland
Cole, Horatio G..........Boston, Mass
Crafts, Moses.................Auburn
*Crosby, William C............Bangor
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, Albert..............Bangor
Farnsworth, B. B..............Portland
Frost, Oscar F................Monmouth
*Gardiner, Robert H...........Gardiner
Gardiner, Robert H.......Boston, Mass.
George, C. H..................Hebron
Gilbert, Z. A.................North Greene
*Godfrey, John E..............Bangor
Hackett, E. C..........West Gloucester
Hanscom, John.................Saco
Harlow, S. C..................Bangor
*Harris, N. C.................Auburn
Harris, N. W..................Auburn
Harris, William M.............Auburn
*Hersey, T. C.................Portland
Hobbs, M. Curtis.......West Farmington
Hoffses, Elmas................Warren
Hopkins, Miss S. M............Gardiner
Hoxie, James S...........North Fairfield
Hoyt, Mrs. Francis............Winthrop
Ingalls, Henry................Wiscasset
Jackson, F. A.................Winthrop
*Jewett, George...............Portland
Johnson, Isaac A..............Auburn
Jordan, Francis C.............Brunswick
Kenniston, E. H...............Arnold
Knowlton, D. H................Farmington
Lapham, E. A..................Pittston
Low, Elijah...................Bangor
Low, S. S.....................Bangor
McLaughlin, Henry.............Bangor
Merrill, T. M..........West Gloucester
*Metcalf, M. J................Monmouth
Moore, William G..............Monmouth
Moor, F. A....................Waterville
Morton, J. A..................Bethel
Morton, William E.............Portland
*Noyes, Albert................Bangor
Perley, Chas. I....Seward's (Vassalboro')
Pope, Chas. S.................Manchester
Pulsifer, D. W................Poland
Purington, E. F........West Farmington
*Richards, F. G...............Gardiner
Richards, John T..............Gardiner
*Richardson, J. M.............Gardiner
Ricker, A. S..................Turner
Roak, George M................Auburn
Robinson, Henry A.............Foxcroft
Rolfe, Samuel.................Portland

*Deceased.

LIFE MEMBERS—Concluded.

Sawyer, Andrew S. ... Cape Elizabeth
Sawyer, George B. ... Wiscasset
Shaw, Stillman W ... West Auburn
Simmons, H. J. A. ... Waldoboro'
*Smith, Alfred ... Monmouth
Smith, Henry S. ... Monmouth
Starrett, L. F ... Warren
*Stetson, Isaiah ... Bangor
Stilphen, Asbury C ... Gardiner
Stanley, Charles ... Winthrop
Stanley, O. E. ... Winthrop
Staples, G. K. ... Temple
Strout, S. F ... West Falmouth
Strattard, Mrs. A. B ... Monroe
Sweetser, S. R ... Cumberland Center
*Taylor, Joseph ... Belgrade
Taylor, Miss L. L. ... (Lakeside) Belgrade
Thomas, William W., Jr. ... Portland
Tilton, William S. ... Boston, Mass
True, Davis P. ... Leeds Center
Varney, James A ... The Dalles, Oregon
Vickery, James ... Portland
Vickery, John ... Auburn
Wade, Patrick ... Portland
*Weston, James C ... Bangor
Wharff, Charles S. ... Gardiner
Whitney, Edward K ... Harrison
Woodman, George W. ... Portland

ANNUAL MEMBERS, 1889.

Arnold, C. A. ... Arnold
Bailey, W. G. ... Freeport
Bartlett, Bradford W ... East Dixmont
Bartlett, M. E ... East Dixmont
Beals, Laura B. ... Turner
Blossom, L. H ... Turner Center
Brown, H. W ... Newburg
Carey, Henry S ... Topsham
Chandler, Lucy A ... Freeport
Chandler, S. H ... New Gloucester
Chase, F. C ... South Etna
Chase, Geo. C ... Lewiston
Davis, Jacob L ... Upper Gloucester
Dudley, J. W. ... Castle Hill
Dunbar, E. W ... Damariscotta
Fuller, Mrs. H. W. ... Readfield
Farwell, S. L. ... Cumberland Center
Goodrich, A. N ... Allen's Mills
Gorden Bros. ... New Sharon
Grant, Mrs. Benson ... Lewiston
Greenleaf, A. C. ... Farmington
Gurney, Lemuel ... Hebron
Haley, John E ... Forest City
Hawkins, M. P ... Auburn
Hoffses, Elmas ... Warren
Hopkins, John ... Newcastle
King, S. M. ... South Paris
Leech, H. T. & S. E ... East Monmouth
Lombard, T. M. ... Auburn
Luce, Willis A ... South Union
Merritt, E. W ... Houlton
Merrow, J. H ... South Smithfield
Nelson, O. C. ... Upper Gloucester
Nowell, F. E ... North Fairfield
Osgood, A. J. ... Cumberland Centre
Perkins, L. J ... Portland
Pike, George A ... Winthrop
Pope, Miss L. M ... Manchester
Pope, J ... Manchester
Ring, A. P ... Richmond
Ring, Cora E. ... Richmond
Rogers, F. A ... North Newburg
Stanley, Cora ... Winthrop
Stetson, Everett W ... Damariscotta
Tarr, Edward ... Castle Hill
Towle, Willis O. ... West Gardiner
Waterman, Mrs. Elbert ... East Auburn
Waterman, Mrs. W. H ... East Auburn
Wharff, W. R ... Gardiner
Wright, Fred ... Bath

ANNUAL MEMBERS, 1890.

Blossom, L. H ... Turner Centre
Brown, H. W ... Newburg
Dudley, J. W. ... Castle Hill
Harvey, F. L. ... Orono
Nelson, O. C. ... Upper Gloucester
True, J. W. ... New Gloucester
Weston, C. M ... Belgrade
Whittier, Phineas ... Farmington Falls

*Deceased.

Annual Statement of the Maine State Pomological Society for the Year Ending December 31, 1889.

Receipts.

Amount in treasury Dec. 31, 1888	$ 61 46	
Cash from loan—Manufacturers' National Bank	250 00	
State Treasurer, bounty, 1888	500 00	
life members	50 00	
annual members	50 00	
State Agricultural Society for 1888	50 00	
1889	500 00	
premiums from Bay State Fair	57 00	
interest on permanent fund	14 87	
		$1,533 33

Expenditures

Cash paid on Secretary's salary	$25 00	
expenses	49 92	
to " clerk	8 00	
on Executive Committee's expenses	117 77	
for stationery, printing and binding	26 15	
Fruit Catalogue Committee	13 00	
Treasurer's expenses, 1888	16 50	
use of hall, winter meeting	18 00	
A. J Tolman	4 00	
loan on Manufacturers' National Bank	400 00	
interest " " "	2 67	
W. W. Rawson	20 00	
Bay State Fair expenses	25 82	
exhibition plates	12 70	
Wiscasset Savings Bank in favor of permanent fund,	60 00	
interest on " "	14 87	
discount, Manufacturers' National Bank, note	3 88	
premiums	616 00	
in treasury	99 05	
		$1,533 33

Financial Condition of the Society December 31, 1889.

Assets.

Due from State Treasurer, bounty for 1889	$500 00	
Property owned by society, estimated	150 00	
Permanent fund deposit	440 72	
Amount in treasury	99 05	
		$1,189 77

Liabilities.

Due Manufacturers' National Bank, note	$250 00	
Outstanding accounts	85 00	
		$335 00

Permanent Fund.

Cr.

By fees of 95 life members to December 31, 1888	$950 00	
5 " " " 1889	50 00	
		$1,000 00

Dr.

To amount on deposit with Wiscasset Savings Bank	$440 72	
balance due the fund	559 28	
		$1,000 00

Maine State Pomological Society.

Report of the Seventeenth Annual Exhibition Held in Lewiston, September 10, 11, 12 and 13, 1889.

The Executive Committee perfected arrangements with the Trustees of the Maine State Agricultural Society for holding the Society's Seventeenth Annual Exhibition in connection with the annual exhibition of their Society. The entire third floor of the exhibition building was given to our Society under this arrangement. The most cordial and friendly relations existed between the officers of the two societies, and so far as we know there was perfect harmony of action. Under this arrangement the exhibition was held in the exhibition hall of the State Fair Park, Lewiston, September 10, 11, 12 and 13, 1889.

The exhibition as a whole was one of the best the Society has ever held. The entire space was well filled, and the display of fruit and flowers was well arranged. It was the purpose of the officers to devote themselves during the fair to the interests of exhibitors and fruit growers. The committee work was done quietly but in a satisfactory manner. The premiums awarded were paid several weeks earlier than heretofore. There were simple decorations of the hall which added much to its appearance. Above the exhibition of fruit at the end of one wing was a large floral design, consisting of an eagle with outspread wings made of golden-rod; the eagle was standing upon a huge shield of alternate bars of golden-rod and evergreen. The design rested on an evergreen platform, and at its base opportunity was given the visitors to ballot for choice of a national flower. There was a very large majority in favor of the golden-rod.

Although the fruit shown was well matured and of large size, there were fewer specimens of perfect fruit than usual. The fruit showed the presence of insects, especially the codling worm and the apple maggot.

The popularity of the special five dollar premiums in 1888 induced the executive committee to still further extend the same feature, and accordingly the Gravenstein apple, Clapp's Favorite and Bartlett pears were added. The exhibition of apples for this premium was very large, occupying a table across the end of the east wing of the hall fifty feet in length. The competition of pears for this premium was less satisfactory, although there were several fine plates.

The premiums on wild flowers were extended by adding pressed specimens to the list. In both the cut and pressed flowers there were two conditions, the number must be not less than twenty, and the specimens must bear the correct botanical and popular names. There was a good display and it proved one of the most instructive features of the exhibition.

It was a pleasure to have an exhibition from Aroostook. Though it was not a large one, it was grown farther north than any ever shown at our fairs. There were several counties conspicuous by their absence. It would add much to the interest of our exhibitions if all parts of the State could be represented. In no other way can the Society so well learn the wants of the State in fruit matters, and furthermore it would aid its officers in laying out the future work of the Society.

Of flowers there was a very large general exhibition, and two green-house displays made by John Burr and W. G. Bailey, both of Freeport. Their collections were good and formed an attractive feature in the hall.

The General Rules of the exhibition were essentially the same as for the last four years. As they were published in full in the Premium List and have reference only to the affairs of the exhibition they are omitted in the present volume.

List of Premiums Awarded at the Seventeenth Annual Exhibition, 1889.

APPLES—General Collections.

AWARDS. Best exhibition of fruit grown by exhibitor: D. P. True, Leeds Center, $5.00; J. S. Hoxie, North Fairfield, $3.00.

Best general exhibition of apples grown by exhibitor in any part of the State: S. H. Dawes, Harrison, $12.00; H. G. Fairbanks, Winthrop, $8 00; E. F. Purington, West Farmington, $5.00.

COUNTY EXHIBITIONS.

Best general exhibition of apples grown by the exhibitor in Androscoggin county: A. S. Ricker, Turner, $8 00; N. W. Harris, Auburn, $6.00; I. T. Waterman & Sons, East Auburn, $4.00.

For the same in Aroostook county: E. Tarr, Castle Hill, gratuity, $5.00.

For the same in Cumberland county: J. W. True, New Gloucester, $8 00; S. R. Sweetser, Cumberland Center, $6.00.

For same in Franklin county: G. K. Staples, Temple, $8.00; M. C. Hobbs, West Farmington, $6.00; D. C. Averill, Temple, $4.00.

For same in Kennebec county: E. A. Lapham, Pittston, $8 00; W. R. Wharff, Gardiner, $6 00; C. I. Perley, Seward, $4.00.

For same in Knox county: Alonzo Butler, Union, $8.00; Elmas Hoffses, Warren, $6.00.

For same in Lincoln county: E W. Dunbar, Damariscotta, $8.00.

For same in Oxford county: C. H. George, South Paris, $8.00; Lemuel Gurney, Hebron, $6.00; S. M. King, South Paris, $4.00.

For same in Penobscot county: E. H. Kenniston, Arnold, $8.00. F. C. Chase, South Etna, $6.00; C. A. Arnold, Arnold, $4.00.

For same in Sagadahoc county: H. S. Cary, Topsham, $8.00; Fred Wright, Bath, $6.00; A. P. Ring, Richmond, $4.00.

For the same in Somerset county: J. S. Hoxie, North Fairfield, $8.00; F. E. Nowell, Fairfield, $6.00.

For the same in Waldo county: M. E. Bartlett, East Dixmont, $8.00; B. W. Bartlett, East Dixmont, $6.00.

For the best collection of crab apples: J. S. Hoxie, North Fairfield, $1.00; E. H. Kenniston, Arnold, 50c.

SPECIAL PREMIUMS—BALDWINS, R. I. GREENINGS, ROXBURY RUSSETS, GRAVENSTEINS.

For best dish of Baldwins, Rhode Island Greenings, Roxbury Russets and Gravensteins, consisting of twelve specimens each.

Baldwins: E. H. Kenniston, Arnold, $5.00; S. H. Dawes, Harrison, $3.00; H. S. Cary, Topsham, $2.00.

Rhode Island Greenings: E. H. Kenniston, Arnold, $5.00; W. E. Rose, Greene Corner, $3.00; H. G. Fairbanks, Winthrop, $2.00.

Roxbury Russet: Alonzo Butler, Union, $5.00; A. P. Ring, Richmond, $3,00; C. H. George, South Paris, $2.00.

Gravenstein: J. Pope & Son, Manchester, $5.00; N. W. Harris, Auburn, $3.00; A. C. Day, Turner, $2.00.

SINGLE VARIETIES.

Alexander: John E. Haley, $1.00; O. S. Judkins, 50c.

American Golden Russet: I. T. Waterman & Sons, $1.00; A. J. Osgood, 50c.

Ben Davis: C. A. Arnold, $1.00; I. T. Waterman & Sons, 50c.

Benoni: J. S. Hoxie, $1.00; H. W. Brown, 50c.

Black Oxford: D. W Pulsifer, $1.00; George A. Pike, 50c.

Deane: E. F. Purington, $1.00; S. L. Farwell, 50c.

Duchess of Oldenburg: John E. Haley, $1.00; J. Pope & Son, 50c.

Early Harvest: Elmas Hoffses, $1.00.

Fall Harvey: M. C. Hobbs, $1.00; E. G. Blake, 50c.

Fameuse: D. H. Knowlton, $1.00; C. A. Arnold, 50c.

Garden Royal: C. I. Perley, $1.00; A. N. Goodrich, 50c.

Grimes Golden: F. A. Rogers, $1.00; M. P. Hawkins, 50c.

Hubbardston Nonsuch: W. R. Wharff, $1.00; T. M. Lombard, 50c.

Hunt Russet: E. Hoffses, $1.00; C. A. Arnold, 50c.

Jewett's Fine Red: S. H. Dawes, $1.00; J. H. Merrow, 50c.

King of Tompkins County: S. R. Sweetser, $1.00; E. H. Kenniston, 50c.

King Sweeting: E. F. Purington, $1.00; F. E. Nowell, 50c.

Large Yellow Bough: A. N. Goodrich, $1.00; E. F. Purington, 50c.

McIntosh Red: H. G. Fairbanks, $1.00; M. C. Hobbs, 50c.

Milding: C. I. Perley, $1.00; H. Johnson, 50c.

Mother: A. J. Osgood, $1.00; J. Pope & Son, 50c.

Munson Sweet: D. H. Knowlton, $1.00; Dan Carey, 50c.

Northern Spy: F. A. Rogers, $1.00; Lemuel Gurney, 50c.

Orange Sweet: J. S. Hoxie, $1.00; F. E. Nowell, 50c.

Peck's Pleasant: A. J. Osgood, $1.00; C. H. George, 50c.

Pomme Royal: C. H. George, $1.00; J. Pope & Son, 50c.

Porter: E. H. Kenniston, $1.00; John Dunton, 50c.

Pound Sweet: S. L. Farwell. $1.00; J. W. True, 50c.

President: I. T. Waterman & Sons, $1.00; W. W. Mower, 50c.

Primate: C. I. Perley, $1.00; E. F Purington, 50c.

Pumpkin Sweet: A. J. Pratt, $1.00; Miss L. Skillings, 50c.

Red Astrachan: E. Hoffses, $1.00; J. S. Hoxie, 50c.

Red Canada: W. O. Towle, $1.00; H. G. Fairbanks, 50c.

Rolfe: S. R. Sweetser, $1.00.

Russell: D. C. Averill, $1.00; E. F. Purington, 50c.

Stark: L. H. Blossom, $1.00; A. H. Bickford, 50c.

Somerset: H. W. Brown, $1.00; F. E. Nowell, 50c.

Starkey: J. Pope & Son, $1.00; F. E. Nowell, 50c.

Talman's Sweet: H. T. & S. E. Leech, $1.00; F. H. L. Sleeper, 50c.

Tetofsky: E. W. Dunbar, $1.00.

Wagener: N. W. Harris, $1.00; H. Johnson, 50c.

Wealthy: T. M. Lombard, $1.00; S. R. Sweetser, 50c.

Williams' Favorite: H. S. Cary, $1.00; W. W. Rodbird, 50c.

Winthrop Greening: F. E. Nowell, $1.00; W. W. Mower, 50c.

Yellow Bellflower: R. H. Gardiner, $1.00; C. I. Perley, 50c.

Yellow Transparent: S. R. Sweetser, $1.00.

Dudley: J. W. Dudley, gratuity $1.00.

Gideon: P. P. Burleigh, gratuity $1.00.

PEARS—General Exhibitions.

S. H. Dawes, Harrison, $10 00; S. Rolfe, Portland, $8.00; D. J. Briggs, South Turner, $5.00.

SINGLE VARIETIES.

Clapp's Favorite: L. J. Perkins, $5.00; Rufus Prince, $3.00.
Bartlett: S. H. Dawes, $5.00; H. T. & S. E. Leech, $3.00.
Belle Lucrative: A. Butler, $1.00; J. S. Hoxie, 50c.
Beurre d'Anjou: S. H. Dawes, $1.00; H. & H. Whitman, 50c.
Beürre Hardy: R. H. Gardiner, $1.00.
Beurre Superfin: D. P. True, $1.00; I. W. Emerson, 50c.
Beurre Diel: I. W. Emerson, $1.00.
Buffum: D. P. True, $1.00; C. I. Perley, 50c.
Doyenne Boussock: C. I. Perley, $1.00.
Duchesse d' Angouleme: S. H. Dawes, $1.00; G. C. Chase, 50c.
Eastern Belle: J. S. Hoxie, $1.00.
Flemish Beauty: J. H. Merrow, $1.00; Mrs. E. A. Ellis, 50c.
Goodale: C. I. Perley, $1.00; J. W. True, 50c.
Howell: J. S. Hoxie, $1.00; I. W. Emerson, 50c.
Lawrence: S. H. Dawes, $1.00; John Dunton, 50c.
Louise Bonne de Jersey: S. H. Dawes, $1.00; D. P. True, 50c.
Nickerson: G. A. Pike, $1.00.
Seckel: G. C. Chase, $1.00; D. J. Briggs, 50c.
Sheldon: S. H. Dawes, $1.00; I. W. Emerson, 50c.
Swan's Orange: J. S. Hoxie, $1.00; C. I. Perley, 50c.
Souvenir du Congres: S. Rolfe, $1.00; E. H. Kenniston, 50c.

Class III—GRAPES.

For best exhibition of open air grapes: J. S. Hoxie, $3.00.
Hartford Prolific: C. H. George, $1.00.
Blood's Seedling: L. Gurney, $1.00.
Concord: H. Johnson, $1.00.
Moore's Early: L. Gurney, $1.00.
Janesville: L. Gurney, $1.00.

PLUMS—Single Varieties.

Golden Drop: C. H. George, $1.00; G. C. Chase, 50c.
Green Gage: E. W. Dunbar, $1.00.
Prince's Imperial Gage: E. W. Dunbar, $1.00.

Purple Gage: E. W. Dunbar, $1.00.
General Hand: L. Gurney, $1.00.
Lawrence: E. F. Purington, $1.00.
Lombard: T. M. Lombard, $1.00; G. C. Chase, 50c.
Smith's Orleans: E. W. Dunbar, $1.00.
River's Blue Prolific: E. W. Dunbar, $1.00.
Niagara: E. W. Dunbar, $1.00; Miss L. Skillings, 50c.

MISCELLANEOUS ARTICLES—Canned Fruit, Preserves, &c.

For best dish of peaches: W. O. Towle, $2.00; S. H. Dawes, $1.00.

Quinces: G. C. Chase, $2.00.

For best peck of cultivated cranberries: A. C. Greenleaf, $2.00; H Johnson, $1.00.

For best variety of canned fruits, preserves, pickles, etc., made and put up by the exhibitor: Mrs. W. H. Waterman, $8.00; Mrs. Benson Grant, $5.00; Mrs. Elbert Waterman, $3.00.

Canned peaches: Mrs. E. Waterman, 50c.; Mrs. Francis Hoyt, 25c.

Canned plums: Mrs. Francis Hoyt, 50c.; Miss Myrtie V. Averill, 25c.

Canned strawberries: Mrs. F. Hoyt, 50c.; Miss M. V. Averill, 25c.

Canned raspberries: Mrs. F. Hoyt, 50c.; Mrs. W. H. Waterman, 25c.

Canned blackberries: Miss M. V. Averill, 50c.; Mrs. E. F. Purington, 25c.

Canned gooseberries: Mrs. E. F. Purington, 50c.; Mrs. F. Hoyt, 25c.

Canned blueberries: Mrs. W. H. Waterman, 50c.; Mrs. F. Hoyt, 25c.

Canned cherries: Mrs. F. Hoyt, 50c.; Mrs. W. H. Waterman, 25c.

Canned quinces: Mrs. F. Hoyt, 50c.; Mrs. W. H. Waterman, 25c.

Canned tomatoes: Mrs. W. H. Waterman, 50c.; Mrs E. Waterman, 25c.

Preserved quinces: Mrs. W. H. Waterman, 50c.

Preserved apples: Miss M. V. Averill, 50c.; Mrs. F. Hoyt, 25c.

Preserved plums: Mrs. F. Hoyt, 50c.; Miss M. V. Averill, 25c.

Preserved pears: Mrs. F. Hoyt, 50c.; Miss M. V. Averill, 25c.

Preserved strawberries: Mrs. F. Hoyt, 50c.; Mrs. W. H. Waterman, 25c.

Preserved raspberries: Mrs. W. H. Waterman, 50c.; Mrs. F. Hoyt, 25c.

Preserved currants: Mrs. E. F. Purington, 50c.; Mrs. F. Hoyt, 25c.

Preserved cherries: Mrs. F. Hoyt, 50c.; Mrs. W. H. Waterman, 25c.

Assorted pickles: E. A. Lapham, 50c.; Mrs. F. Hoyt, 25c.

Tomato catsup: Mrs. F. Hoyt, 50c.; Mrs. W. H. Waterman, 25c.

Best collection of apple jellies: Mrs. W. H. Waterman, $2.00; Mrs. D. H. Colby, $1.00.

Best jar quince jelly: Mrs. W. H. Waterman, 50c.; Mrs. F. Hoyt, 25c.

Apple jelly: Mrs. W. H. Waterman, 50c.; Mrs. F. Hoyt, 25c.

Grape jelly: Mrs. F. Hoyt, 50c.; Mrs. W. H. Waterman, 25c.

Currant jelly: Mrs. E. Waterman, 50c.; Mrs. F. Hoyt, 25c.

Strawberry jelly: Mrs. W. H. Waterman, 50c.; Mrs. F. Hoyt, 25c.

Raspberry jelly: Mrs. F. Hoyt, 50c.; Mrs. E. Waterman, 25c.

Rhubarb jelly: Miss Nellie True, 50c.; Mrs. F. Hoyt, 25c.

Maple syrup: Miss M. V. Averill, 50c.; W. L. Racliffe, 25c.

Apple barrels: Gorden Brothers, New Sharon, gratuity, $2.00.

CUT FLOWERS.

Best display: Mrs. Chas. Stanley, $10.00; Miss Lucy A. Chandler, $8.00: Mrs. H. W. Fuller, $5.00; Miss Cora E. Ring, $3.00.

Best exhibition of roses: John Burr, $5.00.

Dahlias: Mrs. Chas. Stanley, $2.00; Miss Nellie A. Day, $1.00.

Chinese Pinks: Mrs. Chas. Stanley, $1.00; Mrs. Mary Griffin, 50c.

Asters: Master Ned Pope, $1.00; Mrs. Chas. Stanley, 50c

Pansies: Mrs. H. W. Fuller, $1.00; Mrs. Chas. Stanley, 50c.

Zinnias: Mrs. Chas. Stanley, $1.00; Mrs. F. Hoyt, 50c.

Phlox Drummondii: Mrs. Chas. Stanley, $1.00; Mrs. W. H. Waterman, 50c.

Stocks: Mrs. Chas. Stanley, $1.00.

Balsams: Mrs. W. H. Waterman, $1.00; Mrs. E. Waterman, 50c.

Petunias: Mrs. Chas. Stanley, $1.00; Mrs. Mary Griffin, 50c.

Gladioli: Miss Lucy A. Chandler, $2.00; Mrs. Chas. Stanley, $1.00.

Verbenas: Mrs. F. Hoyt, $2.00; Mrs. Chas. Stanley, $1.00.

Best parlor bouquet (amateurs): Miss Cora H. Stanley, $1.00; Mrs. F. Hoyt, 50c.

Wall bouquet (professional) $2.00.

Wall bouquet (amateur): Mrs. D. H. Knowlton, $1.00; Miss Cora H. Stanley, 50c.

Hand bouquet (professional): John Burr, $2.00.

Hand bouquet (amateur): Lucy A. Chandler, $1.00; Mrs. F. Hoyt, 50c.

Floral design (professional): John Burr, $8 00.

Floral design (amateur): Mrs. H. W. Fuller, $5.00; Lucy A. Chandler, $3.00.

Floral wreath: John Burr, $2.00; Mrs. F. Hoyt, $1.00.

Dinner table decoration: Miss L. M. Pope, $2.00.

Basket cut flowers: Miss Cora H. Stanley, $2.00.

Dried grasses: Mrs. W. S. Haskell, $2.00; Mrs. Chas. Stanley, $1.00.

Everlasting flowers: Mrs. H. G. Fairbanks, $1.00; Mrs. W. S. Haskell, 50c.

GREENHOUSE AND POT PLANTS.

For best exhibition of greenhouse plants: John Burr, $15.00; W. G. Bailey, $10.00.

Best exhibition pot plants: Miss L. M. Pope, $10.00; Mrs. Charles Stanley, $8.00.

Ferns: John Burr, $3.00.

Geraniums: John Burr, $2.00.

Begonias: John Burr, $2 00; W. G. Bailey, $1.00

Coleus: Miss L. M. Pope, $2.00; John Burr, $1.00

Double Geranium: John Burr, 50c.

Single Geranium: John Burr, 50c.

Salvia Splendens: John Burr, 50c.

Foliage Begonia: Miss L. M. Pope, 50c.; W. G. Bailey, 25c.

Flowering Begonia: W. G. Bailey, 50c.; John Burr, 25c.
Coleus: Miss L. M. Pope, 50c.; John Burr, 25c.
Carnations: John Burr, 50c.
Single pot plant: John Burr, $1.00; Miss L. M. Pope, 50c.
Rustic stand: Miss L. M. Pope, $2.00.

SPECIAL PREMIUMS.

For best floral design by girl or boy under 15 years of age: Miss Lucy B. Burr, $3.00.

Best exhibition cut wild flowers: Clarence H. Knowlton, $2.00; Mrs. C. E. Waterman, $1.00.

Best exhibition pressed wild flowers: Clarence H. Knowlton, $3.00; Laura B. Beals, $2.00; Geo. M. Chase, $1.00.

Business Transactions.

April 11, 1889. Meeting of the Executive Committee held in Lewiston.

The President announced that our Society had been invited by the Trustees of the State College to elect a member of the Council of the Agricultural Experiment Station, and that in conformity with the invitation he had appointed D. H. Knowlton as the representative of the Pomological Society for one year. The appointment was confirmed.

The Committee were invited to meet with the Trustees of the Maine State Agricultural Society who were then in session, and arrange terms, &c., for the next annual fair. At this conference it was mutually agreed between the Trustees of the State Agricultural Society and the Executive Committee of the Maine State Pomological Society, that our annual exhibition be held with them September 10th, 11th, 12th and 13th. The terms agreed upon were the same as last year—our Society to receive from them the sum of five hundred dollars. At this meeting the Committee revised the Premium List, and the following assignments were made:

Collective exhibitions, general and county, L. H. Blossom.

Single varieties of apples, etc., Henry W. Brown.

Grapes, pears, plums and miscellaneous articles, J. W. True.

Flowers, plants, etc., Chas. S. Pope.

Voted, To hold a public meeting second evening of the fair.

August 5th. The Executive Committee met at the Revere House, Auburn, where the Trustees of the State Agricultural Society were in session.

Arrangements were made for the annual exhibition. The Trustees agreed to give our Society the entire third floor for the pomological display.

The Secretary was instructed to employ a speaker for the evening meeting during the fair.

September 5th. Messrs. Pope, True and Blossom met at the fair grounds and arranged for such alterations as were deemed desirable.

September 10th, 11th, 12th and 13th. Annual exhibition.

September 11th. Annual meeting.

Voted, To postpone the election of officers to the time and place of holding the next winter meeting of the Society.

PUBLIC MEETING.

Report of Committee on New Fruits was made by the Secretary, who exhibited samples of the "Gideon" apple grown by Hon. Parker P. Burleigh of Linneus, and of "Dudley's Winter," grown by the originator in Aroostook county.

For papers and other matters connected with the public meeting reference is made to that portion of the transactions containing papers, etc.

At a meeting of the Executive Committee held during the fair it was

Voted, To consider the feasibility of making an exhibition of Maine fruit at the Bay State Agricultural Show and Fair in October next.

Later this exhibit was placed in charge of Henry W. Brown of the Executive Committee whose report appears in another part of this volume.

October 18, 1889. Meeting of Executive Committee in Lewiston.

Voted, That we unite with the Board of Agriculture in holding a joint winter meeting, and that the time and place be referred to Secretary Gilbert of the Board of Agriculture, President Pope and the Secretary, Knowlton.

The premium account, amounting to $616, was audited, and the Treasurer was authorized and instructed to pay the same. The Treasurer was also authorized to make a temporary loan not exceeding $250.

A letter was read from Mr. H. W. Brown, in whose charge was placed the Bay State exhibition of this Society, in which he announced that he had received premiums to the amount of $57.

Voted, That the Treasurer be instructed to deposit fifty dollars in the Wiscasset Savings Bank to the credit of the permanent fund.

February 4, 1890. Meeting of Executive Committee held in Norway. Letters were read from George B. Sawyer, Esq., former Secretary of this Society, in which he stated that he had packed the books, pamphlets and catalogues, in his possession, belonging to the Society. The bound volumes from other bodies were sent to library of the State College at Orono; the unbound sheets of several years' transactions were sent to Smith & Reid of Augusta, bookbinders, and reports of our own Society, papers, etc., were sent to our present Secretary.

Audited unpaid accounts for the current year.

February 4th. Business meeting of the Society, held in Patrons' Hall, Norway, President Pope presiding.

The officers of the Society made their annual reports. [See report of annual exhibition, Treasurer's report, etc.] Officers were elected for the current year. [See List of "Officers for 1890."]

A letter was read from Secretary Donlop of the Montreal Horticultural Society, inviting our Society to send delegates to the Dominion Convention of Fruit Growers to be held in Ottawa, February 19th, 20th and 21st, 1890.

Voted, To place the letter on file and extend greetings of our Society, etc.

The papers read during the sessions of the winter meeting and the discussions on the same appear in other parts of these "Transactions" under their respective subjects.

Phineas Whittier, A. S. Ricker and J. W. True were appointed a committee to examine the fruit on exhibition and report on the same.

The Committee on New Fruits reported informally.

The Committee on Revision of Society's Fruit Catalogue reported. The chairman stated that as a result of their labors a list had been prepared and was published in the last volume of the Society's Transactions.

Voted, To continue the committee another year.

J. W. True, Prof. F. L. Harvey and Phineas Whittier were appointed a Committee on Resolutions.

Through the kindness of Prof. F. L. Harvey of the State College spraying apparatus from several manufacturers was placed on exhibition during the meetings and explained by him. [See resolutions.]

The Secretary presented samples of the Newtown Pippin, kindly furnished by Mr. Charles M. Griffing, and it was

Voted, That the thanks of this Society be and hereby are extended to Mr. Charles M. Griffing of Shelter Island, Long Island, N. Y., for his courtesy in forwarding to us specimens of the Newtown Pippin, and that the Secretary be instructed to forward to him a copy of this vote.

The Committee on "Maine Fruit Growers' Association" appointed at the State Fair meeting reported: The report was accepted and the Committee continued another year. [See report of Committee published in full.]

Mr. Phineas Whittier in behalf of Committee to examine fruits reported as follows:

First. That there are on exhibition some over one hundred plates of choice fruit.

Second. There are ten collective exhibitions, the largest of which consists of thirteen varieties.

Third. The first premium of $5 is awarded to G. K. Staples, Temple, and the second of $3 to H. W. Brown, Newburg.

The Secretary stated that for the years 1879–80–81 no transactions were published, and the publication of the same was referred to Secretaries Gilbert and Knowlton. The copy for the same is in the hands of the Secretary, having been prepared by Geo. B. Sawyer, Esq., while Secretary of the Society.

The Committee on Resolutions presented the following, which passed unanimously:

Resolved, That the thanks of the Maine State Pomological Society and the State Board of Agriculture be and hereby are extended to the Maine Central, Grand Trunk, and Knox & Lincoln Railroads for reduced rates of fare over their respective roads; to the proprietor of the Beals' Hotel for reduced rates of entertainment; to the local and general press for notices that have been given to the public from time to time; to the Norway Grange and its members for the grand and cordial reception extended to this meeting; to the fine choir that has furnished music for our gatherings; to the citizens of Oxford county for the cordial reception and bountiful entertainment furnished all visitors; to all those persons who have presented papers and reports.

Resolved, That the Maine State Pomological Society tender its thanks to Rumsay & Co., Seneca Falls, N. Y.; The Nixon Nozzle & Machine Co., Dayton, O.; P. C. Lewis, Catskill, N. Y., and Thos. Summerville & Sons, Washington, D. C., for placing on exhibition, free of cost to the Society, spraying apparatus manufactured by them.

Resolved, That the Secretary of the Society be authorized to mail each of the firms above named a copy of this resolution.

Resolved, That the thanks of the meeting be tendered to Mr. H. G. Cole of Boston for the use of Central Hall for our Wednesday evening meeting.

Remarks were made by several citizens, who in behalf of the citizens of Oxford county and Norway Grange tendered a hearty vote of thanks to the Maine State Pomological Society and the State Board of Agriculture for the excellent programme and the valuable fruit knowledge they have furnished during these meetings.

PAPERS, DISCUSSIONS, REPORTS, ETC.,

PRESENTED AT THE

UNION WINTER MEETING

OF THE

Maine State Pomological Society & State Board of Agriculture,

HELD IN

GRANGE HALL, NORWAY,

February 4, 5 and 6, 1890.

"Fruit culture, therefore, whether considered as a branch of profitable industry, or as exercising a most beneficial influence upon the health, habits and tastes of the people, becomes a great national interest, and whatever may assist in making it better understood, and more interesting, and better adapted to the various wants, tastes, and circumstances of the community, cannot fail to subserve the public good."

The Union Winter Meeting.

INTRODUCTORY.

The union meetings held at New Gloucester and Damariscotta were so popular, and the general programmes were so strong, the executive officers were unanimously in favor of uniting again with the Board of Agriculture. A union meeting of the two organizations possesses the strong points of each, and by the arrangements several speakers outside of the State are secured to present features of our agricultural industries, that otherwise would receive little attention. Arrangements were accordingly made with Secretary Gilbert, and the programme presented was one of the best ever offered to the public. It is a pleasure to note in connection with it, that every paper announced was read by its author.

Previously invitations had been received by the Society to hold a winter meeting in Oxford county, but for reasons that seemed satisfactory it was deemed expedient to have the meetings in other parts of the State. This year the invitations were renewed informally by citizens of Oxford county during the State Fair, and later the following cordial invitation was received from Norway Grange, through the courtesy of Worthy Master Tracy:

NORWAY, Nov. 3rd, 1889.

D. H. KNOWLTON, Secretary,

Dear Sir:—Our Grange voted to extend an invitation to the Maine State Pomological Society to hold a meeting at our hall as soon as convenient, also to State Board of Agriculture to hold an institute at the same time.

In accordance with this vote we should be pleased to have you meet with us, and will do what we can to have a pleasant and profitable meeting. Our grange voted to give you the use of the hall, warm and light it. Hall is quite large and provided with an organ. Beals' Hotel will accommodate all of you for $1.25 per day. Rooms are warmed by steam, and it is a first-class house. Our members will accommodate what they can free. Please let me know as soon as you can, if you decide to come when the meeting will be. Also helpful in their general attitude. Take for instance the Young Men's Christian Association. I easily recall when this body forgot almost the "Christian" feature in its organization; when it was carrying itself with an aristocratic air; when it was composed of members who had some means, some business, some education; who would come together in quarters that were quite luxurious and be shut entirely away from the grades needing the companionship of such intelligence and influence as this association could have furnished. Now though they are quite as strict in their by-law feature, they are very much more generous in their organizational purpose; for reading-rooms, libraries, social games are furnished, to which any one can obtain access; and that they have multiplied until not a single small city—as well as large—together with "grown-up" villages, all having such an institution, testifies how, as they have opened up from their secret and more personal attitudes, they have been prospered quite beyond any possibility under the former spirit.

However, such organizations have not yet grown unselfish enough to admit women among their members. Almost I've thought it was going to be left for the church and for the Patrons of Husbandry to take heed of, and have the power of this mighty element by giving it equally honorable and mutual membership. When I've seen the people going to "Grange," driving into town no matter what the weather, what the travelling, with its never being too cold for convening nor too hot for gathering, I've said comfortably to myself, "This is due 'awfully' to the fact that *women* belong and have equal chances at offices or service." Take a matter in which a whole family can be actively interested and it would challenge worse weather than we have here in Maine to keep them away from the place of meeting.

A man will let any number of Masonic or Odd Fellows sessions go by without attending, because he must go alone; at least apart from his family. But where the father and mother with all the household —even the babe can attend, *that* meeting will be looked after, and the team be gotten up with great willingness.

We have army posts; but before they could really flourish they had to be supplemented by relief corps; and if now both organizations could be amended to admit both sexes as members, they would thrive notably, and the Grange have a quality of not rival but parallel order, showing of the same good times, and the same mutual, universal interests. How we like this democracy within the Grange! How I like it! Because while I've not a single qualification for the institution, I'm yet admitted, perhaps because "angels and ministers of grace" are supposed to be harmless, if they are not helpful.

But we are here as an agricultural gathering, and I want to say a few words upon this great industry, that is really the fibre and sinew of the world; for how would any business or vocation flourish but for the support that comes from this particular department? All classes of occupation do reverence to *this!*

Somewhere I've read of commerce, that branch which is so luxurious in many of its methods, I've read that she is "the younger sister of agriculture," because she must look to this for all the strength that carries on her enterprises.

Trade increases the wealth and glory of a people, but the stamina of a country comes from the soil, which the agriculturist renders fruitful. Not long ago I read of a speaker before a Grange who said "This department, with its potato gospel!" and I thought why isn't the potato scriptural! It can feed, and it *does* feed hungry multitudes and that without any of that controversy accompanying so much of the testament gospel. Let us be glad that somebody outside ascribes a sufficient value to any of our productions as to call this rude groundling an evangelist.

Nor do we forget that the feature of fruit growing is the *special* reason of our being in session at this time. If that same man, with his vegetable text, was to stand before this display of fruit he would wonder if it did not all grow in the Garden of Eden! And yet, he would find none that could work the ruin of that mystic apple for these are every one healthful, with no attributes of good *and evil* but *all* superlatively "good" How much the fruits have become the chief food of many classes engaged in sedentary life in business, under cover; and how many of the people look to fine fruits as their luxuries. They all come from the soil, and the soil is "the mother of the world," nourishing from herself not only all occupations by feeding the people so engaged, but she cherishes every grade of sentient life. Agriculture is the basic industry, the foundation department of the whole world's thrift, with the farmer as lord and king of all enterprise.

Daniel Webster called the farmers "the founders of civilization," giving for his opinion that who could make two ears of corn or two blades of grass grow upon a spot where only one could grow before would deserve better of mankind, and do more essential service to his country, than the whole race of politicians put together.

And this order of occupation is the one in behalf of which we are met. We, you are constantly gathering in your respective home places, and assembling primarily for the improvement of your calling; but here, in a session more elaborate than usual, more far-reaching for the State, have sent up delegates and representatives. We are gathered here in a large convention that by comparison, by suggestion, by discussion we may come at methods beneficial to our special branches, and advantageous to ourselves individually. For, beside desiring to be better grangers, better fruit growers, better agriculturists of every kind, we want to become larger souled men and women too, which we can by associations like this, and I should be disloyal to my own calling if I did not sum up *all* of our wishing, and express it in that term, though it, too, belongs to my vocation, but which belongs to all departments, the term Christian! Children of that God who by driving his frost as a plough through the soil of the whole world has constituted *Himself* as a patron of agriculture.

And to this conference we bid you welcome. We welcome you to our town, to our hospitality, to our homes, to our sessions. Our hearts are warmed, and our hands extended in glad greeting, and we trust that to you, no less than to ourselves, this will be a red-letter time in the history of these several societies.

In behalf of the visiting organizations Secretary Gilbert was invited to respond to the Address of Welcome.

RESPONSE.

By Z. A. GILBERT, Secretary of the Board of Agriculture.

It seems to devolve upon me in behalf of the organizations here represented, to give a response to the words of welcome to which we have listened with so much pleasure.

If the position of the distinguished speaker who has pronounced these words was embarrassing, what in comparison must be my own situation in attempting to promptly frame a fitting response?

It gives us great pleasure to be thus welcomed to your presence and to this hall. Such a welcome tends to give us encouragement and lightens our labors.

In the tendency of the different branches of business in our land to protect their own interests by organized effort, we often feel that the importance of that which relates to the soil is too often overlooked.

We are not a "potato society" though if we occupied that place we might well feel proud of the position, for there is hardly a well-ordered table in the land which does not have the potato in its cuisine three times a day, seven days in the week, and fifty-two weeks in the year. Is it a degrading employment then to raise potatoes and supply this unanimous want? This Society, then, would be doing a grand work in encouraging its production and improving the methods and practices connected therewith. People are often wishing that the peach orchards of Delaware and New Jersey and the orange groves of Florida could be transferred to our own State, forgetting that the potatoes of Aroostook are far more profitable than these fruits.

This organization is devoted, first of all, to the promotion of fruit growing here in our own State. Seventeen years ago the Society was organized and started in its work, and every year from that time to this it has held these annual winter meetings. The business of fruit production at the time of the organization of the Society was quite limited compared with the present time. The idea was advanced by the Society in its early years that should we multiply the quantity of fruit produced by the thousand, we should have a better market than we were then having. Results have proved the soundness of that statement. In place of a limited demand such as we then had we find European agents coming across the water in quest of our fruit for shipment abroad. This could not have been so if we had not succeeded in producing sufficient quantities to attract the attention of these buyers.

Our Society has been at work not for its own benefit, but for the benefit of the public, and it is a justice belonging to its faithful members to state that up to the present time none of its officers have ever received any compensation for the time spent in its service, save that recently a pittance of a salary has been paid to the Secretary. Year after year the exacting duties have been performed promptly and we trust efficiently, with no other motive than a desire to promote fruit growing in the State. It is proper that the people who have extended this warm welcome should understand these things and know that it is not for pay that we are working. True some money is needed to carry on the work, and we ask all who are pleased to do so to lend their aid in this way to the extent of a membership. If this is not your pleasure we are still glad indeed to have you encourage by your presence and assure us of your interest by words of welcome.

Fruit growing in our State has a grand outlook. Only a year ago some faint-hearted fruit growers felt that the business had been overdone and that we should never again realize profitable returns. How quickly this idea has been dissipated, with our best apples selling now at four dollars per barrel!

We have heard much of the advantages of Southern California for fruit growing and many from among us have been led to flock there with their means for investment in the business. The luscious grapes of that region have sold this year at only fifteen dollars a ton and the price never goes above twenty. What inducement can there be to emigrate to that region when we can get two or three times as much per pound for Maine apples? Some of the land suitable for orange groves in California is held at $3,000 per acre. In my own town are acres of land covered with beautiful apple trees that could have been bought for five dollars per acre before the trees were set. Fifteen years of time brings an orchard worth $300 per acre, and in that fifteen years it will yield fruit enough to pay every cent of the outlay.

It is one purpose of a gathering like this to encourage confidence in the business and acquaint the public with what has been done, and what can be done in the future. If we are in any degree influential in carrying out this purpose certainly the Society should receive encouragement. While we believe it can justly claim that its influence has been in a measure effectual, still an increase of means to go with individual effort would enable us to accomplish much more. Our only source of receipts is from membership.

We are especially glad to meet the fruit growers of Oxford county and of this town of Norway, and to be assured of your interest in this work; and we heartily thank you for the words of welcome so happily pronounced.

Mr. Charles S. Pope, President of the Maine State Pomological Society, was then introduced and delivered his annual address.

ANNUAL ADDRESS.

By CHARLES S. POPE, President.

Ladies and Gentlemen, Members of the Pomological Society:

For seventeen consecutive years we have met the fruit growers of Maine at this, our annual meeting. Each year we welcome it with increasing pleasure, and should count it a great deprivation were we unable to attend. "Iron sharpeneth iron," and our intercourse here acts as a spur to awaken our best endeavors throughout the year. During these seventeen years we have found much profit and pleasure in meeting with the orchardists in various locations in the State, but this is our first meeting in the famed county of Oxford, noted alike for its intelligent culturists and charming natural scenery. The snows and frosts of winter must of necessity hide much of the natural attractions of your place, but it also gives the farmer liberty to devote more time to the discussion of the fruit question, and we hope to meet a goodly number of your orchardists here.

We were able to make a satisfactory arrangement with the officers of the State Agricultural Society, and again our fall exhibit of fruits and flowers was made in Lewiston. For the first time we were allowed to use the whole of the third floor of the exhibition building, and even those who had grave doubts about our needing so much space were well satisfied with the display. Wishing to improve the appearance of the hall, which in its unfinished condition, is not a good place for such an exhibition, we took pains to put up a little bunting; and if the same room is used again, we would suggest that more be done in the way of draping and decorating. The center of the hall is very dark, and light should be admitted from overhead. With a little outlay in the direction indicated, this hall would be very much improved, and be quite a satisfactory room for our exhibition.

At the close of our exhibition, our Secretary, Mr. Knowlton, proposed that the Pomological Society should make a collection of our standard apples, and forward to the Bay State Fair. To this the other officers readily assented, and Mr. Brown of Newburg kindly consented to take charge of the exhibit. Care was taken to make a small collection of choice apples, rather than a large one of nondescript fruit. Only twenty-eight varieties were taken, and these were collected mostly in Penobscot and Franklin counties. The exhibit was said to be the finest in the hall, but as there was no premium for best collection of apples alone, it was necessary to enter for premiums in the general collection, which included pears also. In this class they were awarded second premium, $30. Ten single plates were entered, and seven of them won first premium, two, second premium, and the other, third premium. From this it will be seen that the collection was a choice one, and we have reason to be proud of the result. Our object in exhibiting the apples was not to secure premiums, but to show that Maine can grow as fine fruit as any other section. [See report of Bay State Exhibition by H. W. Brown.]

Early in the spring, the following letter was received from the officers of the Experiment Station at Orono:

ORONO, ME., March 26, 1889.

To D. H. Knowlton, Esq., Farmington, Me.:

DEAR SIR: Your attention is respectfully called to a vote lately passed by the Trustees of the college, a copy of which is herewith enclosed. It remains with you to take such steps as are necessary to carry this action into effect, so far as it relates to the Pomological Society. The understanding is, that the expenses of the advisory members of the council, necessary to their attendance upon the meetings of the council, shall be paid from Station funds. You are also notified that a meeting of the Station council will be held at the college, April 5th, 1889, at 9 o'clock A. M.

Very respectfully,

M. C. FERNALD, *Pres't Station Council.*

W. H. JORDAN, *Director Station.*

Enclosed was the following vote:

At a legal meeting of the Trustees of the Maine State College of Agriculture and the Mechanic Arts, held at the College at Orono, Penobscot county, State of Maine, this day, a vote, of which the following is a true copy, was passed by said Trustees, viz.:

Voted, That the Trustees invite the State Board of Agriculture, the State Grange and the State Pomological Society, each to furnish one representative as an advisory member of the council of the Experiment Station, and that such a representation of said bodies constitute an advisory board of said council, when so elected, and the Trustees of this college duly notified of the same.

Attest: WILLIAM T. HAINES, *Clerk*.

The Executive Committee at once took action in the matter, and as it was important that the Society should be represented at the first meeting, when plans for experimental work were being outlined, Mr. D. H. Knowlton was elected as advisory member of the council of the Experiment Station. For the work accomplished there I will refer you to his report. We think there is a wide field open before them, and we hope for great results from their investigations.

As most of us are aware, there is considerable discussion at the present time about teaching the rudiments of the science of agriculture in our common schools. Having previously called attention to this subject, I will now simply express the hope that we may take such measures as the Society shall deem best, to properly present this subject to the people, and secure the needed legislation. The education of any scholar is certainly very incomplete without some knowledge of the natural sciences, and this knowledge might be so placed before the minds of the young as to be fruitful of very satisfactory results. It frequently takes but a trifle to direct the thoughts of a youth into a channel which will lead to great accomplishments. John Bartram, a farmer living near Philadelphia, in the middle of the last century, while resting from his plow a few minutes, pulled a daisy to pieces, and being struck by its marvelous construction, left his work and went to the city, and purchased a botany in Latin, and a Latin grammar, and soon mastered so much of the language as to enable him to study his botany, and in a year had botanized all over the country about him, and afterwards became botanist to the King, at fifty guineas a year. He established on the beautiful banks of the Schuylkill, the first botanical garden in America, which resulted, by exchange of plants, in great benefit to both this country and England. I do not think the advantage of introducing the subject will be so much what they learn at school, as it will by awakening thoughts in the minds of many, which will lead to after investigation.

The objection raised by some, that we do not want class legislation, is hardly worth notice. We well know that all the states which are up with the times are already appropriating considerable sums to support colleges and experimental stations, and to otherwise advance the science of agriculture. I am satisfied that we are only to convince the farmers that a little instruction in our common schools in the natural sciences which form the foundation of all intelligent farming, will be for their best interests, elevate their calling, increase the possibilities of those who are to follow them, and all the legislation necessary will be easily obtained. However much our school curriculum may be extended in this direction, there need be no fear that the farmer will not pay his full share of the taxes; but all advantage to be derived from extending the knowledge of fruit culture, will accrue quite as much to the merchant, mechanic and professional man, as to the farmer himself. God pity the man who does not, at some time in life, own a few rods of land, which for the cultivation of fruit, if his mind has been properly instructed, will prove a mine of pleasure, and add wonderfully to the health and happiness of his family. The people at large know but little of the great importance of fruit as a part of their daily diet. If this Society could do something to displace a few pounds of pork, by the products of the orchard, the bush and the vine, it would elevate the standard of humanity, and curtail the business of both the physician and undertaker. As civilization advances, the consumption of fruit will very much increase, and the cultivation must be largely extended to keep pace with the demand.

Farmers realize the value of an orchard when grown, but few have faith enough to set many trees. Ten or fifteen years look a long time to wait before realizing any returns. How many orchards of 500 or 1,000 trees, in good condition, can be purchased for double what it cost to grow them. Let us look at the cost of an acre of orcharding, 70 trees. The best of trees will cost ten cents apiece, and about the same amount will set them, in pasture land. The expense for dressing and care, until the apples give sufficient return to pay expenses, will swell the total to $60 or $70. And who would not give thrice this amount, plus the value of the land, for an acre of young orchard? We know whereof we speak when we give these figures, as we have an orchard of this description set fifteen years ago, in an old sheep pasture, from which we have taken enough apples to pay all expenses, and which bore this year more than $100 worth of apples. I do not speak of this as an exceptional yield, but to show what can be done on almost any of our rocky hillsides, with very little outlay.

I do not wish to recommend much that is new, nor anything startling, and yet I believe it is the proper duty of this Society to investigate, and if possible recommend that which will be for the best interest of all. We know that many of our people are frequently sending part, at least, of their surplus to help develop the mines and boom the towns of the far-off West, and too frequently receive nothing in return but worry and vexation of spirit. There are mines close at home which, if properly worked, would pay much better than the average investment so far away. I beg leave to recommend for the consideration of capitalists the plan of forming a stock company with full power to buy and hold real estate, which shall, through competent officers, secure land and plant orchards upon a scale that will enable them to command the respect of markets both at home and abroad, and not only sell such large lots to better advantage, but all the expenses would be less, the price of barrels lower, and the cost of picking, packing and sorting greatly reduced. None of us here can doubt that such orchardry, intelligently and honestly conducted, will secure larger returns, combined with a minimum of risk. I do not doubt that stock in such a company would always sell at a reasonable price, and any one who wished to realize upon his investment could do so at any time. In competing with other sections of the country, we can claim several advantages, not the least of which is our immunity from late spring frosts, which frequently ruin the fruit crops in other states south and west of us. Land suitable for orcharding is also very low, and Maine apples are popular in the foreign market.

With the obstacles which we must now encounter, in orcharding as with every branch of farming, we must remember that more intellect than formerly is required to make a success, and our people must understand this and train the boys accordingly. Let those who lack the capacity seek employment in the city as salesmen or clerks, and those who have the brains can follow the more independent life of the farmer and horticulturist.

The President's address was referred to a committee consisting of Hon. Rufus Prince, Turner, S. G. Shurtleff, South Livermore, and C. H. George, Hebron, who before the close of the meetings presented their report, which was accepted.

Report of Committee on President's Address.

Resolved, That we commend to the people of Maine the recommendations of the President's address in regard to teaching the rudiments of agriculture in our schools, as we believe it would create a love for rural life, the lack of which is from day to day depopulating our rural towns.

Resolved, That as much of our President's address as relates to forming a stock company for the purpose of engaging in orcharding on a large scale, we commend to our capitalists, as we believe it would not only govern in a large measure the price of Maine fruit, but such an association, well managed, would give such returns as would tend to give orcharding in our State an impetus that could be given in no other way.

FOUR ACRES ENOUGH.

By L. H. Blossom, Turner Center.

"Four Acres Enough" may to some seem of little consequence, but before we cast it aside as a subject unworthy of our attention, let us pause for a moment and consider what we are here for, and what are the objects and aims of this meeting. We have met here for a purpose, and that purpose is to discuss the subject of pomology in some of its many branches. Every year, as we dig deeper into the mysteries of the cultivation of fruit, brings to light, out of the hidden mysteries of the past, something new and unheard-of before. Every year brings to our notice some new and choice variety of apple which claims a place in every orchard; at least, that is what the apple-tree agents tell us, and you all know, who have had any dealing with that class of beings that they can't lie. How many of us have been suddenly awakened to the realizing fact that we have encumbered our farms with too many trees of too many varieties, and almost unconsciously we find our farms burdened with too much orchard. How often we hear a man say, "Oh, I have got ten acres of orchard;" another will say, "I have got fifteen acres;" another has twenty acres, and has ordered trees for two acres more, to be set next spring. Now, to such as these, "four acres enough" may seem to be an absurdity; but stop, my friend, let me ask you a few questions before you tread my little orchard under your feet, and first is this: Do you honestly think that every tree in your orchard is properly pruned to its best advantage? That there are no interlocking branches to rub and chafe each other, and thus cause decay? That your trees are so pruned that the most sunlight possible can get to the ripening fruit, thus putting on that beautiful tinge so dear to the critic's eye, and which naught but the ripening influence of the autumn sun can bring out to its fullest perfection? And when the pickers come along to gather in the fruits of your orchard, are your trees so pruned that they can readily pass through the trees and gather the fruit, or must they take a saw with them to clear the way? My friend, can you answer this question in the affirmative? While one may, I fear there are too many that can't. Again, have you given your trees all the fertilizing material that is necessary to bring them up to their highest stage of perfection? If not, then again I say, you have failed to derive the greatest amount of profit from the smallest amount of ground, and until you bring every tree in your orchard up to its greatest bearing capacity, I shall claim that "four acres are enough" for farmers in general.

We have all noticed in some parts of our orchards that some of our trees were better than trees in different parts of the orchard; now what is the cause for it? Have we ever stopped to think that the trees standing at the foot of the hill, or in the fence corners, were the best ones in the orchard, and what is the cause for it? It is this: More or less of the dressing that has been applied to the soil has been washed to the lower parts of the orchard by the rains, thus doubly enriching those trees on the lower part of the orchard over their neighbors that stand on higher ground. Now may we not learn a lesson from this, that the tree on the lower part of the orchard bears double the fruit that the one on the higher ground does, one is equally as well located as the other, as far as the natural conditions of the soil are concerned, and the one would be equally as prolific as the other if it only had the same amount of plant food to sustain it?

Now, gentlemen, would it not seem foolish to you for that man to set out another acre of orchard when half that he already has on his farm is starving for something to eat, something to make it grow? Well, now is not this just the condition of nine-tenths of the orchards of Maine to-day? Yes, I think it is, and I think it is time for the most of us to stop increasing our acreage and give better care and attention to what we have already on hand.

In the fall of the year when we go into our orchards to select fruit to carry to our fairs, do we go to the poor, ill-fed, scrubby, limby trees that are half dead with neglect to select our samples from? No, certainly not; it is right the reverse. We go to the trees that have been so pruned that they will not be overloaded with fruit, and the sun has put on the finishing touches. It is to these trees that we go for our samples. Now if we have a few such trees, as these, let us try and have more of them before we enlarge on our orchard.

What would we think of a man who had dressing enough for four acres of land, if he should go and plow up twice that amount and apply the dressing for the four acres to the eight. It is needless for me to note the result, you all know it must be a failure. And is this any the more true with the corn than with the orchard? Most certainly not, only with the corn we see the result a little more quickly.

The spread of diseases of fruits, resulting from insect depredations, and other causes, might be checked, if not eradicated, if we would but turn our attention in this direction. A very little attention on the part of *all* the fruit growers of Maine would accomplish much that would be of great benefit to us all.

Last fall I was passing through the orchard of a friend, when we came to a tree of Franklin Sweets, many of which had fallen to the ground, and on my calling the gentleman's attention to them, he said they were utterly worthless on account of the apple maggot, and on examining some of them I found them to be completely infested with that pest. I asked him what he did with them; he said, nothing at all, that he had not picked any of them up for two years, they had been so poor, and yet that man was setting out trees every spring, giving *no* thought to that deadly enemy that he was so careful *not* to destroy.

Now to obviate and overcome this evil, to restore and perpetuate our fruits, a change in the manner of cultivating them is absolutely necessary. We must do less planting, and give more attention to those planted. Too many persons in growing fruits practice quite different from that pursued in growing other crops. They act as though all that is necessary is to plant the trees, when, in fact, this is but a small part of the labor that is required to grow an orchard. Because our forefathers grew full crops of perfect fruit with little or no labor after planting the trees, we should not expect to do so now. They had the rich virgin soil, full of all the elements that were necessary for tree growth and the perfection of its fruits. With us, we find all things are changed; we must prepare the land by deep cultivation, and thoroughly enriching it, and underdraining where it is necessary. Fruit trees, to be healthy and vigorous, must have good cultivation when young, so that when they come to a bearing age they may be capable of rewarding us with a bountiful supply of No. 1 fruit.

Some five or six years ago, while helping my father gather his apples, we kept an accurate account of the number of bushels taken from several of the trees, and I know of two trees, standing thirty feet apart, from which we took twenty-five bushels from each tree; other trees located in different parts of the orchard doing nearly as well. Now let us see what this would amount to, seventy trees to the acre. Calling it eight barrels per tree, it would amount to 560 barrels per acre; now that is better than most of the ten acre orchards will do, so let us cut it down from eight barrels per tree to two barrels per tree, and *then* we have 140 barrels per acre. Now, surely this seems small enough, but to be safe, let us throw off the odd 40 barrels and make it an even 100 barrels per acre, and how many of us, do you think, reach that amount? Very few, I think. And why not? It is just because we fail to give them the proper amount of care and attention. We have been raising too many No. 2 apples, which, taken one year with another, don't pay for handling. Now, in these close times of competition, in order to make the business of fruit growing a profitable one, we have got to so manage it that we can get the greatest amount of fruit possible from the smallest number of trees. If by care and attention we can make one acre yield more fruit than five now do, then we will make fruit raising one of the most profitable industries in Maine. Remember, it is no more work to keep an acre of orchard that will yield annually 100 barrels of apples free from borers and all other insects, than it would one that yielded but 50 barrels. And I believe it is in the last 50 barrels wherein the profits lie.

Some may say, if there is a profit in one acre of orchard, there will be still greater profits in larger ones. This may all be true to a certain extent, but when we increase our area at the expense of what we already have, then I think the profits will decrease in the same proportion. Of course we have fruit growers in our State who make fruit growing the leading business on the farm, to such as these this paper was not written, but for the general class of farmers who have an idea that orcharding is but a sort of recreation which needs but little care and attention. And for proof of what I have written, I will cite you to the many orchards that dot the hills of Maine, and until they show better care and cultivation I shall say "four acres are enough."

DISCUSSION.

Dr. T. H. Hoskins of Vermont. This is a subject which ought to interest every orchardist, and every farmer who undertakes to grow any kind of tree fruit for profit. This requires the closest attention to soil tillage, manuring, setting trees, and care in handling them. Unless they are properly managed they never come to any profit. I take it that it is in this State as in Vermont where I live, the greater part of the farmers realize no profit at all from their trees.

The orchard business is rendered somewhat discouraging by the increase of insects, and before setting out a large orchard I should want to wait to see what is to become of them. The insects injurious to agriculture have trebled during the last forty years, and I do not know of one that shows any signs of leaving. When I began farming in Vermont I had not heard of the currant worm and the cabbage worm. We had the tent caterpillar and have him still. We have had him so long that we should be sorry to lose his company. The codling worm is also an old insect. Sometimes I think he is a very good fellow to thin out our apples. These were the insects which we had when I began orcharding. Of those which have appeared since, this apple maggot is more injurious than all the rest.

It is a great error to set more trees than you can care for, or to set them too close. Those trees which bear young may be set closer than Baldwins and Greenings if they are thinned out at the proper time. They may be set fifteen feet apart at first, but after about fifteen years every other tree should be taken out. In that way something may be made by raising early kinds. I consider the Early Transparent the most profitable. It takes the place of the Early Harvest and the trees begin to bear when very young. They have netted me a dollar a bushel for ten years. They bear heavily. A tree eight feet high will often bear a barrel.

Question. Do you think it would be suitable in this State?

Dr. Hoskins. It will grow anywhere in the State clear up to the Canada line. In those parts of the State where old, standard apples are a failure, it is a "God-send." They come into bearing quicker than the currant bush.

Question. Does it do well grafted into other trees?

Dr. Hoskins. Yes; it does better when grafted into something else.

Question. What is your method of treating trees, beginning with the setting?

Dr. HOSKINS. I do not think much of the old-fashioned way of digging a hole as big as a hogshead. A place large enough to admit of straightening out the roots in good shape is sufficient. The dirt should be carefully pressed firmly against all the fine roots. No water at all should be added. Only three branches should be allowed to grow at first. Pruning should be done while the limbs are small. My theory is that it should always be done with the pen-knife.

Question. Would you set trees as soon as the frost is out of the ground?

Dr. HOSKINS. Yes, sir; just as soon as possible.

Question. Do you apply any manure?

Dr. HOSKINS. Never put any manure in the hole in setting the tree because as the manure decomposes it leaves a vacant space and the roots which pass through this space will die. Manure upon the surface. I manure my orchard as highly as a market garden, and always find that the last load pays the best. It is not necessary to place the manure very near the tree, as the roots will cover the whole orchard. If you should remove the turf from the orchard you would find that you had but one tree. The soil would seem to be filled with one continuous network of roots.

Question. Do you allow grass to grow in the orchard?

Dr. HOSKINS. I allow grass to grow in the line of the trees, but generally want to plow between the rows; however, if land is rich enough to bear heavy crops of grass it will generally produce apples.

PEAR CULTURE.

By C. M. WESTON, Belgrade.

I received an invitation from your President to prepare a paper on "Pear Culture," to be read at this meeting, and I could not well decline, as I had been honored with a like invitation a number of times previous, when other engagements prevented me from complying with the request. And it is now with a degree of diffidence that I come before you with a paper for the first time, knowing full well that there are many present who have had a large experience, not only in fruit growing, but also in preparing papers on the same. But I will endeavor to give you a few ideas as gleaned from some over twenty years' experience in the cultivation of the pear, attended with varied successes and failures, trusting you will receive them as coming from one who has had more experience in raising pears than he has in telling how it is done.

You should first select a suitable piece of ground near your buildings. It should have a dry subsoil. If that cannot be had, it should be underdrained, as the pear will do no better in a wet soil than the apple. The ground should have enough animal dressing applied to raise a good crop of corn or vegetables, then thoroughly pulverized, and marked off in rows fifteen feet apart, placing the trees the same distance apart in rows, in the form of a hexagon. I should select seedling trees if they could be found, if not, I would start my orchard from the seed, as I would prefer a pear seed to a tree grafted at the root. Dig the holes for your trees a little deeper and larger over than the roots extend. Have some two inches of loose dirt in the bottom of the hole to place the roots upon, then incline the tree a little towards the southwest, to prevent what I call sun scald, or trunk borer. Put the dirt in around the roots with the hand as closely as you can, lifting up the small roots and fibers as you put in the dirt, so when it settles around them they will be in about the same position as they were when taken from the nursery. Use no animal dressing around the roots of the trees. Then you should mulch the trees with coarse hay, straw or leaves, about ten inches deep, and extending some three feet from the tree.

The ground can then be planted to beans, potatoes, or some other vegetable, and then continue to plant, giving it an annual coating of animal dressing, until the trees come into bearing. Then leave off the cultivation, and mulch the ground all over, so as to prevent the growth of grass and weeds, and also keep the ground light and mellow. It will need renewing about once in two years.

As soon as the tops of the trees are large enough, I would graft them in the limb, either by splice or cleft grafting, using well known varieties that will give a succession of fruit during its season. I will give a list of a few varieties that I have been fruiting with a good degree of success. First we have Osband's Summer, that will give ripe fruit about the first of August, and are in eating some two or three weeks. Then comes Clapp's Favorite, and if you will commence picking them as soon as large enough, and continue from time to time, and take them into the house to ripen, you will have fine ripe pears for some two or three weeks, until the Bartletts begin to ripen. That is a variety too well known to need any comment from me, except to say no pear orchard should be without it. Next we have the Nickerson, one of the seedlings of old Kennebec, a fine grained sweet pear, excellent for eating, and cannot be easily beaten for canning. Souvenir du Congress, which ripens about the same time, is a bright yellow with a little flush, very juicy and the flesh firm and crispy. The Sheldon ripens the last part of October and the first part of November. The tree is very hardy, and of thrifty growth, but a shy bearer. The fruit is large, round and covered with a light russet, very juicy and melting, one of the best eating and selling varieties we have at this season of the year. The Goodale, one of the most profitable of Maine's seedlings, ripens about the same time as the Sheldon; fruit very large and green; flesh white and of very good quality. The tree is very hardy and upright in growth, an annual bearer and very productive. Later we have the Duchesse d' Angouleme, Buerre d' Anjou, Kieffer, and many others that are highly recommended, but I have not fruited them enough to decide which I should prefer.

As soon as you commence grafting, you will find the trees will require a large amount of pruning until they come well into bearing, which will be earlier than with the apple, thus proving false the old saying, "That he who plants pears, plants only for his heirs." The scions will need cutting back for a number of years after being set.

If you wish the fruit to be melting, juicy and of the finest flavor, they should be picked from the trees as soon as they will readily separate from the limb by lifting the fruit, and carried into the house, put into boxes or bulk and covered up; the cooler the place they are in the longer it will require to ripen them. If left upon the tree until fully ripe, the most of the summer and fall varieties will be dry and devoid of that fine flavor that belongs to them.

I see no reason why pears cannot be raised in any section of Maine where we can raise apples (except the Ironclads). To be sure, it costs more to raise a bushel of pears than it does a bushel of apples, but they bring more in the market. I see no reason why the fruit growers of Maine should allow other states to furnish the most of the pears that are sold in our larger towns and cities. There is certainly no reason why a majority of the farmers of Maine should not have their little pear orchard, and in that way furnish their families with all the delicious, ripe pears they want for the table, from the first of August till into the winter months, and also to can for the remainder of the year. I have no fruit that children seem more pleased with than a good ripe pear, and I also find that children of a larger growth do not object to them.

DISCUSSION.

Question. It was reported a few years ago that the apple borer would not trouble pear trees. What is your experience?

Mr. WESTON. I am not much troubled with the root borer. The trunk borer troubles me most. They sometimes enter the tree through the little holes in the bark found where the sun strikes the trees in the afternoon.

Question. What course do you take to prevent the cracking of the Flemish Beauty?

Mr. WESTON. I found no way to prevent this, and grafted the trees with Bartletts, receiving a good crop four years afterward.

Question. I have a tree that has blown quite full, but I have succeeded in getting only one pear. What do you think is the matter with it?

Mr. WESTON. Well, that is my experience with root-grafted trees. In a few years your tree will probably die. I get good results by setting seedling trees and grafting the top. I have about two hundred such trees that are doing well.

Question. What is your opinion of the Sheldon pear?

Mr. WESTON. It is the best market pear we have. You can ship it wherever you can ship the Ben Davis apple. But with me it has been a shy bearer.

Question. What do you do to prevent the blighting of the leaves?

Mr. WESTON. That is a subject that I want to hear something more about. I find that the trees must be cut back until they begin to bear. When the leaves and ends of the limbs begin to die I cut them off and burn them.

Question. At what distance do you set the trees apart?

Mr. WESTON. Some of mine are fourteen feet apart, and some fifteen feet.

Question. I would like to hear from some one who is able to tell us how to prevent the pear blight. We all understand what it is and how it works, and now can any one give us a remedy?

Prof. HARVEY. I do not know that I shall be able to give much upon the point, but will give all that is known regarding it. Until recently, I had no idea that it was so widespread. It is doing a great deal of damage in the Northwest. The disease is a fungous parasite. It is a little organism that works in the tree. It is interesting to know a little of the history of this parasite. The little spores that produce this disease are well known. They live in organic matter, and perpetuate themselves from year to year, so that it is very difficult to destroy the source of these organisms. The ground beneath the trees should be kept clear of organic matter. In such matter multitudes of little spores are produced, and float in the air, alighting on the twigs of the trees. The organisms are made up of little, slender threads. They work in the cells or fiber of the wood. In removing a limb it is necessary to cut back far enough to remove the whole of the organism. The branches removed should be burned. If left under the tree they furnish the most favorable conditions for propagating the spores. As the spores are liable to enter the tree at the points where the limbs are cut, it is better to do the pruning in autumn than in spring. These are all the remedies that have, as yet, been suggested, and we can only make the best of the situation by preventing the disease as much as possible.

EDUCATION IN FLOWERS.

By Mrs. HELEN B. C. BEEDY, Farmington.

Education begins, we know not where—and ends—not here. Whatever stimulates the mind to activity, producing abiding results, educates. Education in flowers begins with the first impulse of love stirred in the heart in admiration of their brightness and beauty; if cherished and cultivated it pervades and happifies the entire nature, broadening and enlightening, until beneath the shadow of the "tree of life" is begun the study of that heavenly fruit which is yielded every month, "the leaves of which are for the healing of the nations." That the tendency of the study of flowers is for good and only good, needs not to be proven to an audience like this. Flowers with all their beauty and wonderful mystery seem to have been given us as a pastime to help over the rough hard places in this work-a-day world, for we have all repeated from childhood,

"God might have made the earth bring forth
Enough for great and small,
The oak tree and the cedar tree,
And not a flower at all."

It seems fitting that a pomological society, a society devoted to the study of fruit should also turn its attention to flowers, for the fruit is only a part of the flower brought to perfection. Indeed there can be no scientific study of fruit that does not necessitate first the study of the entire plant. It is presumable that your education in flowers is well begun and each spring time brings to you new joys in her bursting flowers. Occasionally we meet one like Peter Bell into whose heart nature could never find the way. To whom

"A primrose by a river's brim
A yellow primrose was to him,
And it was nothing more."

Another who boasts that he cannot distinguish the geranium from the chrysanthemum who would think you indifferent at least should you fail to specify among his flocks which are South-downs and which are Merinos. Flowers are flowers, sheep are sheep, and there is a peculiar pleasure in being able to call them all by their specific names. Your education in flowers cannot be *complete* so long as there blossoms beneath your feet a single flower with whose name and habits you are unfamiliar. Many confine their study to window gardening which affords one of the greatest delights of the home and should be shared in by each member of the family. Too many fail by attempting the culture of exotics which will not always survive our Maine winters. The hardiest of our plants prove the most satisfactory. Geraniums need but very little care and are always bright with blossoms. Ivies, callas, fuchsias, abutilons and cannas amply repay all the attention they receive—and now that veranda gardening is becoming so popular a new zest seems to be given to the window culture, that there may be an abundance of plants for early transplanting out of doors. Boxes perched anywhere are attractive. The fernery may be a constant source of pleasure. It needs very little care and may be simple in its construction—covered with glass or uncovered—from the Wardian case to a simple plate of moss and ferns. The unrolling of the downy fronds of the ferns affording never ceasing pleasure. The extent to which our native ferns may be cultivated has not been tested as it should be. They are not particularly attractive to the farmer as they monopolize his fields and pastures, but as graceful foliage about our homes, they are unsurpassed. Boxes of violets in the cooler rooms of the house are very pleasing winter decorations. All take kindly to out of door gardening, finding in their open beds infinitely more than "pansies for thoughts." Who does not feel the contrast between a home made bright with flowers, and one in which, in winter, no plants are seen? and who can estimate the effect upon the lives of those who share such homes, in the cultivation of taste, the enlarging of the moral nature, and happifying the heart?

> "To me the meanest flower that blooms can give
> Thoughts that do often lie too deep for tears."

Truly "we are creatures that look before and after; the more surprising that we do not look around a little, and see what is passing under our very eyes." It is easy to interest children in flower culture and window gardening, but far more easy and satisfactory to lead them to the study of our native wild flowers, "earth's cultureless buds," that spring up everywhere about us. God made the flowers bright and sweet, not only to attract humming birds and insects, but the children also. Have you ever taken the baby out into the fields in summer, when the buttercups and daisies were in bloom? You have been impressed with the fact that the love for flowers seems inborn. Sad indeed that so enlightening and purifying an agent should be crushed out of its future life. It is a law of our being that the mind must be helped, stimulated to educate itself.

The flowers are given him and the child naturally loves them, but he must be trained to see and taught to apppreciate their ever wonderful growth and development. The savage who roamed over these hills ages ago, had probably the same flowers; and though we hear much of their "medicine men," and Longfellow tells us:

> * * * "In even savage bosoms
> There are longings, yearnings, strivings
> For the good they comprehend not."

We do not know that they ever attained any scientific botanical knowledge. Unaided nature will not accomplish the work. We talk of geniuses, and often refer to the lives of Aristotle, Linnæus, Agassiz, Thoreau and Gray, as botanists whom nature has specially endowed. But if we look into their early history, we find there was a guiding hand in the home that turned their feet into these delightful paths, which to them were often steep and rugged. There is a responsibility resting upon parents in this matter of early guidance. A very little judicious instruction in plant study at the beginning, may mold all the future life. It is not necessary that parents should be able to recognize and name all of our native plants, in order to become competent instructors to their children, but that they should study our more common plants, and know how they grow, is desirable. A very hopeful sign of the times is the formation of adult classes in neighborhoods, for the purpose of reviewing the elements of knowledge, without which knowledge all progress in study is impossible. We are never too old to learn. It is not a difficult matter to acquire the rudiments of botany. Parents and children often make great progress in studying together, and when we consider the great assistance thus given in keeping busy hands and active brains in healthful exercise, especially during the summer vacations, we wonder that so helpful an educator should be overlooked. The methods adopted in plant study must depend upon the individuals pursuing it, keeping constantly in mind that educating is not cramming. The mind must be made to act for itself. Even an adult may go through with the text books in botany, completing a prescribed herbarium, and yet know very little of the science of plants; with no real love for the work that shall stimulate him to pursue it farther. One plant studied in such a way as to awaken a desire to continue the work with others, will do more to lay the foundation for an education in flowers than an entire text book examined in a cursory manner. Having studied one flower, every other becomes to us a new treasure, containing some hidden mystery. And yet we need to go back to our flower over and over again. We have not learned it all. We have known the buttercup from the time we first held it under our playfellow's chin to ascertain if he loved butter. But do we know it? Its perfection of color that no dyer's art has equalled; its shiny petals, its folded flower, its rounded bud so delicately poised, its symmetry and grace, this universal flower, growing in all lands? It might be profitable to question ourselves in regard to many other flowers. Perhaps none are so little studied by us as the firstlings that spring hangs out from her willows, alders, maples and elms. Where do these blossoms come from? How is it possible for some of the elms and maples to ripen their fruit apparently without the aid of the leaves? As we examine the swelling bud of the horse chestnut, removing first its waterproof coating, then its outer wraps, till we reach the woolly packing, we can form some idea of the care bestowed upon the flower so closely folded in its very centre. This we can seem to fathom, but these earlier buds and blossoms seem to defy us, bursting into bloom as if *uncalled* and *uncared* for. Lowell must have studied them, or he never could have written,

> "'Fore long the trees beg'n to show relief—
> The maple crimsons to a coral-reef,
> Then saffron swarms swing off from all the willers,
> So plump they look like yeller caterpillars.
> Then grey horse-chestnuts' leetle hands unfold,
> Softer'n a baby's be at three days old."

And when Mother Nature removes her white coverlid, and wakes up her teeming millions of blossoms, each bristling with interrogation points, then it is that we should find a little leisure for the anemones, the violets, the arbutus, the bloodroots and orchids. She sows with bountiful hand, and yet some of her more delicate plants will not stand a crowd, and should be preserved against extermination. Handfuls, not armfuls, ought to satisfy the most untiring investigation. Nearly all of these early wild flowers are susceptible of cultivation, and we may watch them unfolding beneath our windows, even before the snow banks have disappeared from our dwellings. We are greatly helped in our observations by reading those who have learned to see more than we. Ruskin's description of a blade of grass gives every bit of feeble green beneath our feet a new meaning. "Gather a single blade of grass, and examine for a minute, quietly, its narrow, sword-shaped strip of fluted green. Nothing as it seems there of notable goodness or beauty. A very little strength, and a very little tallness and a few delicate long lines meeting in a point—not a perfect point, neither, but blunt and unfinished, by no means a creditable or apparently much cared-for example of Nature's workmanship; made as it seems only to be trodden on to-day, and to-morrow to be cast into the oven; and a little pale and hollow stalk, feeble and flaccid, leading down to the dull brown fibers of roots. And yet, think of it well and judge whether of all strong and goodly trees, pleasant to the eyes and good for food—stately palm and pine, strong ash and oak, scented citron, burdened vine—there be any by man so deeply loved, by God so highly graced, as that narrow point of feeble green."

Many fresh and suggestive articles may be found in our periodicals. John Burroughs' "Among the Wild Flowers," so charmingly illustrated, takes us to the very heart of the woods, where blossoms in all its beauty our mountain laurel, though found in but few places in our State. Mr. Burroughs tells us that he makes the acquaintance of one or more new plants every season, and only those who have learned to love flowers can realize the untold pleasure in finding, in some of our old haunts, a *new* plant, as if a little stranger had sought our acquaintance, ever after to be our friend. And how like a familiar face seem our native flowers, found thousands of miles from home. Our little blue harebell, growing so abundantly about the cascades of the upper Mississippi, greets us like a messenger from the Pine Tree State, only there it is found with its radical leaves in perfection, which rarely occurs in New England. Many a botanist will tell you that he has visited the Isle of Shoals, that he may watch the pimpernel close its rosy eyes at the approach of the storm, so fittingly termed "the poor man's weather glass."

"Were I, O God, in churchless lands remaining,
Far from all voice of teachers or divines,
My soul would find, in flowers of thy ordaining,
Priests, sermons, shrines."

If you have ever taken a day with a botanist, you are convinced that "nature sells but always at value price." You perhaps became weary while your friend eagerly followed the trail of his sought-for treasure, and heeded not stream or mountain till the prize was won. The pencil and brush are indispensable aids to thorough study in natural history. Children take great delight in illustrating their work, if only correctly directed at first. No more enthusiastic lover of the work has wielded her brush in the study of our Maine flora than Miss Kate Furbish, whose valuable collection is as yet incomplete, but already embraces most of our native plants. Miss Furbish is accorded the honor of being the first woman for whom a plant has been technically named [*Pedicularis Furbisha*], an honor in which every other Maine woman may proudly share. The object of this paper is not to urge that we all become scientific botanists, but that, by learning to read nature in her works, we shall all find a secret of happiness in our own lives, and help to unfold it in the lives of those for whose future we are responsible; that parents and teachers, by leading the children early to the pure and helpful study of flowers, will so preoccupy their minds that unrest and evil may not so readily find a lodgment there; that home shall always be associated with the most beautiful things God has given us—the flowers; that by thus awakening their interest in all that pertains to the culture and adornment of rural homes, this vexed question, "How shall we keep the children on the farm?" may find, if possible, a more satisfactory solution. It is not desirable to keep them all there, but it is desirable that they should love and cling to it. Pitiful, indeed, is this picture given us by a Scottish writer: "There are, in Scotland, ten thousand homes, once sweet and beautiful, each a little paradise, of which there is no trace of the cottage, not even the grassy mound that marked it, and the question naturally follows: Where are the healthy, laughing peasant boys and girls that such homes bred and reared? *They are sweltering and struggling for existence in the towns and cities.*" The author further adds: "I am told this must be, that it is all the result of economic laws. But I confess to a deepening conviction that it need not be, and that the loss to the nation, as a whole, is vital, if not irreparable." Is there not a like process going on in our own State? Are the boys and girls encouraged to remain upon the farms as they should be? The tendency to join the small farms to the large ones, and thus blot out the homes and drive from our rural districts its most valuable population, its small farmers with their families, *is degenerating*. Consult the school records. Only two or three scholars now where often thirty to forty bright, happy boys and girls made music in the air for miles around. This question *is worthy* the attention of a society like this. Can you not, by the dissemination of knowledge and the encouragement of fruit and flower culture, help to give necessary stimulus to those busy brains, and attract to these homes its richest heritage, its boys and girls? Look the world over—where can be found a more favored spot than our own State of Maine? Of all the forty-two stars that decorate our national flag, is not the eastern star the most steadfast in its light? Consult the daily press at any season of the year. Shall we not find *floods*, *tornadoes*, *cyclones*, *blizzards*, *malaria* and *deadly heat* doing their dire work in all the other states, while the dear old *State* of *Maine* moves on the even tenor of her way unmolested by any such destructive agencies. Even the winter storms are now talked of as old fashioned. The Maine people, the original stock, were exceedingly practical, and we, their descendants, are apt to question any departure from the old way with—Will it pay? Will this education in flowers pay? If this life were all, perhaps not; but if this existence is given in which to develop capacities for a higher and broader life, yes! a thousand times, yes. Very little original work in botany has been done in the State. There remains a vast field as yet unexplored; our extensive coast line with its variety of algæ, our broad forests where new plants are springing up with the changes constantly taking place, our numerous lakes and streams, all await the coming specialists who should be *native* born and *trained*, that they may love the work and unfold to us in all its richness our native flora. In order, then, that we as a people may be intelligent in plant study the home should lay the foundation of the work, the school should continue and give direction to it, and societies like this should foster and encourage it

THE DIETETICS OF FRUIT.

By C. D. SMITH, M. D., of Portland.

If he who makes two blades of grass grow where but one grew before, be hailed as a public benefactor, how much more deserving of praise are they whose efforts are directed toward increasing and improving what has always been esteemed as one of nature's best gifts to man. It is, I believe, a recognized truth, that in any business or profession, the best collective results are obtained from combined effort in the direction of certain special lines, and in accordance with this fact, societies such as yours have multiplied themselves, doing work not yet appreciated by the public as it should be, but of infinite benefit to themselves and all who profit by their enterprise. It is, therefore, because of sympathy with this method of work, and a desire to render such assistance as I may be able, by placing before you some facts which may enable you to feel an additional satisfaction in promoting the cultivation and consumption of fruit, and *not* because of any special knowledge, that I venture to ask your attention to some facts with reference to the "Dietetics of Fruit." By this expression I mean the uses of various fruits as articles of diet in health as food, or as quasi-remedies to avert disease, or as corrective agents in disease itself.

If I depart somewhat from the restricted field, which might perhaps be implied by this title, it will, I hope, be pardoned, since a paper dealing with familiar subjects in a popular way must always fall short of its intended aim if too technical in character. I should also labor under the disadvantage of dealing with a subject necessarily limited by the fact that, judged by the standard of *nutritive* value alone, fruit has a field measurably limited At this day how useless a task would it be, to accumulate evidence of the general value of fruit to man ; it has established itself as among our staple articles of domestic use ; it has, by reason of the consequent demand, become an article of commerce, involving large outlays of money for cultivation, and costly facilities for placing it before the consumer. Indeed, its use and appreciation are almost universal, and this fact alone makes more interesting to the student of dietetics his investigations into the actual food value of fruit. Perhaps this value and the true use of fruit may be more readily apparent if we consider briefly the nature, use and services of food in general, since then we shall be able to estimate just what in fruit is of use to the body, and what reasons if any prevail, for such widely spread appreciation as it receives.

It is true that scientifically considered "we eat to live," but how, profiting by that process, the body is enabled to live by eating, is a matter which has been the subject of most elaborate experiment and profound research, involving the labors of some of the most distinguished scientists and economists of the world. In considering the question of food, we are dealing with substances which either induce or contribute to certain chemical changes within, or of the body, whereby its growth is promoted and preserved, and its waste renewed. There are, in such a discussion, certain factors which most prominently assert themselves, and which cannot be ignored, and that they have a special bearing upon the use of fruit as an article of diet, will be easily recognized. Not the least of these factors of special interest to those of slender income, is :

1. The relation of economy in *use* of food, to its cost; in other words, how may the inevitable expenditure for necessary subsistence be reduced to its lowest terms by a judicious selection of the diet?

2. The selection of food with reference to what we expect to accomplish in the body, which involves the adoption of food to work in producing and preserving muscular and nervous energy.

The solution of the second of these problems, the selection of foods, will in a measure furnish a key to the first. It is doubtless true and capable of proof that a useless amount and quality of food is consumed by the well-to-do and the needy as well; that an excess of meat and sweets is a potent source of disease; that ignorance of proper selection of desirable and agreeable food causes much loss, for which reason the extremely poor generally being those who practice the least economy, suffer most; and that food may be wasted and thrown away in the stomach, as well as into the waste barrel.

To the science of chemistry we are indebted for the knowledge which enables us to assert with reference to these questions. Thousands of trials and experiments have been made in the laboratories of Europe upon animals of many kinds, and human subjects of both sexes, all ages and weights. The aid of chemistry, physics and physiology, by the most delicate apparatus, has been worked, and the most gratifying result is the application of the knowledge thus gained, to promote the material interest of mankind. Chemistry analyzes the human body and finds it to consist of certain elements and compounds. It demonstrates how by vital processes they are held together, and how they serve their functions, and returning to the forms from which they originated, pass away and are replaced by new.

The lesson it teaches when applied to food is simple to understand. It takes our various food substances and by resolving them into their component parts, tells us how much of the material used in the body each food contains, how it may be utilized, and how in nature's laboratory it becomes changed or converted into the needed form.

Out of the more than a hundred different compounds in the human body, it will be sufficient for our purpose to outline those of principal importance, since after describing to you the chemical constituents of different fruits, I shall ask you to determine for yourselves the advantage of a judicious mingling of fruits with other food.

1. The first of the compounds is *water*, most valuable as forming a great part of all animal and vegetable tissues; it forms seven-

eighths the weight of milk, one-fourth that of potatoes and lean meat, one-third of bread, a little more than one-half of well fattened beef or mutton, and one-eighth of flour and meal; nearly 80 to 90 per cent of most ripe fruit. The whole body of an average man contains three-fifths water.

2. If our bodies be burned, about six per cent will be found remaining as unchanged mineral matter; for example: phosphate of lime from bone, phosphate of potassium and chloride of potassium from muscle; these mineral matters make from one-half to one to two per cent of our vegetable food, and 31 per cent of animal food.

3. Besides water and mineral salts, there are organic compounds which make the bulk of blood and muscle, called *protein* substances, a name I ask you to remember, as these compounds are the most important of all the ingredients of foods.

4. Are the fats making 16 per cent of average weight.

5. Are substances called *carbohydrates*, that is, materials including sugar, starch and dextrine, containing the same chemical elements as the fats, though in different proportions, and making only a fraction of one per cent of a human body. Therefore we may tabulate somewhat as follows:

In the body of a man of 148 pounds,

Water	90
Proteins	26.6
Fats.	23.0
Carbohydrates	0 1
Mineral matters	8 3
	148.0

When we consider the actual value of these compounds as nutriments, we shall find that the water has very little value, and the main points to be obtained are these facts derived by an extensive series of experiments made at the national museum in Washington, by Prof. Atwater:

1. Our bodies and foods consist of essentially the same materials.

2. The actual nutritive ingredients of our food may be divided into four classes, proteins, fats, carbohydrates and mineral matters.

3. The nutrients of animal foods consist mainly of *proteins* and fats. Those of the vegetable foods are largely carbohydrates.

4. The different nutrients have different offices to perform in the nutrition of the body. The demands of different people for food

vary with age, sex, occupation, and other conditions of life. Health and pecuniary economy alike require that the diet should contain nutrients proportioned to the wants of the user.

The phenomena attending the process by which a portion of food, the familiar slice of bread and butter, and a bit of meat, for example, is utilized in the animal economy, are varied and complex, but an examination of their minutiæ is not indispensable to our present discussion; it will suffice to carry in mind the fact, as exemplifying the use of a true food, that in the bread and butter and meat we have the carbohydrates in starch and sugar, proteins in meat, fats in butter, and mineral salts. The carbohydrates are the fuel which furnishes animal heat, any surplus being converted into fat. The proteins repair the tissues as they are used up by the normal waste, are changed into fats and carbohydrates, and any excess is consumed for bodily heat. The mineral salts form the blood salts and are also transformed into the mineral matters of bone and other tissues, are stored up in the body as fat, the excess being turned in as fuel. Nature is wise, and supplements the processes attendant upon the use of food, by providing the animal with nerves of taste, and a sense of hunger which we call appetite, and the nutrition of the body is thus secured. An old writer has aptly expressed this wise provision for the care of the body, when he says: "In appetite we have a guide in respect of the *times* of taking food and the *quantity* to be taken;" so taste is a guide in respect to the *kind* of food. The discrimination of food with reference to the wants of the system is the evident purpose of the sense of taste, and the enjoyment connected with this sense was designed to afford a security in addition to appetite for adequate alimentation. Were this the whole secret of the food question, there would be no difficulty in supplying the bodily needs regularly and simply; but it becomes often only a question of the gratification of taste, and we make the mistake of confounding the perverted cravings of that special sense with the food demand of the body. In this way, many substances and articles of diet agreeable to the taste, have accorded them a mistaken value as nutritives, when in fact they may consist almost wholly of substances which are inert and of little value.

Doubtless many of you have queried what all this has to do with the dietetics of fruit; a very proper question, and deserving of a reasonable answer. My reply is, that having shown you what food must contain to render it nutritious, I shall try to show you what fruit contains of a nutritive character. And my other reason was, to provide myself with a breastwork of defence, if perchance I appear to oppose any preconceived opinions any one may have upon the question of fruit as a food. The great value of fruit as an *article of diet* is quite another question, and one which I hope I may be able to approach, and leave, with the commendation of those whose experience as specialists in rearing and developing fruit, surely entitles their opinions to the most ready attention and acceptance. Repeated experiment has demonstrated the fact that no one article of food, or class of foods, will suffice to keep the body up to the best standard of nutrition, unless the demands of climate have some modifying influence, as in the case of the Esquimaux, who live almost entirely upon fat, which is essential to maintaining their bodily heat. Perhaps we cannot rightly estimate what an inconvenience the deprivation of all fruit would become, having always been accustomed to it. To the rich it would mean the loss of one luxury; to the poor, parting with an abundant and cheap variation of a necessarily economical, dietary, and a substitute for expensive green vegetables; and to the sick, the loss of a grateful, delicious and refreshing comfort. Botanically considered, we know fruit to be the ovary of the parent tree, containing in the seed concealed within, the germs intended by nature to reproduce its kind. It is probable that this perpetuation of kind was only the original design, the type of all fruit being usually of a simple character, destined only to produce the seed; size, flavor and other qualities which combine to render it agreeable to man, are the results of careful and intelligent effort to make the most of nature's proffered possibilities. A proof of this lies in the fact that the choicest varieties and forms of cultivated fruits, when left alone, invariably revert to the natural type. Fruit of all kinds consists chemically of water, sugar, free acids, albuminous substances and salts, arranged about proportionately in the apple, for example, as follows: Water, 88.0 per cent; sugar, 7.58; free acid, 1.04; albuminous substances, 2.94; salts, 0.44. If you will for a moment allow your attention to revert to the table or compounds in nutritious foods, essential to the repair of waste, to the making of new tissue, and the origin and preservation of animal heat and energy, you will see that the proteins, which include albumen, "the tissue builders," are in a very small proportion. There is no fat to help build normal tissue, or act as fuel to keep the body warm. There is plenty of water; most of the solid matter, is sugar, with salts in small amount. No one could keep warm and grow fat on a diet of apples, oranges or grapes, as he would on baked beans with plenty of pork; pears, berries and plums could not be taken in quantities large enough or often enough to make bone, fat and muscle, as would milk, meat and vegetables. Notwithstanding this, there is demonstrated the fact, and greatly to its credit, too, that fruit has a place and fills it, that the meats, the butter and milk cannot assume.

The value of fruit as an article of food of *supplementary* usefulness cannot be gainsaid; and if I have not already wearied you, it is of some of these uses that I wish to speak. Let us first understand what of the chemical constituents of fruit are utilized in the body. First, the water, as when taken as a beverage, or as a part of other food, is indispensable to give to the blood and secretions the fluidity necessary to the performance of their functions; it also serves as a solvent to facilitate the introduction and discharge of substances naturally solid. In all the tissues it serves to maintain their special consistency, such as flexibility or elasticity. The proteins, though very small in amount, contribute as well as they may toward making new tissue of all kinds; sugar helps create animal heat, and adds a little to the store of fat; the vegetable matter the indigestible portion of fruit, when immature, predominates, and is diminished in proportion to the ingredients; as ripening progresses, this is almost wholly thrown out as waste material. The acids, sugar and salts are the elements which give fruit whatever value as a nutrient it may possess; how, we shall presently see. To these components, combined with certain faint and little known aromatic ethers, are due that which we recognize as the characteristic flavor of various fruits. They are called malic acid, found in the apple, pear and quince; tartaric acid, characteristic of the grape, and existing to a certain extent in other allied fruits; and citric acid, peculiar to the lemon, lime and orange. Now it is a part of nature's system that nothing can be appropriated by the body for its uses, except in the way nature has ordained; so when malic, citric and tartaric acids find their way into the body, in the form in which they existed in the fruit, in combination with sodium or potassium, as the case may be, nature utilizes them as material to obtain the carbonates of soda and potassa, whose office it is to keep the blood alkaline, so that its vital functions may not be interrupted. Herein lies the great value of what are known as acescent or acid bearing fruits and vegetables. Fortunately, we are not obliged to bear this in mind, and continually think of its necessity when we eat our green vegetables in the summer, our apple pies, our Shaker apple sauce, our baked apples, our orange or our bunch of grapes. Nature has ordained that the body shall speak for itself, and so we spice our meats and fish with an abundance of wholesome vegetables and fruits, and the blood and other tissues are all the time extracting from them what they need to keep them in repair and running order; another illustration that "we eat to live," and our free agency in the selection of our food is perhaps not so great as we fondly imagine.

I fear unless we begin to specify, our paper will be in danger of ending without any reason for its adoption of its somewhat pretentious heading. The pear of European and Asiatic origin is a striking example of what painstaking cultivation can accomplish with a fruit originally utterly useless for food; for now it affords, in its different varieties, a fruit so rich and delicious that it would seem the limit had been reached. The pear carries a large proportionate amount of sugar, and to this it owes its great attractiveness. This large amount of sugar enables its expressed juice to afford a greater measure of alcohol than can be derived from the juice of the apple, and this, when fermented, is called "Perry," capable of being turned into better vinegar even than cider. This perry is used as a beverage in large pear-growing districts, and a curious fact is mentioned in this connection, that in some countries, when the fruit is so sour that hungry pigs will not *smell* of it, and the juice from the bitten portion is so acrid and harsh as to cause long continued heat and irritation in the mouth, after being expressed it becomes rich and sweet, with no more roughness in taste than some wines. A tree in Herefordshire, England, is said to have produced fifteen hogsheads of perry in one year; the branches bent down until they rooted, covering half an acre of ground. Pears help out the monotony of our various apple dishes, and may be made a valuable addition to the dietary in the form of preserves, marmalades, sauces, jellies, or boiled, baked or stewed. Well spiced, they may be preserved in vinegar as excellent pickles. The pear was, by old writers, supposed to afford an antidote against certain poisonous fungi.

The quince is a fruit which has long since yielded precedence to more esteemed and aristocratic cousins. The Greeks honored it by carving it among the decorative sculptures of their temples, and looked upon it as an emblem of happiness and love, certainly a more æsthetic position than was ascribed to it by the boy whose idea of its usefulness had been tinctured by his mother's cookery; for when asked by his teacher in botany some of the uses of the quince, replied, "To spoil apple pies." The dried fruit is now used by the house-keepers of southern Europe to perfume their stores of linen, much as our New England housewives use orange peel, lavender, rose leaves and clover; possibly the quince may be one of their agents for similar use; of that I cannot affirm. It is a most excellent fruit for preserves, jellies and sauces, either alone or with other fruits, to many of which a little of the quince flavor imparts an additional zest. From the liquid with sugar is made a good wine. Medicinally, the quince has certain virtues; a decoction of the fruit has been said to cure asthma. Its juice is thought to be a corrective of nausea; the ripe fruit eaten raw is said to be good for spitting of blood, swollen spleen, dropsy and difficulty of breathing, and such a claim for general therapeutic excellence impels me to say, that, as a rule, articles which are heralded as sovereign cures for many diseases in general, are usually not cures for anything in particular. Actual experience has, however, accorded to the quince certain well defined properties of therapeutic value. Its astringency renders a syrup prepared from the ripe fruit a serviceable remedy in certain diarrhœal affections. The seeds contain what medicinal virtue the fruit possesses. Their hard envelope abounds in a mucilage which may be extracted by boiling water, and may be used like other mucilaginous substances in catarrhal conditions of the mucus lining of the bronchial tubes, probably acting reflexly as a soothing application to the throat, thus allaying dryness and cough. For the same reasons this mucilage of quince seeds may be used as an application for sore lips or inflamed eyelids.

Most of us have become more or less familiar with the agreeable properties of the plum, through the medium of the various domestic processes by which this fruit is preserved and stewed. The general properties of the plum render it of considerable value when it is desirable to correct deranged intestinal functions by a regulated diet, rather than by a resort to drugs. When eaten cooked or raw, half ripe or green, the effect is astringent, but when fully ripe, rather laxative. The sloe-plum, which is cultivated to some extent in England, furnishes a juice which when fermented makes a wine not unlike new port, and is used to adulterate other astringent wines. The apricot, which is a variety of this fruit, is highly esteemed by the Chinese, and by them prepared for winter use in a manner which there seems to be no reason to doubt might be employed satisfactorily among us. After removing the stone, the fruit is dipped several times in its own juice, and is then slowly dried in the sun. They also take this fruit, stewing or boiling it until dissolved, add honey and vinegar to it, making what they regard as a pleasant drink.

The cherry is a fruit of universal distribution, and justly esteemed for many excellent qualities for table and medical use. In many parts of Germany, a preparation called "Kirschensuppe" is made by stewing cherries with water and sugar, slightly thickened with potato flour, forming a dish which the rural population uses extensively as food. A wine called Kirschenwasser is made by crushing the fruit and stones together, adding water to the pulp, and fermenting. Inasmuch as it requires to make one pint of this cherry water twenty pints of pulp, it is as expensive as brandy. Fresh cherries crushed and distilled, make a liquor of astringent quality, useful to allay the paroxysms of whooping-cough, or to relieve the irritation of ordinary colds attended by spasmodic cough. This property is doubtless due to the presence of hydrocyanic acid, which exists in minute proportions in the seeds of various fruits, like the peach, cherry, apple, almond and plum, whence is derived that slightly bitter taste. This acid, in a large amount, is a powerful poison, and is medicinally valuable from its property of acting in minute doses as a paralyzer of spasmodic action. It is not uncommon to hear of cases of poisoning, where children have gorged themselves with the meats extracted from cherry or peach stones; it is due to the presence of this acid. Everyone is familiar with the valuable medicinal properties of the combination made by soaking black cherries in rum, by which the astringent quality of the fruit is preserved and rendered useful. The acid varieties of the fruit make excellent tarts and pies, and the sweeter kinds may be subjected to all the various preserving processes with which our New England house-keepers are familiar.

The peach is a fruit the use of which is so well known that I cannot hope to add anything to your present knowledge, except to say that as an article of diet it is strongly diuretic, and at the same time somewhat laxative.

It is probable that no fruits are so indispensable to the inhabitant of the countries where they flourish as the so-called bread fruits of the Pacific Islands, the date and fig. They are literally meat and drink, forming the staple food of the countries in which they flourish. It is said that no Persian cook is considered competent unless she can serve a different dish of dates each day in the month. It is the sugar of this fruit which renders it so valuable, and sugar having a real food utility it is easy to see that the demand for the date is based upon sound physiological grounds. Of course much depends upon becoming accustomed to any dietary regimen, and the eastern nations subsist upon a food of which we should soon tire. It would seem as though no fruit grows upon which the ingenuity of man, civilized and savage, has not been expended to produce a drink, and the date is no exception, for date paste made into an infusion with water, is said to make a pleasant drink, and the sap of the tree drawn from incisions in the trunk, is the so called date milk, which when fermented makes a most potent wine. The production of date sugar forms no inconsiderable industry in British India, seven to eight pounds of sugar from 120 to 240 pints of the juice, being an average result, the total annual yield is something like 10,000 cwt., selling for one-fourth less than sugar from the cane. The dried date of our markets is pleasantly laxative, and forms an agreeable addition to the dessert. The fig is a fruit which comes to us in a dried or semi-dried condition, and is as cheaply within the reach of all as our most common domestic fruits. Its valuable laxative properties have always been recognized and utilized, and it is employed as an ingredient of many mixtures administered for the relief of habitual constipation, as the confection of figs and senna. Its large proportion of sugar and mucilage renders it an agreeable and wholesome food, held in the highest estimation in the countries where it is indigenous. This appreciation of the fruit has not been developed in modern times either, for we are informed that the children of Israel murmured against Moses for leading them where the fig tree did not blossom. The Grecian athletes made the fig their staple article of diet during their training. At Rome the dried fruit was extensively used in place of bread. It is related of the fair Queen of the Nile, Cleopatra, that she cherished for the fig a particular favor, possibly by reason of its popular reputation for retarding the formation of wrinkles. Pliny, the Roman historian, ascribes to the juice of the fig tree the property of imparting a fine flavor to meat. This claim may have had some foundation in fact, since it is true that meat hung in the shade of fig trees will become tender without decay. As a medicinal agent it has certain uses, to the most valuable of which allusion has already been made. As we obtain the fruit in its dried and pressed state, too free indulgence is apt to be followed by saccharine fermentation in the stomach, causing flatulence, pain and diarrhœa; moderately used, it is a valuable substitute for cathartic remedies. Figs are occasionally made into a poultice for application to external inflammations, we find them to have formed the chief ingredient in that poultice which the prophet Isaiah prescribed for the afflicted Hezekiah when smitten with boils. A pasty mixture of milk and figs is commonly recommended by empirics as a cure for cancer. It is, perhaps, needless to say, of no avail, and can only act as a source of dangerous delay when timely surgical interference may ward off and assuage the sufferings of a deadly disease.

The orange, lemon and limes, the latter a variety of the lemon, are fruits whose virtues, as agreeable, delicious and refreshing additions to our tables, need no additional encomiums; but no fruits are of more real value than the two last, and solely by reason of the great amount of citric acid afforded by their juice. Allusion has already been made to the manner in which this acid supplies the blood and other tissues certain essential elements, and as the juice itself cannot be successfully preserved for any considerable length of time, it is utilized by extracting the acid in crystalline form. The rind of the lemon contains an essential oil, and is used as a flavoring to certain medicines. The juice of the fruit, for reasons first stated, is cooling, and forms a refreshing draught in fevers. It may be given in the form of lemonade, or with soothing drinks, like the decoctions of barley and flaxseed. The latter combination is of undoubted utility in certain dry, harrassing coughs, attended with the formation of tenacious secretions. The virtues of hot lemonade are familiar in all households for its effect in warding off our customary winter colds, by reason of its power to stimulate the secretion of the kidneys and skin. One of the most beneficial effects of this fruit is in its power to prevent and arrest the disease known as scurvy, to which crews of vessels, or other companies of men, long deprived of fresh vegetable food are peculiarly liable. This disease is one of disordered nutrition depending upon the impoverishment of the blood which is deprived of those acids necessary to supply it with its essential salts. This condition is called technically a scorbutic condition, and vegetables or medicines which tend to counteract such conditions are called anti-scorbutics. Before the days of canned fruits and vegetables the ravages of this disease were frequently dreadful. In the English navy no ship is fitted out without an abundant supply of lime juice, which is regularly issued as a ration, and has gained for them, from the seaman of the merchant service, the appellation of "Limers." The lime juice of commerce is prepared by dissolving the crystals of citric acid in water, in the proportion of 9½ drachms to the pint, with the addition of a little oil of lemon. It is extremely difficult to preserve the expressed juice without decomposition, and it cannot be made to retain for any lengthy period its original flavor, in spite of sealing at a high temperature, or the addition of alcohol, hence the use of the crystals of the acid is the most satisfactory.

The grape and the apple I have reserved for the last consideration, because they are the source of wine, cider and vinegar, articles of great commercial importance, and most interesting in their processes of manufacture and their use, as well as abuse. Apart from the very limited food value of the grape as a raw fruit, or in the dried state, our chief interest centers upon it as the source of wine. Cider, as such, being valuable for the alcohol it contains, the remarks upon the use and effect of wine may be considered applicable to it as well. One of the first trees to flourish after the deluge, the grape, has proven to man no less a blessing than a curse. Among all nations acquainted with the vine, the product of its fermented juice has been deified in song and story, and debased by vile imitations. The grape, consisting largely of juice and containing but little fleshy matter, is one of the least nutritious of fruits. It is strongly laxative, and its injudicious use quickly gives rise to dysenteric affection. Systematic consumption of the fruit fresh from the vine has been said to be of service in arresting pulmonary complaints, but in the light of present knowledge this must take its way to the hereafter of thousands of exploded cures. Grape leaves, containing tannin, are sometimes dried and powdered and administered as an astringent medicine. Sugar and tartaric acid fix the value of the grape. From one we obtain an important article of cookery, from the other, alcohol.

The importance of the wine industries of Europe and America need no reiteration. Nor do I feel called upon to do more than present a statement of facts relative to the much mooted question of the advantage or harm of alcohol to the animal economy. I do wish to speak briefly about some interesting facts connected with its manufacture, since our knowledge upon the process of fermentation has within the past few years undergone a great transformation. First, a few remarks in general. Wine grapes are not regarded as best for table use, not possessing the requisite fineness, sweetness or flavor. As to the value of a particular grape crop for wine, much depends upon climate. A summer whose mean temperature is below 67° will not produce a valuable wine. A season unusually stormy or devoid of sunlight affects decidedly the flavor by decreasing the production of the sugary elements. The effect of temperature upon the quantity and quality of the wine product is also marked The cold, inclement seasons of 1833 and 1837 in France produced wines scarcely drinkable.

In preparing the juice for the fermentation process, the fruit is subjected to the ordinary crushing and expressing methods. The residue left after the pressing is used to make a thin second wine, but in some districts ot Southern France, previous to being thus used, it is utilized to administer vapor baths by the halt, lame and variously diseased peasantry of the surrounding villages. The pulp, carried to cellars, is laid up in heaps till it becomes hot through fermentation, a hole is then made into the mass, and the patient either gets in all over, or inserts the offending limb, if the application be only local. It is necessary to undergo this steam soaking process in a place well provided with ventilation, otherwise the alcoholic and carbonic vapor would cause headache, intoxication, and even syncope and suffocation. It is supposed that this operation acts like an ordinary steam bath, except that the alcoholic vapor is more penetrating. It is easy to see some grounds for the claims of success which are made for it in the treatment of old rheumatism, sciatica, and indolent tumors. The vintage is impatiently awaited by those who have chronic maladies, and they go up, a long procession of debilitated, abbreviated, and otherwise impaired humanity, as pilgrims toward some ancient shrine. I do not know if apple pulp has ever attained such a curative reputation. For comfort and peace of mind and stomach, let us hope that in New England more modern methods may for a time longer continue to prevail.

The sap of the vine after fermenting is said to possess the power to remove natural spots and stains from the skin, to cure chilblains, and to rapidly remove the effects of intoxication. This latter claim strikes one as founded upon the principle which cures the bite of a dog by application of its own hair. The process of fermentation, by which a solution of sugar and acid is converted into alcohol, or, if carried still farther, from the alcohol into vinegar, has been the subject of most acrimonious debate among the foremost chemists of the world. Up to 1872 the chemical theory upheld by Liebig, the German chemist, was accepted as definite and satisfactory. This held that the expressed grape juice, having been set aside in large vats, the vegetable albumen of the juice absorbing oxygen from the air, decomposed, and in that state became a ferment to the sugar, breaking it up chemically into alcohol and carbonic acid. This has heen shown to be true so far as decomposition of the sugar is concerned, but the cause of the process has been demonstrated to be something entirely different.

It was found by Pasteur, the eminent French scientist, that the decomposing process whereby sugar is destroyed and alcohol results, is due to the presence of a microscopic vegetable organism, and thus has arisen the physiological theory. This fungus is always present upon the outside of fruit, and after the pulp is crushed and the juice expressed, is of course mingled with it, then the fungus must have oxygen, and finding this in the sugar it seizes upon it, chemically breaking up the sugar and changing it to alcohol and carbonic acid gas, the latter rising to the surface in bubbles, a process we have all observed in the so-called working of cider. Every liquid capable of fermenting has its own peculiar species of fungus, named accordingly.

Wines and cider of course owe their useful properties to the alcohol which they contain, the percentage varying according to the amount of sugar present in the juice. Wines which have in fermenting used up nearly all the sugar contain the most, from 19 to 25 per cent and from the lack of sugar are called dry wines; they are strong, and like port and sherry neither sweet nor sour. If on the other hand the ferment be scanty and only a small proportion of the sugar be transformed, the result is a sweet or light wine. If the wine be bottled before fermentation is complete, the gas will not all escape, but will impregnate the wine, making it effervescent and sparkling like champagne. So called rough wines owe their harsh taste to tannic acid derived from the skins and vegetable part of the pulp. The acidity of wine is due to carbonic acid or tartar.

The question of whether alcohol is a food or not, is one which will always be discussed and never settled until the parties to the different beliefs can agree to mutual concessions. I shall content myself with a simple statement of fact with reference to its effects administered in health and disease. Alcohol is, we all know, universally consumed, but in health it is useless, of no good result, and likely to be absolutely harmful Habitual use of sherry, port and Madeira tends to produce gout and congestive diseases. All wines used in excess weaken the functional activity of the stomach, and induce congestion of all the viscera. As an article of medicine it ranks among the first. In the convalescence from continued fevers it is of great value. In low febrile affections, if it increase the fullness and lessen the frequency of the pulse, soothes delirium and induces sleep, its use may be continued with advantage; if the opposite effect, then it should be omitted. The sparkling wines are most sedative to the stomach and most heady; but as they contain considerable sugar, acid fermentation and headache are likely to follow their use. The sweet wines have usually considerable alcoholic strength, but the appetite soon tires of them and they disorder the stomach. The red wines, having a good deal of tannin, are apt to cause constipation and increase tissue waste.

To the grape we are indebted for pure cream of tartar. Tartaric acid of commerce is wholly prepared from a substance called argol, or tartar, which is an impure tartrate of potassium, deposited from grape juice during fermentation. This substance is purified by hot water with the aid of pipe clay and animal charcoal, to remove the coloring matter of the wine. The deposit resulting from this process is cream of tartar, and from this is prepared, by various chemical processes, the crystalline tartaric acid, which forms with different salts such valuable medicinal substances as tartrate of sodium, Rochelle salts and tartar emetic.

When we come to consider the apple we must confess our inability to do justice to its many excellent qualities. The ancient fable relates that when the Goddess of Wisdom competed with the other divinities to produce the most perfect work, the result of her handiwork was a fruit tree. Familiar as we are and appreciative as we all ought to be, of the produce of our apple orchards, we must admit the excellence of her judgment. Those of us who are proud of our New England origin, and who have not yet deserted her for the more liberal promises of western skies, will never easily admit the existence of any superior or more useful fruit. Other fruits may be more luscious, more delicate in flavor, more beautiful to the eye; but the apple surpasses them all. If beautiful, they are transient, while the hardy apple constantly ministers to the demands of our tables and asserts a decided superiority in its comparatively easy production, its variety of flavor, its endurance both fresh, dried and preserved, and in its multiplicity of uses as food. Besides affording a welcome addition to the dessert, apples combine nutriment enough with water and agreeable acids to render their use in the ripe state highly beneficial; their general effect is mildly laxative. Apple water, made by slicing up two good-sized apples in a quart of water, allowing it to simmer and then boil down to a pint, makes a most refreshing and cooling drink for patients suffering from febrile affections. Whether stewed, fried, baked whole or in pies, or made into jelly, they form a most valuable diet, for by keeping the blood supplied with those acids which are necessary to maintain its vitality, they take the place of green vegetables at a time when such are difficult to procure, besides being, when thoroughly cooked, more easy of digestion. Many a person who has arisen from long, exhausting fevers, when the diet has been reduced to a minimum, or has continued with a wearying sameness for weeks, will always wish that all foods could always taste as rich and satis ying as that dish of baked sweet apples and cream, which was the first solid food allowed. I know of nothing which by judicious preparation may be made to go so far in the dietary of the sick or well, with so little expense, as the apple. Very sweet apples are not so useful as those containing a moderate amount of acids, and the fruit, when eaten raw, should be used in moderation; half ripe or green it contains so much vegetable fibre in place of water and sugar, that even cooked it is inferior. The universal demand for apples is a good proof of their excellence as an article of food, even if their percentage of actual nutriment is low.

The medicinal value of cider depends upon how much alcohol it contains, and if care be taken to prevent the acetic acid formation of vinegar, so that the sugar be entirely converted in fermentation, it may be made to contain as much as nine per cent, a very large amount, and the cider thereby becomes a dangerous foe to sobriety, if freely indulged in. The true value of cider is, of course, in being a liquid easily obtained, from which a most excellent vinegar can be prepared. The so-called acetic fermentation by which cider vinegar is produced, differs somewhat from vinous fermentation in this: In the formation of alcohol, the wine ferment takes its oxygen from the sugar; in acetic fermentation the vinegar ferment takes its oxygen from the air. This microscopic organism is known as the mycodema aceti, and in the new commercial method for manufacturing vinegar on a large scale, assumes great importance. The process by which cider is converted into acetic acid is substantially this: The sugar of the apple juice is first changed to alcohol by the vinous ferment and carbonic acid set free; then if exposed to air, the vinegar ferment goes to work and converts the alcohol into acetic acid. Vinegar is a valuable addition to the dietary, from its manifold uses as a preservative and condiment with which we are all familiar. Medicinally it is much used in the form of dilute acetic acid; it is a useful and stimulating application to sprains and bruises, and an efficient application in the form of a gargle for inflamed throats. No better remedy can be found in an emergency for the common accident of getting unslacked lime or plastering into the eyes. A little water acidulated with vinegar from the table, has saved a good many eyes by speedily combining with the lime to form a harmless compound.

I fear I have already wearied your patience, without affording you any information of which you were not before possessed, and with a brief recapitulation I shall have done. Fruit may properly claim to be of value as food because it contains substances of direct benefit to the bodily tissues; because it has established its right to a place among vegetables which are known as anti-scorbutics, and because apart from its own direct action, it serves as a grateful and refreshing accompaniment to other foods, enabling us to keep the appetite stimulated by a healthful variation of the diet. Fruits are a part of the food of man, and when rightly used, are most wholesome. Good ripe fruit (over ripe is almost as bad as half ripe or green) in reasonable quantities, is an excellent addition to the diet of growing children. It is certain that if children be deprived of it, they will obtain it when, where, and of what quantity they can. In case of its unwholesomeness, the sooner it is cast out the better. Good fruit should form a part of every meal, or better, the lunch. The best time is in the morning, accompanied by a little bread and a glass of water; the most unseasonable time is after a hearty dinner, or late at night. Grapes, figs, peaches, cherries and oranges are the most digestible; plums, apples and pears less so, and melons least of all. Sugars, acids and alkaline salts are furnished by them in varying proportions. The juicy fruits, like cherries, strawberries and apples, are of the greatest value to those people who are prone to acid secretions, and if the subjects of gout and rheumatism would increase their fruit diet, it would save them money expended for medicine.

Fruit preserving was once a household matter, now it is an extensive and profitable business. The attractive dried apples and other fruit exposed for sale in our large city groceries, are no doubt tempting to purchasers who can ill afford the more expensive canned goods. Fruits prepared in this way are especially valuable at seasons of the year when the fresh article can only with difficulty be procured. It is to be regretted that for purely speculative reasons, much of this fruit has been subjected to chemical treatment to make a "nice white fruit," the price rising in proportion to the degree of whiteness. "The use of the bleached fruit is not without risk," says the bulletin of the Iowa State Board of Health. The bleaching is done by exposing the green fruit to the fumes of burning sulphur in the evaporator, or often before the time of exposure, varying with the degree of whiteness desired.

Germany forbids the importation of American evaporated dried apples, unless accompanied by a chemist's certificate that they are free from injurious substances, usually zinc, derived from galvanized iron trays used to hold the fruit in the evaporator. The burning sulphur forms sulphurous acid, which in contact with the air and water, becomes sulphuric acid, or oil of vitriol, which readily acts upon all metals, even in very weak form. Bleaching always injures the fruit flavor. The quality, and even variety, of well known fruits, if unbleached, can often be told by the looks and taste, when cooked, but when bleached, those made from good and poor fruit all taste alike. The sale of dried fruits has materially suffered from the over-doing of the evaporator business in 1888. Stewed fruits are valuable, but are often objected to as causing acid fermentation and flatulence. This is because of the addition of cane sugar. It would be better, in the preparation of such fruits, to neutralize the acidity by the addition of an alkali like carbonate of soda, thus leaving its natural sweetness. Such stewed fruit ought to be a regular addition to the diet of those well advanced in years. Fruit has its uses in disease, but it is well always to remember that when one is sick, the digestive organs are more or less affected, and whatever is given as food must be carefully selected. Suppose we have a patient with one of the diseases characterized by a sharp burning fever; the throat is dry, thirst is urgent. Now we can afford relief by frequent draughts of apple water, tamarind water, drinks made from the currant, raspberry, the lemon or lime. All soits of preserved sub-acid fruits, grapes, or other easily masticated fruit, may be included in the diet.

Fruit both raw and cooked, lends valuable assistance in regulating functional disorders of the intestinal tract characterized by deficient secretion, a few figs daily, stewed prunes or apples with the other food will obviate the frequent recourse to pills or other drastics, the demand for which often grows with their use. Sometimes fruit will relieve an undue looseness of the bowels. A quantity of apples consumed peel and all has often checked a billious diarrhœa. All vegetables and fruits which contain tannic acid or other astringents are useful in these affections. The juice of cranberries or the pomegranate and various other plums as well as the juice of cherries and the astringent wines are all valuable to aid in checking over action of the bowels. There is one disease in which almost everything that can be done must be accomplished by management of the diet, from which fruit fresh and preserved must be rigidly excluded, that is diabetes, characterized by an excess of sugar in the blood, hence everything which will contribute to the formation of sugar in the body must be avoided. The gouty and rheumatic, as has already been intimated, need acid fruits in large amcunt both raw and cooked.

Knowing what fruits contain, knowing what in their composition is appreciated by the body, the question assumes relatively the same position as that of preparing animal food for consumption Nature is always ready to meet us half way and if we want fruit abounding in healthful propeities, loaded with a maximum of useful sugars and acids and a minimum of hard, indigestible, useless vegetable fibre, let us feed the trees with those substances which are necessary for their nutrition and which will be returned to us in the form of the fruit. We shall then feel the satisfaction of having contributed to human food one of its most valuable, healthful and economical elements, and can heartily agree with that old writer who characterized fruit as "the most perfect union of the useful and beautiful that the earth has known."

THE DOMESTIC VALUE OF THE APPLE.

By Mrs. FLORENCE J. RICKER, Turner.

Long, long ago God placed two happy sinless beings in the Garden of Eden. Everything about them showed the handiwork of a Divine Being, from the tiniest flower to the abundance of delicious fruit. All this loveliness was to be theirs to enjoy with the exception of one tree, the fairest so it seemed to them of all, of which they were forbidden to partake. But the tempter came and said to the woman, "The fruit of this tree is fair to look upon and its aroma is as the nectar of the gods, so if you but eat of it you may, like them, know good and evil." Then the woman did eat and saw that it was good, and did offer to her husband and he did eat, and for this one disobedient act, they lost their beautiful home in the Garden of Eden and were banished to a life of toil, sorrow and suffering.

You ask, why do you tell that old story of the fall of man? Has it any connection to the present subject, "The Domestic Value of the Apple?"

This was the first family formed on earth, and here we find as believed by most persons, the apple to figure largely in their domestic happiness. It was not that the apple was inferior to other fruits that it is supposed to have been chosen as a test of their faithfulness to their Creator, but rather that it was the King of Fruits, so that the temptation being greater it would be a more perfect test whether they preferred to obey God or satisfy their own selfish desires.

We find accounts that apples were cultivated by the Romans and that they had a number of varieties; it is also believed that they introduced the apple into England. Pliny mentions twenty varieties. Early chronicles are silent as regards the propagation of the apple until after the establishment of Christianty when the monks and religious leaders planted orchards. In the time of Solomon we find Christ referred to by him, "As the apple tree among the trees of the wood, so is my beloved among the sons, I sat down under his shadow with great delight, and his fruit was sweet to my taste," showing how highly the apple was prized at that time.

The early settlers of America brought over the apple tree with them from England and planted many orchards, and from them the Indians started orchards throughout the country. One of these old

Indian orchards was in being not long since in the vicinity of Boston. All this time new varieties were being found and the apple was improving with culture. We therefore see that from the creation the apple has held a prominent place among fruits, through successive ages up to the present time when it is considered the most valuable fruit of all, and the one from which we would be the last to part.

Many will perhaps say, we beg leave to differ with you concerning that last statement. Are there not fruits more delicious than the common apple? Perhaps, yes, but do those same fruits last the year round always obtainable and within the bounds of the purse of nearly every one? Let us look at the comparative value of the apple and some of our other fruits in the market. Seldom do we ever have to pay more than one cent apiece and oftener less for the apple while oranges are from three to five cents apiece, bananas, ditto, and so on through all imported fruits, for we must pay the cost of transportation, therefore for the same money we can at least obtain twice the quantity of apples, that we can of other fruits. But you say, "we make up in quality what we lack in quantity in other fruits." This time I beg leave to differ with you. What is more delicious than the Sweet Bough, Porter, Gravenstein, Hubbardston Nonsuch, Fameuse, King Sweet, Russell, Munson Sweet, Deane, Nodhead and many others too numerous to mention? for we have such a variety in the apple itself that at any season, some kind may be found that would tempt the appetite of the most insatiable epicure. We all know that there is nothing better to promote good digestion, than a good apple eaten directly after a meal, and a baked sour apple is a luxury in which the invalid may indulge.

Another plea for other fruits for dessert is, the artistic taste that may be displayed by the arranging of many kinds of fruit together. Now, cannot there be as much beauty in the arranging of different varieties of apples if the same care be taken to put kinds together whose colors would harmonize as in the former case? I think too little pains is taken to select good perfect apples and kinds that are seasonable for the table at our hotels and restaurants, while on the other hand the imported fruits are displayed at the best possible advantage, thus giving the general public the idea of inferiority to the apple.

Having spoken of the apple as it comes to us fresh from the hand of nature, we will now turn to the culinary department. Here we find a wide field to exercise the taste of display, as well as to tempt the appetite. What can be a more dainty and palatable dessert than the following, taken from the *Orchard and Garden?*

Pare, core and cook a dozen apples in a syrup made of a cupful of sugar and two of water. When they are tender lift them out and cover with a thin layer of beaten whites of eggs. Sift granulated sugar on this and let it brown slightly with the oven door open. Let the syrup boil away till it will be a firm jelly when cold. Cut it in squares and lay it on and about the apple. Serve with sugar and cream.

Another, equally as dainty, is "apple snow," served in the same manner. Then the sweet apple custards, sweet apple honey, bird's nest pudding, steamed pudding with apples in it, baked sweet and sour apples, steamed apples, baked Indian sweet apple pudding, Indian cake with sweet apples in it, the pickles, the jellies and the preserves. Oh, time would fail me to tell of the multitude of delicacies for the table that can be made by combining other ingredients with our common (or, shall I say, uncommon) apple. And then the dried apples, from which many turn away as of no value, are so nice in "steam puddings," "Marlborough pies," "farmers' fruit cake" and many other nice dishes for the table.

As this Society is composed almost entirely of male members, I will not weary them with an account of the manner that many of these nice dishes are prepared, but for the benefit of the ladies many recipes which I have gathered from various sources are printed in subsequent pages of the Transactions of the Society, so that there they can have the opportunity to read them, test them and place them before their "lords and masters" in an eatable form, who will then be able to pass judgment in a capacity best suited to their taste.

But we must bear in mind that not every variety of apple will make as nice a dish as one just suited for what we wish to use it. For instance, if we wish the apple to be soft when done, as in apple pie, we must choose a tart, juicy apple, and one that is just in its prime, not one that will be good two months hence; but if, on the other hand, we wish the form to be preserved, we better take a harder and not so acid an apple. A little care exercised in selecting fruit for cooking will often make a nice dish of what would otherwise be an unpalatable mystery.

Having endeavored to point out some of the numberless ways in which the apple is of use to us as house-keepers, perhaps it may lead the orchardist to look well to his trees, that we may have the best fruit to use to make these tempting dishes, and in selling to remember if he leaves all the inferior fruit for home use, he need not flatter himself he will see these nice dishes on his own table, for it is true as regards fruit as it is in other things, inferior material will not make a first-class article. So, now, Mr. Pomologist, lend us your aid and approval and we will do all we can to tempt the appetite and gratify the eye by nice dishes prepared from the apple.

RECEIPTS FOR COOKING APPLES.

Compiled by Mrs. RICKER.

SWEET APPLE CUSTARD PIES. Stew and sift and use like pumpkin or squash in making a filling. Still nicer if frosted like lemon pies.

SWEET APPLE HONEY may be made from the juice of stewed sweet apples and sugar Boil until it is thick like honey.

APPLE SNOW Pare and core tart, juicy apples; stew with just enough water to keep from burning; sweeten with white sugar; flavor with lemon, the juice is better than the extract; sift through a potato masher or beat it until light; eat with whipped cream.

NO. 2. To the above when cold, add, for a dish large enough for eight to ten persons, the whites of two eggs; beat the mixture until it is stiff enough to stand alone and "white as snow," and serve with whipped cream. Fameuse apples or any white-pulped ones are good.

APPLE SNOW is nice to put between small squares of cake and for filling tart shells. Use any flavoring preferred.

BAKED APPLES. Take tart, even-sized apples, scoop a round piece out of each end, fill the upper end with sugar; bake with a little water. Serve with whipped cream and sugar.

APPLES BOILED with either sugar or molasses make a change in the routine of apple sauce, as also the following:

Select medium sized apples, wash them and pack into a stone pot as closely as possible, turn over them one cup of sugar and one-half cup of water to every three quarts of apples; let them cook about two hours in a moderate oven, and remain in the pot until cold.

Another way is to boil or steam apples until they are soft and then turn over them a syrup made of brown sugar.

Apple Fritters. Make the batter as for plain fritters. Pare and core nice tart apples; cut them in thin slices, dip them in the batter and fry brown.

Bird's Nest Pudding. Pare and core six large apples. Make a syrup of one quart of water and one cup of sugar, simmer the apples in this until they are tender, but not so tender but that they will keep their shape; lay them in a pudding dish, and cover with a custard made with one quart of milk, five eggs, and three spoonfuls of sugar. Bake until the custard is firm. May be eaten either cold or hot and without sauce.

Apple Float. Fill a deep glass dish half full of soft custard and then heap up with apple snow. (Make the custard with the yolks of the eggs).

Apple Dowdy. Pare and quarter about one dozen good tart apples, put them in a kettle with one cup of molasses, a small piece of butter, and one pint of hot water. Set this on the fire, and let it come to a boil, and while it is heating make a paste with one pint of flour, one teaspoonful of cream tartar, one-half of saleratus, and a little milk; roll this large enough to fit into the kettle, and when the mixture begins to boil, put in the paste, cover tight, and boil gently twenty minutes. To be eaten without sauce.

Apples are Very Nice in sago and tapioca puddings also in steamed batter puddings.

Farmer's Fruit Cake. Two cups dried apple, two cups of molasses, two eggs, one cup of butter, one teaspoonful each of cloves, cassia and nutmeg, three and a half cups of flour, one teaspoonful of soda. Soak the apples over night in cold water, then chop, put them in molasses and simmer slowly two hours, then mix the ingredients.

Apples. Two pounds of apples pared and cored, sliced into a pan; add one pound sugar, the juice of three lemons, and grated rind of one. Let boil about two hours, turn into a mold. When cold serve with thick cream.

Cider Apple Sauce. Boil cider away about one-third, then take three parts cider to two of dried, sweet apple. Put into a kettle and cook slowly two or three hours until the apple is soft.

APPLE GINGER. Allow four pounds of light brown sugar to four pounds of apples, weighed after paring and coring. Chop the apple fine with the juice and rind of three lemons. Add to the apple one ounce of white ginger root which can be bought at the druggists, and cook all together slowly three or four hours or until it looks clear. This will keep for years in a cool place, and is considered a very nice addition to the usual stock of preserves.

SWEET PICKLE. Pare and quarter sweet apples and boil them in clear water till they can be pierced with a fork but not until tender enough to break Now make a syrup of one quart of vinegar and one pound of sugar, boil it and then put in the apples, which may have a whole clove stuck into each quarter; cook a few minutes, put in jars and seal closely. The syrup may be spiced if liked.

MARKET GARDENING.

By W. W. RAWSON of Arlington, Mass.

[Abstract of paper delivered before the State Fair Meeting.]

Market gardening should be distinguished from farming. While the market gardener is a tiller of the soil, his occupation differs essentially from that of the farmer.

By market gardening is meant the raising of such vegetables as celery, lettuce, cucumbers and the like, with a few of the more stable and hardy characters, such as squashes and beets.

The business of market gardening has within the last twenty years become one of considerable importance, and when understood is quite profitable. In this business, as in every other, the success depends more upon the man conducting it than upon anything else.

He must understand the nature of growing plants; the different qualities of soil required for each; the mode of cultivation and the time of planting best adapted to the climate where located. He must have some knowledge of chemistry and botany, must be a practical engineer and mechanic, and also be familiar with the laws of nature. After these requirements, the more common sense he has, the better for him.

The location of the garden is quite important. It should be as near the market as possible. If the roads to and from the market are level, the land will be much more valuable, because one of the largest items of expense in connection with the business is the teaming of the product, and the manure necessary to secure a crop.

The land should be of various qualities, and a gentle slope to the south and west is much preferable, because on it the crop will mature earlier, and it is easier to irrigate it. Nearness to a river or pond would be advantageous, because from it a supply of water could be obtained. If not near a river or pond, then a well could be driven which would answer the purpose. The possession of these would add value to the place. Ten acres well irrigated are worth more than twenty acres without irrigation.

The use of glass has also become very important in connection with growing crops of this kind, and many of the largest crops are grown almost entirely under glass. Hot-houses and hot-beds are used. The heat in the former must be furnished in cold weather by steam or hot water, in the latter by hot manure.

The man who undertakes this business must serve an apprenticeship of several years, in order to become familiar enough with it to enable him to carry on a market garden, either for himself or for any one else, successfully.

I have had many come to me and say that they would like to work for me a year, that they might become familiar with the business, or, in other words, learn the trade.

I have told them that that would not be long enough time, and that five or six years would be little enough.

There is no class of men at the present time for which there is so much demand as for market gardeners, and at better wages than they could command in any mechanical or professional pursuit, with the same time spent in fitting themselves for their calling. It is a very healthy business. There is a great variety in it, and something is constantly coming up that is new, and which will demand study and earnest attention.

I have followed it for twenty-five years, and have been unusually successful; yet I feel that I have many things to learn, and that the business is at present but in its infancy.

It is but a few years since hot-beds were introduced, and but ten years since hot-houses were first used. They were first heated by hot water, and later steam was used. Then it was learned that irrigation would be a great benefit; and now the electric light is coming into use. I believe that it has not only come, but that it has come to stay, because of the very great benefit it will be in the growing of our kind of crops during the short days of winter. It will be a very profitable investment to all who will use it. I have one large light of 2,000 candle-power over one of my houses, and ten 30 candle-power inside another house. The effect has been very manifest, and the result of the experiment very satisfactory to me. I could see the effect upon the growing crop very soon after the lights had been placed in the houses.

I think I prefer to have them all inside the houses, and placed about twenty-five feet apart in a house twenty-four feet wide; the house would then be almost as light as day. The great objection to a light outside is that in frosty weather the light could not shine through the frosted glass, and it would therefore be of but little benefit, but when placed inside it has all the chance possible.

I cannot tell at present just how much benefit the light is, but by another year I shall have had it thoroughly tested.

The market gardener has many difficult problems to solve and but very few things in his favor. The weather is quite an important factor; but this is uncontrollable and we cannot find a substitute or a remedy. First-class help is hard to find; good land is difficult to obtain, all of it being occupied; the South is competing very closely with us; it is a constant struggle from beginning to end, and from morning to night. Unless the market gardener is in love with his business, it will be very discouraging.

In market gardening, as in every other branch of business, if one would carry it on successfully he must have special men for special work, and this can only be done by one who does sufficient business to enable him to employ a head for each department. In a mercantile establishment each member of the concern has a special part of the work to perform, and devotes himself to it exclusively. Each department has a head, who is held responsible for its success.

In mechanical establishments the same plan is adopted and the same responsibility is placed. In the professions we find that individuals are applying themselves to specialties. It must be so if success is to be achieved. In carrying on a market garden, I say employ a superintendent, a salesman, a green-houseman, a foreman for each department; a night-man to attend the fires in winter, and to keep an eye on the whole place; a machinist to look after the machinery and tools; a painter to keep wood-work from going to decay and to keep the glass in repair; a hostler to take special care of the horses; a harness-maker to look after the harnesses and to keep them in repair and to keep the horses from having sore shoulders in summer, etc.; a man to put up or to see to the putting up of all the vegetables that are going to market, so that they may always be put up uniformly and in a salable condition, so that your first and second qualities may run always the same, and the trade may know what to depend upon. Always select for a driver of the teams one who is adapted to it, so that the most may be obtained from the horses with the least wear upon them.

The selling of goods is not so difficult as in former years. Large quantities are now sold where but a little was sold a few years ago. The market gardener near a large city can dispose of large quantities of vegetables of many kinds if the quality is first-class.

Sometimes the prices realized are quite small, but where they are raised in large quantities the cost is much less than it was twenty years ago.

The sales are all for cash, and in this respect it is one of the best kinds of business carried on. If the market gardener has a load for market every day, there is money constantly coming in, and he has ready money to pay his bills after he once gets started.

The cultivation of the soil is a very important matter to be understood. It requires much experience to know when to plant and how to plant. The selection of seed is also a very important matter. Success in this direction can only be obtained by carefully looking ahead, and by making the selections in the early part of the winter. You must know just how much is wanted; but always buy enough.

Before I went into the seed business I bought a great many seeds. My plan was to go to some reliable dealer, and tell him just what I wanted. I asked for the best and always paid the highest price, so I was reasonably sure of getting the best I fared much better than if I had spent my time looking around to find where I could buy the cheapest. You will find that, if you will always look for the best, the best will always be looking for you. and the man with whom you deal will, if he has something extra nice and knows that you want it, send you word or save it for you. Follow this rule in relation to seeds, and you will find that you will come out a long ways ahead. I have bought as high as $1,000 worth of seeds in one year, and I have never been cheated by a seedsman. I have paid the highest price and have felt that I have received my money's worth. The tools upon the market garden should be the best and of the most approved pattern. They should be kept in perfect order and in a building expressly for the purpose.

A plan of the place should be marked out early in the winter, and it should be definitely settled what crop is to be put into each piece the following season. This will enable you to get the manure into position—the different kinds for the different crops Estimate the quantity of seeds required by the size of the piece to be planted. Look the tools over carefully and have them put in the best of order. Do everything that can be done before the ground opens.

With the work all planned, the seed bought, the manure in place and the tools all ready, you can go to work, and in the busy time of planting you will appreciate all that has been done in the winter, you will be able to keep up with the work, and you will see how important it is to get everything ready, as I have described.

I would therefore advise young men who are thinking of taking up the market gardening business, to carefully study the requirements and then fit themselves to fill them. By following the suggestions I have offered they will be fitted to carry on the business with satisfaction and profit. Some may ask: How can the necessary education be obtained? I would say to them: Complete your grammar school course, spend one or two years in a commercial college, go to the Agricultural College, and after that course is completed, spend one year in the Experiment Station. Then engage yourself to the best market gardener you know of who will take you for three or five years. Then you will be fitted to take a position as a foreman, or you can carry on the business for yourself.

Some may ask: Are there any positions for young men with the education you have described? I will say that there are, and I have some waiting to be filled at the present time, and can find no one to take them. There is a good salary waiting the position for the right man. This business is in the advance line of agriculture. It has never been brought to the notice of agriculturists as it should have been, but it is now, or soon will be, in the front, even though it is but in its infancy. It is that kind of a business that requires special training and a practical knowledge to secure satisfactory results. The amount of capital required is quite large, but not more so than is necessary in other lines of business carried on at the present time.

The profits, if carried on on a small scale, will not be so great as if carried on on a large scale, and they are not so great as a few years ago.

By starting small, giving close attention, and keeping the business on a pace with the times, the capital will be readily obtained. Only those will succeed in any business who attend to it, and as we learn in the Scripture, "only those who endure to the end shall be saved."

SOME FUNGOUS DISEASES OF FRUITS.

By Prof. F. L. Harvey of the State College.

The depredators upon fruits and fruit trees are not confined to the insect world. There is a host of minute plants, known by the general name of fungi, that are parasitic upon higher plants and derive their nourishment from them. The rusts, smuts, bunts, rots, scabs, moulds, mildews, blackknots and blights, so common on our fruits or farm crops, are all parasitic fungi. The parasitic fungi are mostly minute organisms, and have to be studied by the aid of the compound microscope. This is why they are so difficult to observe, and why so little is generally known about them by fruit growers. It is a difficult undertaking to wage war against minute organisms, so small, that the compound microscope is necessary to see them. The study of these parasites must largely be turned over to specialists, who have the time and apparatus to investigate them. The study of parasitic fungi is now claiming the attention of many good botanists in this country, and we may hope for a better knowledge of them. The last few years has added much to our knowledge of these pests and their treatment. A few words about fungi in general, and their relation to higher plants, may prove interesting and instructive.

Upon the method of reproduction, botanists divide the vegetable kingdom into two great groups: phænogams and cryptogams. The former reproduce their kind by means of seeds, which are the product of true flowers. These seeds contain a little plant, more or less formed, which under proper conditions of moisture, warmth and oxygen develops directly into a plant like the parent. The plant body is generally large in proportion to the flowers. Though some are parasitic; as the dodder, some orchids, the mistletoe of the south and others; the most are provided with chlorophyll, the green coloring matter of plants, and capable of elaborating their own living. They are frequently called the higher plants and are believed, as a class, to have been the last introduced upon the earth. Most of the plants we cultivate for their fruits, roots and seeds belong to this group. In fact most of the useful plants of the world are flowering plants.

The cryptogams or flowerless plants produce neither flowers nor seeds, but are perpetuated by minute simple cellular organisms called spores. Some fungi produce several kinds of spores, each capable of reproducing the species. The spores of most fungi develop into the parent form directly, but in many flowerless plants, there are one or more intermediate growths or generations. The real plant among fungi is so small, that it is not usually noticed, especially when it is parasite and internal. The plant body of fungi is usually composed of small, white, slender threads. These ramify through the host plant, or the decaying matter on which the fungus feeds. In other forms the parasite spreads over the surface of the host. The reproductive organs being so much larger, they are the parts that generally attract attention. The white slender threads, that compose the real plant, are collectively called the MYCELIUM. The fungi that get their nourishment from decaying or dead organic matter, are called SAPROPHYTES, (Corpse-plants). They are the scavengers of the vegetable world, hastening the decay of organic matter, and converting it into food for higher plants. They serve a good purpose, and cannot be classed as injurious fungi, only as they attack wood used for fuel and timber, or hasten the death of weak or diseased fruit or shade trees. There is another class of fungi which live on the inside or outside of living plants and derive their nourishment from them. These are called PARASITES. They are the tramps, paupers, and robbers of the vegetable world. They have no chlorophyll in their structure and therefore no ability to make their own living. They have the voracity of tramps, the dependence of paupers and the audacity and pertinacity of robbers. They seize their victims with relentless grasp, sapping their life juices, producing weakness or decay. This is the class of fungi that damage our fruits and fruit trees. There is another class of fungi that are saproprytic in some stages of their growth and parasitic in others. These may be injurious.

Fungi may be perennial, that is, the mycelium may live from year to year. When this is the case the continuance of the species from year to year does not necessarily depend upon the spores. This is the case w th apple scab and others. Many fungi produce profusely, during the summer months, what are called *summer spores.* These spores rapidly multiply the pest. It is largely to the summer generations that the damage is due. In the fall, winter, or resting spores may be formed to perpetuate the species. Fungi have their likes and dislikes. They usually select their particular host plants, though a fungus will often infest a number of plants botanically related, or infest in different stages, plants not at all related. We feel inclined to ask the question, whether fungi serve any good purpose, or are they only thorns in the flesh of man? The saprophytes certainly hasten the decay of matter, and prepare food for the higher plants. The parasites, in nature, serve to hold vegetation in check and preserve the equilibrium. Man is the disturbing force. By bringing the wild plants into a high state of cultivation he has made their tissues softer, and more inviting to parasites, and he must cheerfully and patiently adopt measures to restore the balance of forces he has disturbed. This can only be done by a careful study of the nature of fungi, and the enforcement of a rigid warfare against them. They must be regarded as our eternal enemies and kept in subjection by constant watchfulness. Many a fruit grower can trace the destruction of his orchard or vineyard, by a parasite, to not taking trouble to stamp out the pest when it first appeared. The Horticulturist should be watchful, detect the first appearance of parasites and act promptly before it is too late. There are some fungi that cannot be eradicated, but require constant treatment to keep them in bounds. The application of fungicides and insecticides has become as necessary for successful fruit culture as tillage and fertilization. This is to be regretted but must be endured. We must put our armor on, and keep it on, and always be ready for the fight. Vigilence is the price of fine fruit now days, and the prize is to the vigilent. The fruit business is profitable, and if fruit could be produced with no trouble the business would be over-crowded. Insects and fungi are nature's regulators. They develop patience and industry in man, drive out the lazy, and leave the vocation to the few workers. In spite of drawbacks fruit growing in Maine pays well. We heard it remarked the other day, that the prosperous farmers of Maine are large orchard owners. To intelligently cope with fungi we must know their natures, their lives, their weaknesses, their strongholds. There are helpful and useless methods of dealing with parasites. Successful methods must be based upon a general knowledge of fungi, and a familiarity with the life changes of the one in hand.

The following rules, based upon the general nature of fungi, may aid somewhat in checking, avoiding, or destroying these pests:

1. If the parasite is established and lives within the host, remedies are generally useless.

2. If the parasite is external, spraying with a suitable fungicide is often helpful, but sometimes the fungus will resist the action of poisons as well, or better than the host.

3. If a plant is hopelessly infested and liable to spread the disease to healthy plants, it should *without delay* be burned, root and branch.

4. Apply protective fungicides, to prevent the germination of spores that fall upon plants. This is a preventive measure of great promise. It would destroy summer spores, the greatest source of infection, before they have a chance to grow. Copper compounds are coming largely into use. They destroy the spores which are so rapidly formed during the summer months.

5. Spray plants affected with a perennial fungus, during the season of spore formation, to prevent the disease spreading to the fruit and leaves and to other trees.

6. When only portions of a plant are infested, use the knife at once. Burn the diseased part. Do not throw it on the ground.

7. Burn all refuse from crops in the fall, which may contain resting spores and perpetuate the disease over winter. Don't leave rotten apples on the ground, or spread refuse from diseased apples in the orchard.

8. Destroy any wild plants or weeds, growing in the vicinity of crops, that harbor injurious fungi.

9. Keep plants in health by proper fertilization. An impoverished or weak plant, like an animal lacking vigor, is an easy prey to disease.

10. Special fertilization, that is, the introduction into plants of substances not harmful to their growth, but prejudicial to fungi. This is problematical, though perhaps possible.

The above principles are more or less applicable in the treatment of fungi, but the life history of a particular fungus must be known before a specific treatment can be adopted. Below we give a list of a few common fungi that affect large and small fruits.

In this paper only a few of the fungi of large fruits are considered, and these, for a want of time and space, have not received a detailed consideration.

A Few Common Fungi Injurious to Fruits.

Large Fruits	Apple	Scab or Black Spot—Fusicladium dendriticum, (Wallr.) Fckl.
		Powdery Mildew—Podosphæra oxycanthæ, (D. C.) DeBy.
		Bitter Rot—Glœosporium versicolor, B. & C.
		Rust—Rœstelia species.
	Pear	Pear Blight—Micrococcus amylovorus, Bur.
		Pear Leaf Blight—Entomosporium maculatum, Lev.
	Plum	Black Knot or Plum Wart—Plowrightia morbosa, Sacc.
		Rot—Monilia fructignea, Pers.
	Cherry	Leaf Spot—Septoria cerasini, Pk.
Small Fruits	Blackberries	Anthracnose-Glœosporium venetum,
	Raspberries	Anthracnose-Glœosporium venetum,
	Gooseberries	Powdery Mildew—Sphærotheca mors-uvæ,
	Currants	Leaf Blight.
	Strawberries	Leaf Blight, Rust—Ramularia Tulasnei, Sacc.
		Leaf Blight—Sphærella Fragariæ,
	Grapes	Downy Mildew—Peronospora viticola,
		Powdery Mildew—Uncinula ampelopsidis,
		Anthracnose-Phaceloma ampelinum, DeBy.
		Black Rot—Lœstadia Bidwellii, Sacc.
		Bitter Rot.
		White Rot.

RECIPES.

The following recipes, taken from the United States Agricultural Reports, will be referred to in this paper, and for convenience of reference are given here. They have all been tried and have stood the test of application. The one selected will depend upon the disease and the material at command.

(1) SULPHATE OF COPPER SOLUTION.

Dissolve one pound of pure sulphate of copper in twenty-five gallons of water. Should not be applied to tender foliage. Can be used before the leaves start. Can be easily prepared

(2) BORDEAUX MIXTURE.

(*a*) Dissolve sixteen pounds of sulphate of copper in twenty-two gallons of water; in another vessel slake thirty pounds of lime in six gallons of water. When the latter mixture has cooled, pour it slowly into the copper solution, taking care to mix the fluids thoroughly by constant stirring.

(*b*) Dissolve six pounds of sulphate of copper in sixteen gallons of water, and slake four pounds of fresh lime in six gallons of water. When cool, mix the solutions as described above.

This formula requires *fresh* lime. Air-slaked lime, or a paste made by allowing freshly slacked lime to settle, contains a large percentage of water; consequently, if they should be combined in the proportions indicated, there would not be sufficient lime to decompose the copper. Experience has shown that while four or even three pounds of fresh lime is sufficient to decompose six pounds of copper sulphate, it requires double that quantity of air-slaked lime and three times the amount of paste.

The manner of preparing the Bordeaux mixture may be modified in various ways. Colonel Pearson pulverizes the sulphate of copper, and then dissolves it in from two to four gallons of hot water. The lime is then slaked in the same way that masons slake it for mortar. This is strained into a box, left to settle and thicken, and then combined with the copper, adding water to the required amount.

(3) SOLUTION OF AMMONIACAL CARBONATE OF COPPER.

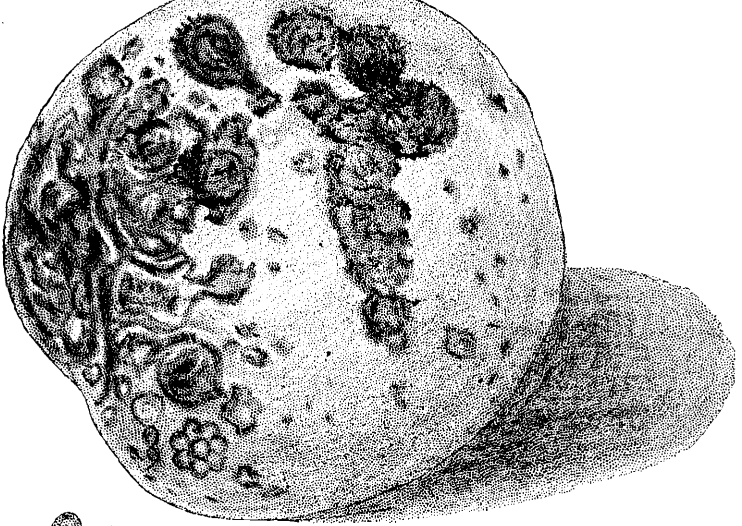
Into a vessel having a capacity of about one gallon, pour one quart of ammonia (strength 22° Baumé), add three ounces of carbonate of copper, stir rapidly for a moment, and the carbonate of copper will dissolve in the ammonia, forming a very clear liquid. For use, dilute to twenty-two gallons.

(4) EAU CELESTE.

(*a*) Dissolve one pound of sulphate of copper in two gallons of hot water; when completely dissolved, and the water has cooled, add one and a half pints of commercial ammonia (strength 22° Baumé), when ready to use dilute to twenty-two gallons.

(*b*) Dissolve two pounds of sulphate of copper in two gallons of hot water; in another vessel dissolve two and a half pounds of carbonate of soda; mix the two solutions, and when all chemical reaction has ceased add one and a half pints of ammonia, then dilute to twenty-two gallons.

The strength of the above solutions can be modified by adding more or less water, and arsenical compounds may be added to destroy insects.



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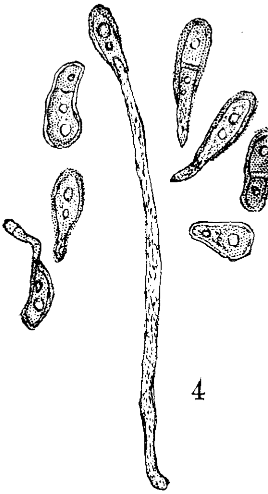

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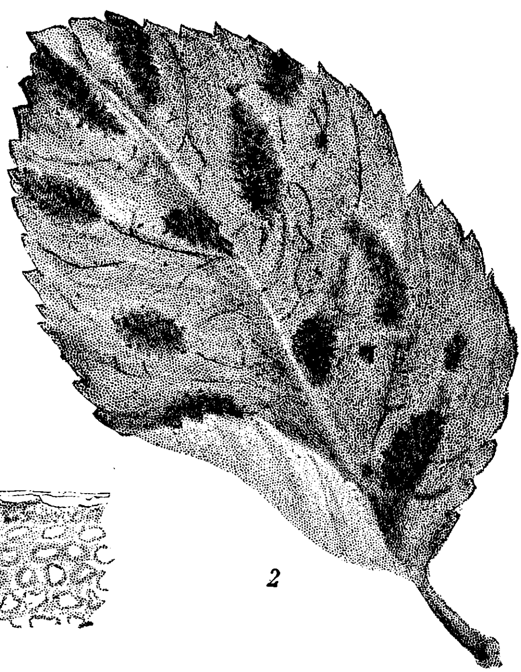

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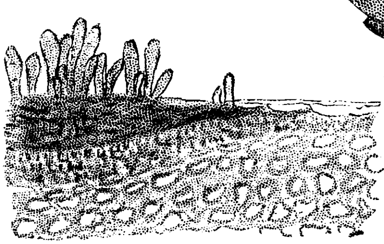

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APPLE SCAB [*Fusicladium dendriticum*]. This plate was drawn in crayon stipple by Miss Hannah Lord, Orono, Me., from the colored plate by George Marx (U. S. Agr. Rept., 1887, Pl. II). Fig. 1. Apple showing the scab. Fig. 2. Apple leaf showing the scab. Fig. 3. Section through a portion of a scab spot on the fruit, showing the growth of the fungus, greatly magnified. Fig. 4. Spores of the fungus greatly magnified, four of them germinating.

APPLE SCAB OR BLACK SPOT—FUISICLADIUM DENDRITICUM.

Attention has been called to this fungus parasite as doing considerable damage to apples in the State. Apples marketed in Orono and Bangor have been examined and the disease found to be common in this region. We also learn that it is prevalent in other portions of the State. The disease is widespread over the country, destroying in some of the states annually from one-half to one-sixth of the crop.

This fungus attacks the twigs, buds, leaves and fruits, but is most noticeable on the fruit, appearing as olive green spots, with a circular outline, which become velvety as they get older. When the fungus attacks the twigs and leaves it affects the vitality of the tree. The greatest injury is done to the fruit, the marketable product. An early attack causes the fruit to shrivel and drop—a later attack produces a withered stunted growth. A late attack upon the full grown fruit discolors its surface and depreciates its marketable value, making it liable to rot under the scab spots when stored. The disease is worse in damp, cold seasons. It starts in the spring from spores that have lived over winter, or from the plant body, which has retained its vitality in the twigs, fruit or fallen leaves. The cold, damp, spring weather causes a rapid growth of spores, which establish themselves upon the young fruit and leaves. The warm, dry, summer weather arrests the growth, which is continued again during the damp, cooler, autumn months. The fungus shows some preference for certain varieties, but in bad seasons all are more or less affected. The parasite has a wonderful vitality and the plant body is probably perennial. We have now, January, apples covered with the fungus in a vigorous growing condition. Specimens apparently dead when taken from the barrel, kept moist a few days, begin growth. It has been shown that the spores will germinate in about eight hours at the low temperature of 50° F., insuring an early start in the spring.

The successful treatment of this disease may be regarded as an open question, but on account of the annual injury done it should be carefully studied. The station will conduct some experiments next season upon this disease and will be pleased to correspond with orchardists in different parts of the State where the disease was bad the past season, and coöperate with them.

The life history of this fungus would suggest the application of some chemical, by the spraying pump, early in the spring before the leaves start, to kill the spores as formed, and prevent them attacking the young fruit and leaves.

Mr. Goff of the New York Experiment Station has tried spraying the trees early in the season with a solution of one pound of hyposulphite of soda to ten gallons of water with encouraging results.

Prof. Scribner suggests for trial the following treatment:

(1) Spray the trees early in the spring, before the buds start, with a solution made from one pound iron sulphate (copperas) and one gallon of water.

(2) After the fruit sets, spray again with Bordeaux mixture prepared by dissolving sixteen pounds copper sulphate (blue stone) in twenty-two gallons of water. In another vessel mix thirty pounds of lime with six gallons of water. After the latter cools, pour the two preparations together and thoroughly mix them. It is best to prepare this mixture several days before it is needed, and stir it well before applying it. If the season is cold and damp, a second application should be made, later in the season. The spraying pump used to apply copper solutions should be made with copper or brass fittings.

To determine whether the spraying does good, the application should be made only to alternate trees in the row, or to one side of each tree. The effects upon the trees can thus be readily compared

RECENT INVESTIGATIONS.

The Department of Agriculture at Washington tried many experiments on fungicides the last season, to be considered in Prof. Galloway's report, which promises to be of unusual interest. Prof. Galloway has kindly sent us advance sheets of his Report from which we condense the following:

The past season experiments upon apple scab were conducted, under the auspices of the United States Agricultural Department, in Michigan and Wisconsin by Professors Taft and Goff. They experimented with various chemical compounds as shown in the table below, but the copper compounds were so much superior, they alone deserve consideration. It is recommended to spray as soon as the buds begin to swell. They sprayed seven times during the season, but think four or five times in ordinary seasons would be enough. The last application was made about August 10th. The following copper solutions are recommended :

1. Dissolve, in a wooden vessel, three ounces of carbonate of copper in one quart of ammonia water 20° and dilute with water to thirty-two gallons.

2. Dissolve two pounds copper sulphate in hot water, and in another vessel dissolve one and one-half pounds bicarbonate of soda ; mix the two, and when cool add one and one-half pounds ammonia water 20°. Dilute to thirty-two gallons with water before using.

REMARKS.

The ammonia of commerce varies in strength. Usually that kept at drug stores is either 20° Baumé or 26° Baumé. If the former is purchased then follow the above recipes, but if 26° strong is used then add one-third more water.

DIRECTIONS FOR SPRAYING.

The first application should be made when the buds begin to swell, or as soon thereafter as possible. Apply the ammoniacal carbonate of copper solution with any good force pump, one to three gallons to the tree, according to size, being careful to cover the branches evenly and thoroughly. The Nixon nozzle is the best for this work, though any nozzle that will give an even, fine spray, will do.

The second application should be made when the apples are about the size of peas or larger, and if it is desired to spray for codling moths at the same time without extra labor, add one ounce of London purple to every twelve and one-half gallons of the ammoniacal carbonate of copper solution, and apply as stated above. A third application should be made two or three weeks later, and a fourth about August 1st to 10th. The cost of material for four applications need not exceed ten cents per tree. The copper carbonate, in twenty-pound lots, can be purchased from Eimer & Amend, 205–11 Third Avenue, New York, for fifty cents per pound, and ammonia by the carboy, eighty pounds, twenty-six degrees strength, for nine cents per pound. The material could be ordered direct, or through a local druggist, at a small advance in price The labor required will vary with the kind of spraying apparatus used : ten minutes to the tree with a small pump, while with a larger pump the time could be reduced to five minutes. For a large orchard it pays to buy the best apparatus. Below is given a table showing the results of experiments conducted by Profs. Goff and Taft in 1889.

Table—*Showing Results of Experiments.*

	Prof. Goff's Experiments.					Prof. Taft's Experiments.					
	Applications.	Free from scab—per cent.	Slightly scabby—per cent	Badly scabby—per cent.	Cost per tree—cents.	Applications	Free from scab—per cent.	Slightly scabby—per cent.	Badly scabby—per cent.	Cost per tree—cents.	Total yield—pounds.
Potassium Sulphide.......	7	30.04	48.55	21.41	37	7	25.5	74.3	.2	39	1,615¼
Sodium Hyposulphite	7	43.24	42.78	13.98	29	7	23.6	75.4	.89	23	1,648
Sulphur Powder	7	32.72	54.31	12 97	31	7	17.6	81.2	1.1	31	1,435¼
Am'l Copper Carbonate ...	7	75 02	23.35	1.63	38	7	51.2	48.6	.16	49	2,112¾
Eau Celeste	-	-	-	-	-	7	68.8	31.0	.2	60	1,675½
Sulphur Solution	3	42 9	48.99	8.11							
Unsprayed	-	23 34	53.89	22.71	-	-	12.5	85.7	1.8	-	769¼

DEDUCTIONS.

The ammoniacal copper carbonate gave excellent results, though all the solutions proved beneficial. The yield in pounds was increased by all, but most by the copper compounds. The greatest difference between the perfect fruit on sprayed and unsprayed trees (Prof. Goff's experiments) was 51.68 per cent, and the least 6.7 per cent. In Prof. Taft's experiments the greatest difference was 56.3 per cent, the least 5.1 per cent. The results were practically the same. The yield was nearly three times as great where copper compounds were used as on the unsprayed trees.

APPLE POWDERY MILDEW—PODOSPHÆRA OXYCANTHÆ. (D. C.) DeBy.

This is a minute fungus which spreads itself over the surface of the plant and by means of suckers, sent into the cells of the leaves or stems of the host, obtains its nourishment. It covers the plant with a powdery, meal-like growth, hence the name. During the summer the greyish, cobweb-like threads extend themselves over the plant and throw out powdery tufts, composed of chains of oblong bodies, the summer spores (conidia). These drop and spread the disease. These summer spores may live over winter under some conditions, but the plant also develops winter spores (ascispores) in sacs called perithecia. This disease has been quite troublesome to nursery stock in some parts of the country. It also is known to affect the plum, peach, cherry, sugar pear and other related plants. It is particularly bad on small trees in the nursery The disease occurs sparingly in Maine.

REMEDIES.

Prof. Galloway has tried spraying the trees in the nursery row, with a solution of six ounces carbonate of copper and one-half gallon of ammonia water in twenty-two gallons of water. The cost for material and labor of applying it did not exceed two cents for 1000 trees. The results were satisfactory.

BITTER-ROT OF APPLES—GLEOSPORIUM VERSICOLOR, B. & C.

This disease is widely distributed, having been reported from many states. It seems to be worse in the southwest. We have found it somewhat common in Maine. The disease first appears as small, more or less circular, brownish, or blackish spots. These run together rapidly and finally involve the whole fruit. As the disease progresses it involves the whole interior of the fruit, which turns brown. The disease may develop after the fruit is stored, and spread rapidly from apple to apple. The mycelium, or plant body, is composed of threads that extend through the fruit. On the diseased spots are darker portions composed of slightly raised black points, sometimes grouped in clusters, or arranged in circles. These black specks are the external appearance of the organs of reproduction. They have small holes at the top, leading to receptacles, which contain the spores. The fungus lives over winter in decayed fruit.

REMEDIES.

Destroy all rotten apples. Do not throw them on the ground. Be careful not to store any apples showing the disease, as it will spread to the healthy fruit.

Sort apples frequently during the winter and remove any that show even the least evidence of the disease.

Spraying, with a solution of sulphuret of potassium, has been tried and promises well. It is probable that the copper compounds used for apple scab would also hold in check this fungus.

APPLE RUST—ROSTELIA SPECIES.

The apple rust is quite common in the Middle and Western states. This fungus in one of its stages of development causes, on cedar trees, what are called "cedar apples." The spores from the cedar apples fall on apple trees, germinate, enter the leaves and sometimes the fruit. It lives within the tissues of the host, finally appearing at the surface when the spores are produced. The Rostelias are generally believed not to survive the winter without the cedar apple stage, but there seems good reason for thinking that in some cases the rostelia stage may be perennial. We have not seen the rust on apples in Maine. But cedar apples are found, and Rostelia aurantiaca, occurs on the sugar pear. Destroying cedars near the orchard, and spraying with a copper solution, just before the cedar apples drop their spores, have been advised. The disease is of but little importance to Maine growers at present.

PEAR BLIGHT—APPLE BLIGHT—MICRCCOCCUS AMYLOVORUS, BURRILL.

By the researches of Profs. Burrill and Arthur this disease is now known to be due to the species of bacteria named above. The parasite is always present in actively blighting tissue and by inoculating healthy branches with the organism the disease has been transferred. In the East the disease is mostly confined to the pear, but in the West, Minnesota, Wisconsin, Michigan and Iowa it is as bad on the apple as on the pear in the East. The disease is believed to retain its vitality in dead organic matter outside of the tree and the minute organisms are carried to the trees by the wind. They find entrance through the tender growing twigs, blossoms, or through injuries in the bark caused by sun scald, cold, or mechanical injuries. The parasite feeds upon the starch of the twigs causing an exudation of gum and liberation of carbon dioxide. When attacked, the tree appears as though fire had scorched the twigs and leaves of the new growth. Hot, wet seasons, especially a series of them, favor the disease. Dark porous soils are said to be favorable to the blight. Cultivation, by prolonging the period of growth, is said to favor the disease. If length of season increases the disease, why is it worse in apples westward and northward? If excess of moisture favors the plant, why is it worse on apples in the drier western climate? We hope the pest will continue its preference for western apples. We have received a number of complaints of its attacks on pears but none on apples in Maine.

REMEDIES.

The parasite works inside the bark and is beyond the reach of external applications. Being perpetuated outside the tree in organic matter, the entire removal of the cause is impossible. The following remedies, though helpful, can not be wholly satisfactory:

1. Cut and burn the blighted twigs.
2. Keep the ground under the trees free from decaying organic matter.
3. Do not cultivate, or till early. This will shorten the period of growth and insure the early formation of a dense bark.
4. Plant on soil; light colored, deep, and porous, and not liable to become overheated.
5. Plant buckwheat, clover or grass, to shade the ground and keep it cool. This growth would probably prevent the germs formed in organic matter on the ground, being carried to the trees.
6. Protect the trunks from sun scalds by low heads and inclining the trees to the southwest.
7. Avoid injuries to the trees.
8. Plant varieties least subject to blight.

PEAR LEAF-BLIGHT—ENTOMOSPORIUM MACULATUM, LEV.

This disease is so bad in some localities, that nurserymen have abandoned raising pear seedlings on account of it. It is due to a minute fungus which is composed of small colorless threads, that grow between and through the cells of the leaves destroying them and feeding upon their substance. The fungus first appears as small more or less circular brownish spots which soon run together causing the whole leaf to turn brown and drop. While the leaves still hang, a close examination will reveal numerous small black specks on the brown patches. These are the reproductive bodies of the fungus. These contain the spores, which are liberated by the rupturing of the epidermis of the leaf. Under favorable conditions of heat and moisture, the spores grow and bore their way into the tissues of other leaves. Spores formed in the fall live over winter in the fallen leaves and perpetuate the disease.

REMEDIES.

Prof. Galloway has tried spraying pear seedlings in the row with Bordeaux mixture, prepared as follows:

Six pounds of sulphate of copper was crushed and dissolved in ten gallons of water; four pounds of fresh lime was then slaked in six gallons of water in another vessel. When the solutions were cool, they were put into a barrel and thoroughly mixed.

The mixture can be applied with a Japy, or Eureka pump and the improved Vermorel lance and nozzle, or any other suitable spraying apparatus.

THE BLACK-KNOT OR PLUM-WART—PLOWRIGHTIA MORBOSA, SACC.

This fungus was described over sixty years ago by the noted botanist, Dr. Schweinitz. The nature of the fungus was quite well known at that time, at least the appearance of the excrescences and the cause of them was recognized. The nature of the reproductive organs, the conidia, stylospores, ascospores and pycnidio-spores were made known by Dr. Farlow, but how these spores produce new knots has never been observed. From analogy it is thought the spores are carried by the wind, and, lodging on the branches, germinate and find entrance. There is need of careful study of the early stages of the knots and the means of infection. The fungus is probably perennial and not dependent upon the spores. The mycelium lives in the wood over winter and extends the knot the next season. The spores that find entrance develop into knots the next season. The summer spores begin to be formed in the spring, and continue to appear during the summer. The winter spores are ripe by February. The disease affects the plum, morello cherry and some of our wild cherries. The disease is confined to America, not occurring in Europe. In this country it has, with the curculio, about caused plum raising to be abandoned.

To devise means of destroying this fungus and restore plum raising is of great importance. There have been several remedies proposed and some interesting experiments have been tried the last season at the Massachusetts Agricultural Experiment Station. Below we give some of the remedies, preventive, protective and direct, that have been tried.

REMEDIES.

1. Cut the diseased branches and burn them. (Care should be taken to cut enough wood to include the mycelium. If the tree is hopelessly involved, it should be destroyed at once. Burning is necessary, as the spores are produced on detached branches. The

old knots should be cut before February, and the young ones, as soon as possible after they form, to prevent the formation and spread of spores.)

2. Cut and burn all the wild, fire cherry and choke cherry trees near the orchard. (Spores are light and are carried a long way by the wind. Out of the millions produced by an infested tree enough will be carried a long distance to start the disease.)

3. Spraying with a solution of some copper salt has been recommended. As the winter spores are formed by February, and the summer spores commence to form early in the spring and continue to be formed all summer and as it is not known when, where or how the disease is propagated, this method would necessarily be work in the dark. It is based on the belief that the spores lodge on the branches, germinate and spread the pest. Experiments alone can decide its efficacy. If adopted, spraying should be kept up all summer, after every heavy rain. An application in the spring would probably destroy any spores of this or other fungi on the branches. Washing the trunks and larger branches with brine was tried as early as 1863. So this method is not new.

4. Cutting out the warts and applying varnish was tried as early as 1863, but the fungus produced new warts around the old ones. (See United States Agricultural Report, 1863, p. 572.) This served only as a temporary protection. It is to be seriously doubted whether a tree badly affected can be saved. It would be better to begin anew and carefully observe preventive methods. The first knot should be noticed and destroyed, or it becomes a source of infection near at hand. An ounce of preventive in the shape of precaution will save a pound of disease, the sure product of neglect.

5. Painting the knots over with some solution or substance, to destroy the fungus or prevent spore formation, is now claiming the attention of experimenters. This is an old method revived. Townsend Glover in United States Agricultural Report, 1863, p. 572, says: "Even when the wound had been washed with a strong solution of nitric, or sulphuric acid and water the disease invariably appeared either above or below the old scar." Something must be found to penetrate the branch and kill the fungus and not kill the branch, or the remedy would have no advantages over pruning. It certainly will take more time than pruning. Prof. Maynard has published recently (Bulletin No. 4, Massachusetts Experiment Station 1, p. 15) the

results of his work in this direction, and I can do no better than to record his conclusions.

"To determine if there is not a more effectual and satisfactory remedy than that of cutting off and burning the warts (which is in part effectual) the following liquids were applied:

1. Linseed oil.
2. Turpentine.
3. Kerosene.

These remedies were applied with a small brush as soon as the warts began to appear. As they do not all come out at once, examination and application of the remedies were made three times during the summer, all warts being painted over each time.

RESULTS.

In three examinations made with the microscope during the fall and winter, no spores (ascospores) were found in the warts. In fact none of the sacks (peiithecia) were developed enough to produce them before the warts were destroyed by the remedies. In some cases where the kerosene and turpentine were applied in so large quantity as to spread around the branch or to run down it, the branches were killed. No such injury occurred where the linseed oil was used.

CONCLUSIONS.

1. Linseed oil, turpentine and kerosene all effectually destroyed the plum wart.
2. Turpentine and kerosene must be used with great care.
3. Examinations should be made at least three times during the summer, from June 1st to August 30th.
4. Enough of the liquids must be applied to saturate the wart.
5. As the plum wart is readily propagated on the wild choke cherry all such trees should be destroyed, and all of the warts upon the trees of the garden (morello) cherry should receive the same treatment as those on the plum trees.

SUGGESTION.

While the above remedies have proved effectual it is suggested that possibly a more harmless remedy may be found in the use of sulphate of copper, although no experiments have been made with it to our knowledge. Applied with the hand pump in the spring, before the leaves have unfolded, it would probably destroy all spores lodged in the crevices of the bark; and used in concentrated solutions with the brush it would probably destroy all warts that might start later in the season from the mycelium or spores remaining in the tissues during the winter."

When applied to the young knots kerosene or linseed oil may kill them. This could only be determined by noticing whether new knots are formed around the old ones. Painting the knots would certainly prevent the formation and spread of summer and winter spores and narrow the formation of new knots to sources of infection outside of the tree. The outside sources are wild and morello cherries. These should be destroyed. Mr. Knowlton sent us recently some plum and cherry twigs bearing knots that had been treated with kerosene three times during the season. They contained no summer spores (ascospores) and only imperfect (perithecia) and no winter spores. The mycelium did not appear to be dead even on the young knots. This method should be tested farther and we hope those who raise plums will paint the knots with linseed oil. We shall do so and also try to discover the missing links in the life history of this fungus.

REMARKS.

It must be apparent from what has been said, that the tendency of the times is toward the use of chemicals, as preventive and direct agents, against the attacks of injurious fungi, and that the copper salts have proved the most efficacious. To apply these, spraying apparatus has become almost as essential as the plow and hoe. Great importance attaches to a proper selection of apparatus for the different kinds of spraying, and the right fungicide or insecticide. For this reason we have placed on exhibition a few pieces of spraying apparatus, that have been tried by experiment station officers and recommended by them. These will be explained to any who wish information regarding them.

It must also be apparent, that a knowledge of the life history of fungi is most important as a basis for the application of remedial measures; in order that there be no waste of time and expense in trying unreasonable methods or those that have been tried and found useless. With the name and life history of a fungus known; with a knowledge of the remedies that have been tried and found worthless or useful; with an intelligent plan of action based upon the life history, the experimenter is prepared to begin on intelligent and hopeful warfare. The specialist has the apparatus and books and is better prepared than any one to give this information.

It is a part of the work of the Station Botanist and Entomologist to study injurious fungi and insects. He will therefore always be pleased to name plants or insects sent, and give, if known, their life histories, and if not known he will study them and report. It is also his duty to impart information regarding remedies and their application and coöperate in trying new experiments.

The Station Botanist and Entomologist desires to make himself useful in this capacity, but cannot be expected to take upon his shoulders the burden of exterminating the injurious insects and fungi of the State. It would be too great to bear. Even with a thorough knowledge of a pest, we may be largely at its mercy. There are often thrown around parasites, strongholds, that even man with his boasted strength cannot break down. The Creator and not the entomologist should be held accountable for this. It may well be doubted whether man has dominion over the whole animal and vegetable kingdom. We think he has his match in several injurious insects and fungi. We must not, however, give up the advantages we possess, that have been gained by study, but make best use of the means at hand, striving by more careful research for greater advantages. Insects do not change much in their habits, but man aspires to higher achievements and possibilities. Each year brings some new light, showing man has not yet reached the limit of his dominion over the lower animals and plants and may yet succeed in putting all things under his feet. We heartily sympathize with the farmers and horticulturists in their warfare with injurious insects and fungi, and promise to be their faithful ally, hoping that persevering and patient research will finally bring their reward.

THE EXPERIMENT STATION AND ITS WORK.

By D. H. KNOWLTON, Member of Advisory Board.

EXPERIMENT STATIONS IN GENERAL.

Agricultural experiment stations in this country are of recent date. They may be considered as the offspring of our necessities. There are several notable experiment stations, or experimental farms, in Europe, which have covered a large field of observation and study, and to them we are indebted for much of our knowledge of feed properties and values, as well as the crop producing values of manures and cultivation. The conditions of soil and climate in the United States are so different from European localities, that beyond certain scientific data, the conclusions reached had little practical value for the American farmer; for to make many of the results available, they must be interpreted and adapted to our conditions. From the primitive methods still employed by the majority of European farmers, there is doubt whether these stations have really effected any great change in European agriculture, and, as far as any great change has been brought about there, it is more largely due to the importation of the cheaply-produced crops from the United States, South America and Australia. At any rate, the changes in European farm methods have been less rapid than in this country where our farmers so generally read and study the agricultural papers.

We have no desire to underrate the work of these stations, for they have been of great value, not only to Europe, but to the United States as well, for the results have been largely drawn upon by our agricultural writers and chemists. The data furnished have been of great value, but in order to utilize many of them there was need of experimental work in our own country. In the United States the increasing competition in the production of crops has necessitated many changes in farm methods. The first great question was how to produce crops the most cheaply, involving a knowledge of soils, their cultivation, and the value of manures. The next question is how to dispose of the crops after they are raised. If they are to be marketed, it is a matter of business, but if these crops are to be utilized in the growth and rearing of stock, the demand for an accurate knowledge of their feeding values becomes imperative. It is an old saying, that "necessity is the mother of invention," and the attempt to answer these questions gave birth to our agricultural experiment stations. The first one was established in Connecticut in 1875, and its early work in analyzing commercial fertilizers and publishing the results, saved thousands of dollars to the American farmer, who, until the fertilizer was used, was unable to determine whether he was purchasing old leather scraps compounded into a highly odorous mixture, or a valuable food upon which his plants would grow and thrive. So important was the work done by this pioneer station, that a demand arose for others, and there are now no less than fifty established in different parts of the country. With such a trained corps of educated workers, the scientific features of agriculture are likely to be developed quite as rapidly as the farmers are educated up to their adoption. Under the general guidance of a national station and the association of directors, which meets frequently for the discussion of methods and work, we have abundant reason to expect much from them in the future.

MAINE FERTILIZER CONTROL AND AGRICULTURAL EXPERIMENT STATION.

Here in Maine our legislature, in the winter of 1885, passed an act locating and establishing the Maine Fertilizer Control and Agricultural Experiment Station in connection with the State College at Orono, and appropriated the sum of $5,000 annually for its support. This station existed for about two years and a half. Its work consisted very largely of the inspection of the commercial fertilizers sold in the State, and in conducting a few farm and feeding experiments. As a matter of fact, the means were entirely inadequate for carrying on satisfactory experimental work. As a preparation, however, for the larger work of the present station, it certainly did all we could expect, though some who had anticipated great results, without measuring their cost in money and labor, were disappointed.

THE HATCH EXPERIMENT STATION.

The "Hatch Act," so called from its author, establishing an agricultural experimental station in every state, went into effect Oct. 1st, 1887, and our legislature in consequence repealed the law under which the original station was created. Under the "Hatch Act," the sum of $15,000 is annually appropriated for each station, but for some reason the first payment was not available till February, 1888. The law establishing the station makes it a department of the State College, the general oversight being vested in the trustees of that institution. The college, in order to receive the appropriation from the government, must show that the funds are wholly applied to agricultural research and experiment, and not to the general use of the college. In other words, the trustees of the college have charge of the funds, but expend them in carrying on the work of the station.

Under the conditions of this law, the first work was to provide suitable buildings, and furnish them for the purpose intended. This used all the funds permissible under the law for the first year, and drew somewhat on the funds for the second. As a result, however, the station is now provided with good quarters, and is well equipped for experimental work. As already stated, the general oversight of the work is placed in the hands of the trustees of the college, who, at a recent meeting, voted to create a "council" for the purpose of laying out the work of the station from time to time, subject to the approval of the trustees. The work of the council, as will be seen, is advisory, but as it is composed in part of the trustees, the recommendations are likely to be conclusive. Desiring to have the various agricultural industries of the State represented in this council, the trustees proposed that it consist of the President of the college, the farm committee of three from the trustees, the Director of the station, and his associates. The State Grange, the State Board of Agriculture, and the Maine Pomological Society were each invited to send a member of the station council. The council thus far has held two sessions, and we believe it is the intention to hold two sessions annually. By courtesy of President Pope, and the approval of the executive committee, your speaker was elected to represent the interests of the Pomological Society.

THE GENERAL WORK OF THE STATION.

It is not the purpose of this paper to pass in review the work of the Station, for the opportunities for studying it have been too meagre, even had I the desire to do it. It is a satisfaction, however, to note that while the work thus far has been preliminary, it now appears to be well organized. The various fertilizers sold in Maine have been analyzed, the results have been published for the benefit of the farmers, numerous farm experiments in growing crops by the use of different fertilizers have been conducted, the vitality of seeds offered for sale in the State has been tested the past year, and with the live stock several feeding experiments are being conducted, and some of the results have been made public. The diseases of farm animals are made special objects of study by the veterinarian. as well as the conditions of food and shelter that secure good health.

There are other features of special interest, but time will only permit reference to one or two lines of work of a general nature. In order to raise large crops, and to raise them cheaply, it is important to know what kinds of plant food are the best for this purpose. Should the seeds be planted in the open field, no one can tell with certainty from what source all the plant food does come. To gain this knowledge a series of experiments is being tried at the Station, called the "pot experiments." The problem to solve is, what makes the plant grow? Pots of suitable size are filled with ground glass, or clean sand, in which no available plant food is found; in these pots seeds of the same kind are planted; chemically pure water is used to water them. The pots must be marked and a record of every condition so far as known must be made. When the seeds begin to germinate, the several pots are treated with the various kinds of plant food in soluble form. One receives nitrogenous food, another potash, another phosphoric acid, and others receive some combination of these. Results are closely watched and noted for reference, under which treatment does the plant thrive the best? A definite result may not be reached this year, but it is believed this line of work accurately followed for a series of years will give results in determining the most economical manures to apply to our various crops.

SPECIAL WORK OF THE STATION.

A few years ago, from some unknown source, a troublesome little insect settled down among us in Maine. So small an insect was hardly noticed at first by our fruit growers, but when our King Sweets and other summer favorites were found to be the abode of a disagreeable maggot that would peep out at one at every mouthful. we began to feel uneasiness, and wonder what business the creature had in Maine apples. Year by year the insect spread over the State, till its presence is recognized in nearly every county, and an alarm exists among fruit growers lest the Trypeta may ruin not only our autumn fruits, but spoil the sale for our winter apples. In

Professor Harvey's excellent work on the Trypeta pomonella, we have another illustration of the manner in which our experiment station may aid the farmer. Already the Professor has brought to light the life history of this new pest, and before his labors are completed I anticipate he will prove the insect's worst enemy.

As our Society is more especially interested in fruits, and as the raising of fruits is one of our most important agricultural industries, I will mention some of the work intended with reference to them. Requests have been made for the establishment of branch stations, but it seems unwise to do this at present. The first work of the station is one of organization, and until the work there is well in hand, it would be folly to attempt the running of branch stations. This work of organization, by the way, is one of many intricacies, whose difficulties can only be hinted at when we say that no chance work can be permitted. First of all, before a successful experiment can be undertaken, the one who has charge of it must have a clear-cut idea of the results sought for, as well as the manipulations by which they are to be reached. Conditions have to be considered at the outset, and measured, so to speak; then at every step there must be the greatest accuracy, and records of the whole must be plainly kept. Then from the data recorded, conclusions may be drawn, or perchance the experimenter finds he has failed to recognize some of the conditions, and the ground has to be gone over again. Nor is it safe to accept the results reached in a single season as conclusive. Not many years since, Dr. Sturtevant conducted some interesting experiments in planting corn grown on different parts of the cob The first year's results showed that the tip kernels possessed the greatest germinating power, and gave the largest yield. This was perfectly astounding, for our fathers taught us years ago to give tip kernels to the pigs. The experiments seem to have been well conducted, but the next year, alas, the results reached the first year were all set at naught, and in succeeding years, we believe, the experiments confirmed the practices of our fathers.

THE PROMOTION OF FRUIT CULTURE.

Fruit culture, although one of our important industries, is rapidly increasing in extent. In Aroostook and other parts it is in its infancy. There never has been a time in the history of the Society when there were more inquiries, searching after the best varieties for profitable culture. At our exhibitions and public meetings, our members are "under fire" all the time. It is impossible to give all the information sought, but it is believed the station may come to our aid now, and "lend a hand." Having in mind that the station should begin its work at once, nursery stock was ordered from Ellwanger & Barry, and last spring, trees and plants were set as follows: Thirty-three varieties of apples, thirteen of plums, seventeen of strawberries, six of grapes, two of currants and one of gooseberries. Of the trees, two of a kind were set, and of the small fruits, six or more. More trees will be set the following spring. With hardly an exception, every tree and plant grew, and after a single season's growth, one rarely sees a handsomer lot. Scions were cut from these trees so far as possible, last fall, and these are now stored, ready for distribution throughout the State. From the small fruits, plants will be propagated the coming season. The object of the distribution is to determine the adaptability of varieties to the different parts of the State. These scions will be set under the direction of the station officers, and records will be kept. In this way, it is believed, a fruit list will be made up that will prove far more reliable than any that can be made from results obtained in a less thorough manner.

It is already well known that most varieties of apples grow and thrive in the State, but it is not yet known what the limits of successful growth of these varieties may be. I have often thought this would be a good work for our own Society to do, but the amount of labor involved in it has held me back from attempting it. I could make the beginning, but the next secretary, unless the funds of the Society should be largely increased, could not be expected to follow it up. But I am glad to know the station will undertake this work. The plan is simply this: The Baldwin, for instance, is the variety. First, in a suitable book for the purpose, the history and description of the variety are placed; the general conditions of soil, location, etc., under which it is known to succeed; then the conditions under which it does not succeed. Then record, from known results and results to be obtained, the actual areas in which the variety flourishes. It may also be proper to record any peculiarities of the variety which may be developed in any section; its quality, its liability to attacks from insects and diseases, hardiness, etc. This kind of labor, followed for a few years, will give us a fruit map, so to speak, of the State, and something that will be of great value to our interests.

The field for experimental work is of large extent. It is two-fold in its nature, scientific and practical. It may be scientific and not practical, and again, it may be practical and not scientific. The grand object of the promoters of the agricultural experiment stations was to make them of practical value to the farmers as producers of the sustenance of life; and secondarily, of importance to the world at large. There has apparently been more or less confusion among the stations in formulating the work to be done, but the general organization of the stations will remedy this confusion, and give unity to their purposes and plans. The directors of the stations are men who have been selected for their several positions in consequence of their scientific attainments. They are, so far as we can judge, disposed to make the general work of the stations practical; at the same time, they are quite unanimous that it shall be scientific. This suggests the tendency, which in some of the stations is already too apparent, to make them purely scientific. The station officers are engaged in study and research, and are disposed to learn all there is of importance on the subjects under consideration. They are associated in their work, and know little of the necessities of local agriculture, and there is good reason to suppose they will be likely to pursue only those investigations that are most congenial to their tastes. There is certainly a tendency that way, not premeditated, but perfectly natural. There is only one remedy for this, and that is, to have the interests of the farmer brought home to them. In our own station, the officers are sincere, earnest workers, and express the wish to undertake the lines of work most important to the farmers. But if the farmers fail to make known to the officers of the Station what work they need to have done, it naturally follows that the station officers will select their own work. Thus far, there have been two meetings of the council. Your society was the only organization, outside the college and station, that was represented. Probably there will be no meetings in future of equal importance, as at these meetings the future work of the station was agreed upon. Should this policy continue in the future, the results may not be entirely satisfactory to the farmers.

REPRESENTATION OF IMPORTANCE TO THE FARMERS.

There is only one remedy for this, and that is, to secure in some way representation at all the meetings of the council, where the work done is subject to criticism, and future work is discussed and laid out. The station pays the expenses of the members of the council, but no provision is made beyond this. It may be advisable that the bodies which have been invited to send a member to the council, should pay their respective delegates a reasonable compensation for their time. There are few in this busy world who can afford to leave their work for several days without some pay. By all means, secure representation at the meetings of the council. The results may not be so apparent as they sometimes are when a few politicians manipulate the party caucuses, and thereby determine vast State and national interests; but the interests of the farmers may be involved in all the essential details that go to make up the warp and woof of profitable production.

In conclusion, I have endeavored to give you briefly the origin and history of our experiment station. I have shown you somewhat of its work. I have also called your attention to the tendency of the station to engage in purely scientific investigations, and pointed out to you the only way in which you can insure work there that shall accord with your interests. This leads me to say that, to the full extent permissible, every farmers' organization should be represented in its management, but it is useless to send men there who have not the ability to discern our needs, or who may be indifferent in pressing them before the station officers. The institution was intended for your benefit; in short, it is yours. Your representatives should first of all be in full sympathy with your work. They should be men of education and sufficient mental calibre to comprehend the work needed, to measure the interests involved, to see beyond the experiments the object sought for. Last, but not least, they should be men who have the courage to insist upon having work carried on that is strictly agricultural, for it matters not how good the heart may be, how clearly the object may be comprehended, if there is not behind it the working faith that perseveres unto the end.

MAINE FRUIT GROWERS' EXCHANGE.

During the State Fair Meeting, President Pope presented the following paper:

HOW SHALL WE MAINTAIN THE PRICE OF MAINE APPLES?

By CHARLES S. POPE, Manchester.

Is there any profit in orcharding? This question which we have heard so many times of late, has set some of us to thinking that it is time to change our methods, or we must give up the raising of apples altogether. Many orchardists in this section the past year did not receive enough to pay the expense of handling. Others sold for a good profit. Now why should there be this difference? I have just visited one of the largest orchardists in Kennebec county, to learn, if possible, how he obtained $2.25 for his Baldwins when the buyers were paying $1.00 only. From what I could learn the great secret was perfect sorting and careful packing, and then shipping direct to England.

Apples from Maine have been in good repute in England, and the price, generally higher than for apples from any other section, but the returns last year must have been anything but satisfactory to most of the shippers. When the price is low the fruit grower will be very careless in handling his fruit, both when picking and packing, and the majority think the more poor apples they can crowd into the middle of a barrel and have it accepted by the buyers the better. The buyers in our section are very careless and will take almost anything if it can be purchased low enough. They will put a few good apples at the top and mark it with a string of X's, and sometimes are fortunate enough to get a little profit on such a lot. Very few of them did last year. This ruinous policy must be stopped if we expect to keep up the reputation of Maine apples.

With the present methods of selling, what inducement is there for an orchardist to pack his apples in good shape? Unless he is an extensive grower, his apples are lost, comparatively speaking, in the thousands that are shipped, and he gets small returns for his pains. From the appearance of apples, as they are opened in the auction rooms in Liverpool, it would seem that the science of packing apples correctly is understood by very few of our people. It is surprising what an immense amount is lost by poor packing, causing what they call "slack" and "wet" and the question is, how shall we remedy this and obtain a fair price for our fruit?

Many of our large orchardists, by careful sorting and packing, have obtained a reputation in our local markets, and the name of such grower on a barrel of apples is sufficient to sell the same at a good price, even without the trouble of inspection. Now we wish to do the same thing abroad. But who of us raise enough to make any show in the thousands which are sent across the ocean?

The plan which I shall present to you this evening is this: That we form an association of fruit growers which shall oblige all its members to sort their apples according to a set standard. This, we think, can be done by appointing inspectors who shall show the several growers how the apples must be sorted and packed. Each brand will then be marked with the association brand or label giving the name of the grower, requesting the party who buys the fruit to notify our secretary if the fruit is not put up according to our standard. This will be a check on those who might be disposed to cheat. We believe the brand of such an association, if properly managed, with efficient officers, would be a guarantee for good fruit well packed, and would give us a reputation and a profit, instead of a loss in handling our apples.

I think it is time for us to leave the middlemen, not that they are getting rich at our expense, but because of their disastrous methods of sorting. With the carelessness of most of the buyers in sorting, our State must soon lose her reputation for first-class apples. Nor is this all; we are losing money all the time by this pinching policy. Two-thirds of the apples would bring more money, with less expense by far. We must have better sorting, better packing, and thus less loss by rotting, wet and slack-packed apples.

The officers of the association should keep its members informed of the state of the market and give them the names of reliable firms abroad to whom they can ship direct, and such other information as shall enable them to sell in a good market, at a fair price.

But to return. How will an association benefit the fruit grower?

First. By teaching the proper methods of sorting and packing, that the fruit may arrive at the market in such shape that the loss will not eat up all the profit

Second. By allowing only first-class fruit to be put in as No. 1, and obtaining a better price, and in a few years establishing a reputation which will command higher prices.

Third. By selling direct to the wholesale dealers and saving two or three commissions.

Large interests are involved in this, and if the fruit growers are sufficiently interested it is important that measures be taken at once for an organization of such a society.

The address was referred to a committee consisting of J. W. True, H. W. Brown and C. H. George. At the winter meeting the committee reported as follows:

OUR NEED OF ORGANIZATION.

By J. W. TRUE, New Gloucester.

It is needless for me to take up your time in trying to prove that united effort in any given direction to accomplish any definite results can be done in very much less time, than as though each individual was working on a plan of his own, even if that plan was to work out the same desired result. Whenever a condition exists that tends to affect the interests unfavorably of any considerable number of people, especially in this free country of ours, the subject begins to be agitated, talked over, plans made, and not a few tried, to change those conditions, and in some cases they succeed to quite an extent; but when the subject is too large, extends too far and one life is not long enough to accomplish it, then men turn to each other and unite their efforts with a single aim toward the accomplishment of that much desired change for the better.

Now the question that confronts us to-day is whether our Maine apples shall be made to maintain and improve their reputation in the foreign markets—and how it shall be done. In the first place let us consider for a moment whether under existing circumstances this condition is being accomplished. Within the last two or three years it has been the custom for a few men known as shippers to buy up or engage all the Maine apples they positively can early in the season, so that in a short time after the crop is harvested, nearly all of it passes out of the producer's hands and into the hands and under the control of comparatively a few men, and each individual fruit grower tries to sell his stock to the best present advantage to himself, and for that reason it has become the rule to sell his No. 1's and 2's just as they come at the same price, (with the exception of the culls) with the understanding that the buyer is to pack them, and the universal testimony of the producer is that the packer takes them very nearly to an apple, puts in apples that they should not think of selling. In fact, I heard one packer say of another that "he put in apples that he would be ashamed to offer to his cow." The producer is pleased with the transaction, he sees a part of the barrels marked with a pencil No. 1 B, for Baldwins, or No. 2 B, etc., and thinks it is all right, but before those barrels go onto a steamer, they are regularly marked with stencil plate. I have recently talked with two parties that happened around when their apples were being marked, and it read something like this, the No. 1 B's were marked *Fancy Maine Baldwins*, the No. 2 B's were *No. 1 Extra Maine Baldwins*, and one of them (who has sold 200 barrels this year) said that he should be a little diffident about standing before the *consumer* and acknowledge that he was the producer of that barrel of *No. 1 Extra Maine Baldwins.*

Then again, the shipper is in a hurry to buy so as to get all he wants, and the farmer is anxious to have them packed at once so as to avoid loss by shrinkage, and a large quantity is barrelled up before they are wanted to ship, and we personally know of lots that were bought before the crop was all gathered, to be packed at once and they had not all been shipped, February 1st. Another lot that was packed early was partly re-packed, the balance just opened and the decayed ones that were in sight picked out, the head replaced, and sent to market in that condition. What shape must those apples be in after their transportation to a foreign market when they reach the consumer? One of the obstacles to a reformation in this business is that the producer appears to lose nothing at the time; in fact, he feels that he is the gainer in two respects, the packer takes all his apples and takes them at once. If there is a loss it appears to fall on the buyer, but if he makes but a small margin on each barrel by handling large quantities he makes money out of his winter's work. The loss to the producer comes in later. The Maine apple does not stand quite as high in the market as those from some other localities, notably Canada; the buyer cannot pay quite as high a price next year, but he will buy and pack the same as the year previous, giving satisfaction to the farmer as before. It should be our aim to change all this. We produce or could produce as fine apples as are grown in any part of the world, and what we desire is to have some system by which our fruit may be packed uniformly and marked honestly, so that when a barrel of apples is ready for market the producer could stand before the consumer and acknowledge without a blush that he raised, packed and marked those apples. When we have accomplished these results the price will improve from year to year over other stock that is sent under present conditions, and in order to achieve this we must have organized effort, have an inspector to look after and instruct the farmer in a uniform method of packing and marking. An association must be formed with officers, rules and regulations which the officers must see enforced, and the more strict the enforcement the better will be the results. It possibly might be thought best to send an agent to Europe to inspect the markets and to represent the association in the matter of business and perhaps as time goes on it will be thought best to establish a Fruit Exchange with store-houses arranged for the cold storage of our apples. There are great possibilities for such an organization, but the first great object is to get started, even if in a small way, and then by feeling our way along and finding out just what we want we will have courage to take hold of the more formidable problems as they may present themselves. We herewith present a few articles and rules under which it seems to us we could form such an organization as we believe would be of great benefit to the fruit growers of Maine.

BY-LAWS.

We, being fruit growers in the State of Maine and desirous of improving the quality of our fruit and arranging for a more uniform method of packing, marking and disposing of the same, hereby form ourselves into an association for that purpose and agree to be governed by the following by-laws:

ARTICLE I—*Name.*

This Association shall be known as the Maine Fruit Growers' Association.

ARTICLE II—*Membership.*

SECT. 1. Any fruit grower may become a member of this Association by paying a membership fee of —— dollars.

SECT. 2. Each member of this Association shall pay an annual assessment of —— dollars.

SECT. 3. Any member violating any of the rules or by-laws of this Association upon complaint coming to the Secretary, shall receive a notice from the Secretary, stating the complaint, with a request that more care be used to observe the rules, and for second complaint shall be given a hearing before the full board of officers of this Association, and if, in their judgment it be for the best interests of the Association, the member may be dropped from the roll of membership.

SECT. 4. Every member of this Association shall be entitled to one vote.

SECT. 5. Any member may vote by proxy provided he give notice to the Secretary of this Association.

ARTICLE III—*Officers.*

The officers of this Association shall consist of a President, Vice President, Secretary, Treasurer, and a board of three Trustees, the President and Secretary being members of the board *ex-officio.*

ARTICLE IV—*Duties of Officers.*

SECT. 1. The President shall preside at all meetings of the Association and shall be chairman of the Board of Trustees. In the absence of the President his duties shall be performed by the Vice President.

SECT. 2. It shall be the duty of the Secretary to keep a record of all the proceedings of the Association and of the Board of Trustees; to give to all members a proper notice of time and place of all meetings of the same.

SECT. 3. The Treasurer shall have charge of all the funds of the Association and shall disburse the same in accordance with a vote of the Association or by order of the Board of Trustees. He shall give bonds for the faithful performance of his duties if required so to do by the Board of Trustees.

SECT. 4. The Board of Trustees shall have a general supervision of all the affairs of the Association. They shall establish a standard by which all fruit sold under the Association brand, shall be packed and marked.

ARTICLE V—*Election of Officers.*

SECT. 1. The election of officers shall take place at the annual winter meeting of the "Maine State Pomological Society" unless otherwise ordered by the Board of Trustees.

SECT. 2. All officers shall be elected by ballot.

ARTICLE VI—*Term of Office.*

The term of all officers shall begin when chosen and continue one year or until their successors are chosen.

ARTICLE VII—*Quorum.*

—— members shall constitute a quorum to do business.

ARTICLE VIII—*Amendments.*

All amendments of the "By-Laws" may be made by a majority vote of all members present.

DISCUSSION.

Mr. G. F. HAMMOND. It is well known that the present method of disposing of our apples is a very faulty one. We now sell to middlemen who purchase for shipping to foreign markets and there are two or three profits on them before they reach the consumer. We desire to reach the consumer more directly. The fine flavor and high color of our apples gives them a value above those raised elsewhere, and we should be able to dispose of them in such a way as to get the benefit of it.

Mr. H. W. BROWN. As a member of the committee I have tried to learn something about the practical working of other organizations similar to the one proposed, but have not succeeded in learning much that can be of value to us. As a general thing these fruit exchanges are nothing more or less than commission houses. They receive fruit from various quarters, place it in their store-houses, assort it, and in selling put their own special brand on the best fruit and sell the remainder as ordinary. The buyers that go through the country seem anxious to get everything regardless of quality, and so manage them as to make a large profit. We must organize a society if we can, but it is a matter of great difficulty. We want to make some arrangement to handle and manage our fruit so that we can stand behind it ourselves. We must establish a market where we can obtain first-class prices for first-class fruit, but I hardly know how it is to be done. When farmers are satisfied with what they are doing and getting, it is hard to get out of their present track.

Dr. G. M. TWITCHELL. For a series of years some of the patrons of Northern Aroostook have massed their wool, placing it in the hands of a representative of the order to be sold, and have realized from two to five cents a pound more than was paid to others. I merely mention this to show what you can do in a similar manner by combining for the sale of your apples.

Mr. POPE. I think there are a few fruit growers here who feel that such an association is desirable, but it will require much wisdom to make it a success. It cannot be done unless we take hold of it heart and hand. Our people are so well satisfied that they cannot look ahead. Our reputation now is below that of New York and Canada and yet we can raise as good fruit as they. Our buyers have been buying the whole crop, putting the poor apples in the middle of the barrel and the good ones at the top and bottom, and we are the ones to suffer in the long run. We have great difficulties to meet in organizing an association. How is it going to be possible to prevent a man from putting in bad apples and marking it with the brand of the association? If we could raise capital enough to provide for bringing the apples all together to one point and having them assorted or inspected it might do, but that would be very expensive. Not a quarter part of the growers of apples know how to pack. Some pack too loosely and some too closely.

Mr. KNOWLTON. I do not rise to discuss this matter now, but to impress upon you and those present the importance of the subject. I think our president has touched the key-note exactly, in combining his remarks with those of Mr. True concerning the satisfaction of farmers with the prices they are receiving this year. The question is not about this year, but looking forward into the future what is it that is going to sell Maine apples in competition with those of other places? If I were a large grower of apples I would not risk my reputation in the hands of men who go through the State and buy apples for speculation. The only safety in past years for large growers, has been to pack the apples themselves and place them where they could get good prices. I will refer you to the case of our president here in illustration of the point. His apples have sold from one dollar to three dollars a barrel in excess of the general market price because of the reputation he has won. I will call upon my friend, Mr. Whittier, to give us his experience.

Mr. WHITTIER. I would say that the best way that I can do is only to market my best apples in a green state and evaporate the inferior ones. I take the same pains with the evaporated apples as with the green apples so as to establish a reputation for them. By keeping the inferior apples for evaporating I get as much for the choice apples as I could for all together as they are usually handled. It has previously cost me about two and a half cents a pound for the labor in evaporating. This year I have obtained a better evaporator and it has only cost me about two cents. This year I got a little over seven pounds to the bushel of apples. The whole cost amounts to just about three cents. That would be about twenty cents a bushel. Last year the evaporated apples would sell for nine cents a pound, but this year they bring from nine to twelve cents.

In most years it does not pay to send fall fruit to Boston. Only once in a while will it pay to send second quality apples to Boston. One-half of the apples which I evaporate would pass for a second quality and the remainder such as we would feed out to stock or make into cider.

Question. How small apples do you put into your No. 1's?

Mr. WHITTIER. That depends upon the kind of fruit and the quality. In the case of Baldwins I would put in an apple two inches in diameter if it were fine and smooth.

Mr. KNOWLTON. I am thankful to Mr. Whittier for establishing a point in connection with this matter of a fruit exchange. He is a large grower of fruit and does not care whether we have an exchange or not. His apples are going to sell first anyway. But there are few who raise apples enough to get the reputation of Mr. Whittier even if they exercise the same care.

Now the idea of this fruit exchange is to meet just that point, so that the man who raises ten barrels or even two or three barrels by following the directions given may have the advantage of just the same reputation that Mr. Whittier has won for his fruit.

I am not willing that the matter be dropped here. I do not desire to press the matter at this time, but that it shall have further consideration, I move that the committee be continued, so that if they see any way to carry the matter further in the future they may do so and bring it before some future meeting.

[In accordance with this motion the committee was continued for the ensuing year and the matter referred back to them for further consideration.—SECRETARY.]

REPORT OF COMMITTEE ON NEW FRUITS.

D. H. KNOWLTON of the Committee said: There are many different varieties of apples sold in this State by agents, some of which are not known to the officers of the Society. We have a great many enquiries from farmers from time to time.

My attention has been called to the Wealthy apple. You are all aware of its beauty and excellence. An objection is that it drops badly, but it is claimed that if picked as soon as it is ripe it will not drop any worse than other varieties. If picked at the proper time it will keep till late in winter.

Mr. BLOSSOM of the Committee: I wish to call attention to two varieties of apples which have been confused. Agents have gone over the country and represented the Stark and the Starkey as the same apple. They have been placed on exhibition at the State fairs, both as the same apple. The Starkey originated in Vassalboro', Maine, on the farm of Moses Starkey. It is very vigorous and hardy. Its season is from October to January. The Stark is of unknown origin. I raise the Stark. When the trees first came into bearing I recommended it, but I find that the more I raise it the less I like it. Its greatest fault is that it drops from the tree early in the season which is a fault for a late winter apple. I have no apple that the codling moth seems to take to so much as to that. I will speak of an apple grown in some parts of the State and which should be grown more than it is. The tree is hardy, and there are few better apples in the State of Maine. It is the Milding. It is an old apple, having been raised to some extent for quite a number of years. I find we can raise this variety in places where we cannot raise the Baldwin.

RUSSIAN FRUIT.

By Dr. T. H. Hoskins of Vermont.

I suppose that this subject which has been announced is one upon which there is as little general knowledge as any subject in pomology. In all the great fruit growing regions there are established varieties and there is but little desire for new ones. There have been attempts, on the part of tree agents, to introduce Russian apples in districts where they are not required. We may state, in the first place, what is meant by Russian fruit.

About fifty years ago three varieties were introduced from England, obtained there from Sweden and introduced as Swedish apples; the Duchess, the Red Astrachan, and the Alexander. Some other varieties were brought at the same time, but did not attract so much attention. The Red Astrachan was found to succeed equally well in Maine, in Louisiana, and on the Pacific coast. It originated in the Province of Astrachan where the climate is not so severe as here. It is not strictly an iron clad variety. The Duchess of Oldenburg got an almost equally wide distribution. It has proved better in quality, and the farther north it is grown the larger and better it is. I sent Mr. Downing a specimen of it and he was so struck with it that he sent for scions, but afterwards found that it was the same as his own.

The first Russian apples introduced proved very satisfactory, because they are susceptible of being successfully grown in so many different locations. An attempt was made to have other varieties imported from Russia and an appropriation was made by Congress for that purpose. Between two and three hundred varieties were imported and distributed. The distribution was made, as is usual among Congressmen and their constituents. They should have been distributed among nurserymen and responsible and interested parties. The parties who received those varieties must have thrown them out of doors or burned them up. At all events, out of 300 kinds imported I do not know of more than about forty now in existence.

About eight years ago the people of Iowa, feeling the necessity of hardy varieties, sent the professor of their horticultural school to Russia. He visited all the fruit districts and brought home a good collection, as numerous as that of the government. A neighbor of of mine, over the Canada line, also brought from Russia a good collection.

The Alexander is a very popular apple, and the Duchess sells as high in market as the Gravenstein. This is surprising to some, but it must be remembered that only a small portion of our apples are used for dessert purposes. By far the larger part are used for cooking. The Russian apples are not, as a class, inferior. The most of them are early bearers, and the fruit averages large and handsome. A fair proportion of them are of fair dessert quality. Perhaps the proportion is as great as in our American apples. There are a dozen out of the Russian varieties better in quality than the Baldwins.

The Russians handle their apples with greater care than we do, and in that way they are able to keep them very well. Our apples are so good keepers that we are in the habit of abusing them. Their season is very short and filled with vivid sunshine. The apples must mature quickly and be gathered early in September. In sweet apples, and nice early apples the Russians are well supplied.

I think that out of the two or three hundred Russian apples imported and now being tested in the Northwest we shall have an abundance of good fruit for supplying Aroostook county with all they will need. I think for Aroostook, the Wealthy will take the place of the Baldwin.

In regard to the other tree fruits of Russia we know but little. The Russian pears are evidently a distinct variety or a distinct species. Some of them have a very thick, glossy leaf. I think they are descended from the stock of Northern Asia. They show a wide difference from our pear trees. In their vigorous growth of foliage and exemption from the injury of insects and fungous growth they are quite wonderful. I have trees ten feet high that were brought over in 1884.

The Bessemeanka is grown a great deal in Germany. My own trees have blossomed two years but I have only obtained a single pear. There is quite a discussion with regard to the quality of this pear. It seems to be the principal pear in Russia as the Bartlett is in New England.

There is a great number of Russian plums and a great choice among them. I have fruited only one kind as yet, called the Early Red. It is of good size and somewhat larger than the Lombard. In ripening, it first becomes yellow, then purple and then red. The plums of Russia do not seem to be so different from ours as the apples and pears.

The cherries come largely from Northern Germany. Several kinds we have proved to be hardy. They belong to the Mazzard family. They are cherries that grow and improve after they are colored. If you can protect them from birds till they are ripe they are good, for an acid cherry, as good as any I know. They do not grow very high but bear profusely.

DISCUSSION.

Mr. KNOWLTON. Do you consider the Keifer pear adapted for Maine?

Dr. HOSKINS. The Keifer pear and all that class of pears, are better the farther south they are grown. In New England they will never be of any use except for cooking purposes. Probably the Keifer is the best cooking pear known. Pears generally lose their flavor in cooking but the Keifer is improved by it.

Mr. KNOWLTON. The question is whether we wish to buy for Maine, a pear that only possesses good cooking qualities?

Mr. POPE. I have fruited that pear half a dozen years. The best I could do has been to get one pear, the size of a hen's egg, and a meaner pear never was grown. I did not try to cook it because I did not think it was possible.

Dr. HOSKINS. That flourishes in the Southern States, but will not do well even so far north as the Middle States.

MAINE FRUIT AT THE BAY STATE FAIR.

By HENRY W. BROWN, Newburg.

The officers and members of the Maine State Pomological Society collected and sent an exhibition of apples to the Bay State Fair, held in Boston the second week in October, 1889, of which I had the charge. The collections and display of apples were fine, being shown in a very high, attractive, well lighted building with plenty of room. The number of entries in the apple department was large, there being several entries in the collections and a very large number of entries of single plates. The apples were all shown on large flat plates with just twelve specimens on a plate. This feature added much to the fine display. The largest collection was exhibited by Warren Fenno of Revere, Mass., and consisted of fifty-two plates of apples and pears. The first premium of $50 was awarded to him. The Maine State Pomological Society in this department had twenty-eight plates and received the second premium of $30. The Society also took premiums on ten single plates as follows: Charles S. Pope, Baldwins, $3; E. H. Keniston, Fameuse, $3, Porter, $3, Tompkin's King, $3, R. I. Greening, $2; A. N. Goodrich, Garden Royal, $3; C. B. Nottage, Pumpkin Sweet, $2; H. W. Brown, Maiden's Blush, $2; Mother, 3; Talman's Sweet, $3.

There were apples in the collection grown in different parts of the State, among which was a plate of McIntosh Red from Franklin county. There was no plate in the entire exhibition of fruit that attracted so much attention from visitors as this. It was superlatively fine.

In addition to this report I will call attention to some of the exhibits I noted while at the fair. The display of pears was very large and fine. There must have been nearly four hundred plates, from the smallest Seckel to the large Duchess. Of the latter variety there were twenty-eight plates, from which it was not an easy matter to pick out the best. The committee selected eight plates which they considered the best, and put them in the scales in order to get the three heaviest, on which to place the premiums. The lightest tipped the scales at thirteen pounds two ounces and the heaviest at thirteen pounds four ounces. Four of the heaviest on this plate weighed one and one-fourth pounds each. The Louise Bonne de Jersey came next in order as to size, and the showing of this variety was large. But for beauty the Sheldon takes the lead ; there was a very large exhibit of this variety, all being placed on large platters on a table together. They looked very fine and they were nice ; I know by the eating of some of them myself. There were a great many other varieties of very fine looking pears. This part of the exhibit alone was worth going a long way to see.

The apples of Massachusetts are not so good, or, at least, not so fine looking, with few exceptions, as our Maine apples. The Baldwins, Rhode Island Greenings, Snows and many others seemed to spot very badly, more than I ever saw them at home. The Gravensteins and Hubbardstons of Massachusetts are very fine. I never saw any in our own State that were nearly so fine. *I took a specimen of Gravensteins with me from home and it was the best that I ever saw, but when I got there found that I was far behind in that variety.* Of new varieties I saw but one that promised very *much*, and that was a Russet, which in shape resembled the *Worcester* Russet. The color was a leathery or a little of the reddish cast. It seemed to be a very fine apple. Flavor sub-acid. The committee gave it the name of Fletcher Russet.

The flowers and plants in the exhibit were very good, especially in the potted plants, of which there was a very large show of large and rare plants. The cut flowers were arranged about the same as we arrange them at our fair, and although not so large a display, perhaps, as we usually have, but being displayed in so large a hall with plenty of room to move around them, they made a very fine show. In the center of the hall there was arranged a lily pond that looked very nice. It was arranged by inserting the stems of the leaves and flowers in bottles and sinking them so that the flowers and leaves would float on the water.

The show or exhibit of farm products seemed to be made mostly by market gardeners, and it was very large and the finest that I ever saw. There was about everything in the vegetable line, also many kinds of corn, beans, peas and grains of most all kinds. One thing I noticed in particular, every article shown in this department was of the very finest quality, not large or overgrown as we usually see at our fairs, but of just the right size for table use, and really about the smallest beets shown took the first prize.

NEW VARIETIES.

By S. G. SHURTLEFF, South Livermore.

So many new varieties of fruit are advertised every year that often it is quite difficult to decide what to select. Many nurserymen are not reliable, and, without waiting to test new varieties, often offer them to the public with extravagant recommendations. With occasionally an exception they usually do not come up to the recommendations and prove to be inferior to older and well known sorts. As they always charge high prices for new varieties such nursery companies and their traveling agents, find it more profitable to sell such stock, and generally find the people more willing to buy it. There is too much humbugging done in this business, and doubtless will be so long as so many people are so easily taken in. Experienced fruit growers are shy of new varieties, but the majority of people have to depend upon the recommendation of the tree agent, or of untrustworthy catalogues. How the Jessie strawberry was boomed a year or two ago—which proved inferior to all the older varieties. With me it proved absolutely good for nothing. More new varieties of strawberries are sent out every year than of any other fruit, and nearly all of them prove disappointing. Two exceptions that may be mentioned here are the Haverland and Bubach. The former seems to give general satisfaction in productiveness wherein new varieties usually fail. The Bubach is also very productive, of very large berries. But the claim that has been made, that it is the coming market berry should be taken with caution as it is soft for shipment, and its season with me is too short, not more than half as long as that of the Crescent.

People generally will not take the trouble to lay down raspberry and blackberry canes for protection in winter. Therefore, while quality and size are desirable, hardiness is the most important consideration. There are varieties, which, if shortened back so as to mature the wood, are sufficiently hardy to withstand our winters with the aid usually afforded by the snow. The results of two years' testing of many varieties of raspberries and blackberries by Prof. Maynard are given in the following table, indicating greatest perfection:

	Productiveness.	Quality.	Earliness.	Size.	Per cent winter killed.	Remarks.
Raspberries.						
Rancocas	6	1	-	4	40	Very good.
Brandywine.........	5	3	3	5	23	Good.
Belle de Fontaine ..	7	6	7	2	13	
Highly Hardy	8	1	2	6	15	
Crimson Beauty.....	5	4	2	5	28	
Cuthbert............	1	5	9	2	-	Standard market berry.
Hansel	1	2	2	5	35	Profitable.
Marlboro...	2	5	2	2	52	Firm,pr'f'table,high culture
Golden Queen	5	7	9	2	27	Soft
Caroline	4	3	3	6	12	Very soft.
Turner..	5	6	2	7	13	Small and crumbles.
Black Cap.						
Nemeha.	4	7	9	5	78	Vigorous
Cromwell............	2	3	3	4	-	Promising, vigorous.
Hilborn....	1	2	8	3	-	Not sufficiently tested.
Thompson's Sweet....	6	7	4	5	-	Not sufficiently tested.
Ohio................	3	7	3	2	16	Vigorous.
Gregg	1	3	10	1	39	Tender.
Blackberries.						
Erie................	5	6	5	2	16	Continued fruiting until [August 28.
Early King	6	3	3	4	-	
Wilson, Jr..	2	8	8	2	25	
Wilson's Early.... ..	3	7	2	2	48	
Early Harvest.......	1	5	1	5	62	
Early Cluster	3	6	1	4	21	
Agawam	5	1	2	3	5	Sweet and quite firm.
Taylor's Prolific ...	1	3	9	3	10	
Wachussett	4	4	5	5	8	
Snyder..............	3	3	5	4	9	
Minnewaski.........	5	7	4	5	20	
Excelsior	8	6	5	8	50	
Lucretia......... ..	3	8	2	2	14	Productive, good.

This table cannot everywhere be taken as a standard for productiveness. For many of the varieties will vary much in this respect in different places and on different soils. But for quality, earliness, size and hardiness, it may be considered reliable. Certain new varieties recently offered to the public as something remarkable, according to this table are inferior to the old sorts. The Nemeha which was to supersede the Gregg on account of its hardiness, is put down as the most tender of the lot. The Golden Queen which is now being boomed, is not equal to the Caroline. The Erie and Minnewaski blackberries which are also now being boomed are inferior to older and well-known varieties. The Cromwell and the Hilborn seem to be the most promising of the new varieties. And the Cuthbert raspberry and the Agawam and Snyder blackberries, well-known standard varieties, still remain near or quite at the head of the list.

I think the cherry is too much neglected in this State. Doubtless the ravages of the black-knot and the depredations of the birds are very discouraging; but there are some varieties not difficult to grow under proper conditions. I believe if it was better appreciated it would be more generally grown. There is no fruit I value so highly for canning, and none that so well retains its flavor when canned. Most of the sweet varieties are rather tender for this latitude. The Black Heart which has hitherto been the only perfectly hardy variety, is a capricious bearer, and in some localities will not bear at all. There has recently been introduced another variety, equally as hardy and an earlier and more reliable bearer. This is the Windsor. Mr. Willard, who seems to be high authority, stated at a meeting of the New York Horticultural Society, that it was the best cherry for both market and domestic use, of the sweet varieties. The Morello cherries are hardy and more adapted to Maine than the Heart or Bigarreaus. The old English or tame cherry and the Early Richmond are as good as any for canning or cooking. Of the many kinds of the Morello class advertised by nurserymen, there are some of very good quality, but they are apt to be shy bearers. There is one promising new variety, however, which is very hardy, very productive, and of quite good quality, and that is the Montmorency Ordinaire. President Barry says it has been tested in many sections of the country, East and West, and is giving excellent satisfaction. One tree set eight years ago by a neighbor of mine, proved an early and abundant bearer. Mr. Willard, referred to above, at the same meeting, said the Montmorency was the best sour cherry for all purposes. The Dyehouse is earlier than the Early Richmond, and is the earliest reliable cherry. It is hardy, very productive, an early bearer, and, when perfectly ripe, of good quality. It is very highly recommended, but it has not been tested in this section to my knowledge. I have trees set two years ago which are doing finely.

Professor Budd has brought a great many varieties of cherries from Europe to test in Iowa. As the climate is as severe in winter in that state as in Maine, some varieties which succeed there, may be desirable here. Some of them have proved hardy even in Minnesota, and they ought to succeed in Northern Maine. Professor Budd says these trees, "have been exposed to the recent test summers and winters that have killed out the young trees of the grade of hardiness of the Early Richmond and English Morello." The most promising of these are, the Orel, Cerise de Ostheim, Shadow Amarelle, and Spate Amarelle.

Our summers are so short that it is quite difficult to raise grapes in Maine. However, if all the conditions necessary to success are observed, enough can be raised for home use. The earliest varieties, dry soil, a warm, sunny spot, sheltered from northerly winds, vines not allowed to carry too much fruit, and fertilized with well decomposed manure and ashes are the most important conditions. The selection of late varieties like the Concord, Pocklington, Niagara, etc., has done much to discourage grape growing here. The Worden, Brighton and Delaware may be tolerated on account of their good quality, but we want earlier varieties than these. The Janesville is the earliest variety I have now that has fruited, but it is of too poor quality to be generally recommended. Like strawberries, there are many new varieties constantly coming out, and we shall soon have some as early as the Champion and Janesville and of much better quality. Indeed, there are now five or six new varieties recently sent out with great flourish, combining with other good qualities, extreme earliness. These are the Northern Light, Winchell, Colerain, Green Mountain, Moyer and Jewel. Making due allowance for the usual exaggeration of the parties who propagate them, I have strong hopes that out of this list we shall find one or more good grapes as early as the Janesville or Champion.

CONDENSED FRUIT LIST.

The high prices received for Maine fruit the past season (1889) in some instances as high as $8.00 a barrel in the Boston market has given a new impetus to fruit growing, and many people are preparing to extend their orchards by setting more trees. The agents of nurserymen are canvassing in all parts of the State, and from many quarters inquiries come asking what kinds to set? As an aid to those seeking information of this nature it has been thought best to publish a condensed list of fruits in the present volume. It should be borne in mind that while the Society does not urge Maine fruit growers to plant only the kinds enumerated, attention is called to the fact that so far as the apple list is concerned it contains the apples which the past ten years have been found the most profitable in the State. Occasionally some orchardists have found other varieties for local reasons profitable, but when the fruit has gone out of the State, those whose names are followed by a star (*) have brought the most liberal returns. The experience of our best orchardists therefore recommends those which bring in the most money, and their experience so far as contained in the list may be regarded as a safe guide by the inquirers. Those printed in italic are considered the best in quality.

APPLES.

SUMMER—Duchess of Oldenburg, *Early Harvest*, Golden Sweet, *King Sweet,** Large Yellow Bough (sweet), *Red Astrachan*,* *Russell*, *Tetofsky*, *William's Favorite.**

AUTUMN—Alexander, *Deane*, *Fameuse*,* *Garden Royal*, *Gravenstein*,* *Munson Sweet*, *Porter*, *Pound Sweet*,* Wealthy.

For trial, Montreal Peach, Somerset, Gloria Mundi.

WINTER—Baldwin,* Granite Beauty, Harvey Greening, *Hubbardston Nonsuch*, *Jewett's Fine Red*, *King Tompkins*,* *Milding*, *Rhode Island Greening*,* *Rolfe*, *Stark*, *Talman's Sweet*,* *Yellow Bellflower*, *American Golden Russet.*

For trial, McIntosh Red, Minister.

LATE WINTER—*Northern Spy*,* Roxbury Russet *

In the above list it should be borne in mind that the seasons, so far as used with reference to the maturity of the fruit is necessarily somewhat indefinite, since the same variety grown in different parts of the State or on different sites in the same locality actually has different times of maturity. As an illustration of this at this time (May 15th) from a farmer's cellar in Franklin county we received perfect specimens, just in their maturity, of Baldwins. In most localities in the State this variety was past maturity several weeks earlier.

AROOSTOOK COUNTY—From reports received there are several apples that thrive here, among which are Red Astrachan, Duchess of Oldenburg, Fameuse, Alexander, Wealthy, Yellow Transparent. The Dudley is also recommended by those who have tested it.

DESCRIPTIONS OF FRUIT.

NEWTOWN PIPPIN—As there is a general desire for information concerning this variety of apples, which thus far leads all American apples in the foreign markets, we publish below full descriptions taken from our best authorities. So far as the Committee are able to learn the apple does not succeed well in any part of this State. For experimental purposes it is, however, being set by a few growers, and before many years we hope to be able to record the results. The description is given for information only, as we do not recommend the variety for Maine:

"One of the most celebrated of American apples, on account of its long keeping and excellent qualities, and the high price it commands abroad; but its success is confined to certain districts and soils. It attains its greatest perfection on Long Island and the Hudson. In Western New York and New England it rarely succeeds well. It requires rich and high culture, and it makes such slow, *feeble* growth that it has to be top grafted upon a strong growing variety. November to June".—*Ellnanger & Barry.*

The Newtown Pippin stands at the head of all American apples and is, when in perfection, acknowledged to be unrivalled in all the qualities which constitute a high-flavored dessert apple, to which it combines the quality of long keeping without the least shrivelling, retaining its high flavor to the last. The fruit is of medium size; roundish; a little irregular in its outline, caused by two or three obscure ribs on the sides—and broadest at the base, next the stalk; about three inches in diameter, and two and a half deep; color dull green, becoming olive green when ripe, with a faint, dull brownish blush on one side, dotted with small gray specks, and with delicate russet rays around the stalk. Calyx quite small and closed, set in a narrow and shallow basin. Stalk half an inch long, rather slender, deeply sunk in a wide, funnel-shaped cavity. Flesh greenish white, very juicy, crisp, with a fine aroma, and an exceedingly high and delicious flavor. This is one of the finest keeping apples, and is in eating from December to May. This description is abridged from Downing who adds "This is entirely distinct from Yellow Newtown Pippin, which is handsomer in appearance and has a higher perfume. When fully ripe the latter is yellow, with a rather lively red cheek, and a smooth skin. It is hardier than the former."

RUSSELL—This apple has been traced to the farm formerly owned by Capt. William Russell of Farmington, where it was known to be in fruit over fifty years ago. There is a tradition that Capt. Russell who was an early settler in Farmington walked from Massachusetts to his farm and brought in his pockets a lot of apple seeds. These were planted, and this variety is supposed to be one of the seedlings. The first scions were taken from the tree by Eliab Eaton and later more were taken by James Seales. From these cuttings the variety was mainly disseminated.

The apple has a well established reputation in Franklin county, where it is recognized as superior to any other apple maturing in the early autumn. It was exhibited at the county fair some years ago, and by some was called "Cole's Quince," since which time by many it has borne that name, locally. But recent committees at the State fairs, say this apple is not the one described by Downing as the Cole's Quince.

The Russell is thus described by President Pope: Large, round ovate, sometimes oblong conical, somewhat flattened at the base, nearly regular; color bright yellow, with a red cheek in the sun, obscurely striped; surface waxy; stalk very short in a small narrow cavity; calyx closed, basin small; core small; flesh yellow, fine grained, pleasant sub-acid; quality best; season September; tree spreading, hardy, an early and regular bearer.

HURLBUT—Origin, Winchester, Conn.; tree very vigorous, and a great bearer; young wood dark brownish red, slightly downy; buds prominent; fruit medium, oblate, slightly conic, angular; skin yellow, shaded with red stripes, and splashed with darker red, and thinly sprinkled with red dots; stalk short, rather slender, inserted in a broad deep cavity, surrounded by russet; calyx closed; basin rather shallow; flesh white, crisp, tender, juicy, mild, sprightly, sub-acid; good to very good; core small; October, December.

BAILEY'S SWEET—Origin unknown, introduced by a New York party; tree hardy, vigorous, upright, spreading, productive. This variety is regarded as profitable for all purposes, although perhaps a little too tender skin for shipping long distances; fruit large, form roundish conical, often approaching oblong, obscurely ribbed; color yellowish, mostly shaded and obscurely striped with red, and thickly sprinkled with minute dots; stalk short and rather small, inserted in a narrow cavity; calyx small, closed, set in a narrow, irregular basin; flesh white, tender, not very juicy, almost melting, with a honeyed sweet flavor; core rather large; very good; November to March.—*Downing.*

FALLAWATER—A favorite apple of Pennsylvania of which state it is a native; tree a strong grower and very productive; fruit very large, globular, inclining to conic; skin yellowish green, shaded with dull red, and sprinkled with large gray dots; stalk very short, inserted in a deep cavity; calyx small and closed, set in a slightly plaited base; flesh greenish white, juicy, crisp, rather tender, pleasant, sub-acid flavor; good; November to February.—*Downing.*

STARK—Origin unknown, grown in some parts of Ohio, and valued as a long keeper and profitable market fruit; tree vigorous, upright, spreading; young shoots dark brownish red; fruit large, roundish, inclining to conic, sometimes a little oblique; skin greenish yellow, shaded, splashed and striped with light and dark red nearly over the whole surface, and thickly sprinkled with light and brown dots, a portion of them areole dots; stalk short, rather stout, inserted in a medium cavity; calyx closed; basin rather large, slightly corrugated; flesh yellowish, a little coarse, moderately juicy, mild sub-acid; good; core small; January to May.—*Downing.*

Some confusion has arisen regarding this apple and the Starkey to which reference is made by Mr. Blossom on page 125 of the Transactions.

PEARS.

SUMMER — *Bartlett*, Brandywine, *Clapp's Favorite*, Osband's Summer.

AUTUMN—Belle Lucrative, Beurre Superfine, Eastern Belle, Goodale, Louise Bonne de Jersey, Nickerson, *Seckel*, *Sheldon*.

WINTER—*Beurre d' Anjou*, Lawrence.

HISTORY OF THE BARTLETT PEAR.

Mr. Thomas W. Silloway in the *Massachusetts Ploughman*, after years of careful investigation gives to the public the following facts regarding this excellent pear:

I am clear that our Bartlett pear and the English "Williams' Bon Chretien" are one and the same thing. I make no especial claim to this discovery for it has been accepted as a fact for something more than sixty years.

Early in my investigations I became convinced that the pear did not originate with Mr. Bartlett of our Roxbury, and from whom it took its American name, but that it was of English origin and imported.

I am now able to say that such is the fact, and that it has been known there by its English name for more than a century. The words "Bon Chretien" are pure French, meaning Good Christian. There was at the time another pear known as the "Bon Chretien," and that I think was of French origin, and hence its name. Mr. Williams of England as will be seen later on, having presented the new one to the public, gave it his name, a half century later, the same pear in America took the name of its raiser and owner, Mr. Bartlett.

The first notice of the fruit I have been able to find is in the second edition of William Forsyth's treatise on the culture of fruit trees. Mr.

Forsyth was superintendent of St. James and Kensington gardens at London, and died in 1804. In the work referred to, published in 1784, one hundred and six years ago, he says of the Williams' Bon Chretien:

"This is a seedling pear from Williams' nursery at Turnham Green, originally from Berkshire. It resembles the summer Bon Chretien, but it is more juicy; it is a great bearer, and ripens in (August on walls) September. This pear will be a valuable acquisition to the market gardeners as it immediately succeeds the Windsor pear. It is of a large pyramidial shape; the eye not sunk; of a pale green color, spotted with darker green and russet brown, turning yellowish and faintly tinged with red next the sun when fully ripe; the flesh whitish, tender, and full of sweet perfumed juice."

The next information I quote from the "Transactions of the London Horticultural Society." Page 250 of Vol. 2.

"LXV. Account of a new pear (with a figure) called Williams' Bon Chretien; in a letter to Joseph Sabine, Esq., Secretary. By Wm. Hooker, Esq., F. H. S.

"DEAR SIR: I beg leave to lay before the Horticultural Society an account, which I have obtained at your request, of a variety of pear; specimens of which were communicated to the Society in August last by Mr. Richard Williams of Turnham Green, and much approved.

It will be remembered that Mr. Forsyth spoke of it as a "seedling from Williams' nursery at Turnham Green, originally from Berkshire."

The statement of its being a seedling from Williams' nursery, would imply that it originated there, but the additional remarks, "originally from Berkshire," raises the question, which of the two, the pear, or the nursery itself, was originally there. All is yet in the dark, but the "missing link" is found in a work by William Aiton, "Hortus Kewensis," published in London, in 1789, just a century ago. Mr. Aiton was superintendent of the royal gardens at Kew, as early as 1759, and he did much to improve and prepare them as we see them to-day. In the work named he remarks as follows:

"The Williams' Bon Chretien, appears to have sprung from a seed in the garden of Mr. Wheeler, a schoolmaster at Aldermaston in Berkshire, about twenty years ago. It was suffered to remain in order to prove the value of its fruit. Subsequently, grafts have been extensively dispersed, and many trees are now in Mr. Williams' nursery and other gardens about London."

As Mr. Aiton wrote sometime before 1789, and states that the seedlings originated about twenty years before, we have as the date of its appearance not far from 1769.

I now return to Mr. Hooker's letter before spoken of, and in it he describes the fruit as follows:

"The trees of this variety are of vigorous growth and fertile habit; their branches remarkably erect and straight until bent by the weight of fruit. Leaves broad, deep green, very sharply serrated. Fruit, of an irregular pyramidal and somewhat truncated form; large, being from three to four and one-half inches in length, and two to three inches in width at the widest part near the head. The eye is inserted on the summit and never sunk in a hollow cavity as in the other varieties called Bon Chretien. The stalk is very gross or fleshy, about three-fourths of an inch in length. The color of the fruit is pale green, and russet brown, becoming yellowish and faintly tinged with red on one side next the sun when fully ripe. The flesh is whitish, very tender and delicate, abounding with juice, which is sweet and agreeably perfumed, ripens in August when trained to a west wall, but on standard trees it is three weeks or a month later."

Any person familiar with our Bartlett pear will at once recognize the description as perfect in every point.

At the time Mr. Hooker made his report, which was in 1816, the pear was evidently one few people were acquainted with, and certainly the Horticultural Society had not as yet taken it under its fostering care, and given it its sanction, for Mr. Hooker continues as follows:

"This pear I would recommend to the notice of the Horticultural Society as superior to any of its season with which I am acquainted. It immediately succeeds the Jargonelle, and is earlier as well as much superior to the Doyenne, or White Beurre, and resembles in flavor the Summer Musked Bon Chretien. Its merits over the latter variety are, that on standard trees as well as trained, it seldom fails to produce fruit in abundance."

He next presents a drawing of the fruit, which, I will say, exactly conforms to an average outline of our Bartlett, and he adds:

"The drawing which accompanies this was taken from specimens which ripened on a west wall, and may be considered an average size; but I have seen fruit of this variety weighing from ten to twelve ounces."

I remain, sir, most respectively and sincerely yours,

WILLIAM HOOKER.

NO. 5, YORK BUILDING, NEW ROAD, November 30, 1816.

As will be observed, this was written about seventy-four years ago, and when it was not a very well known fruit, although as we have seen that Mr. Aiton, in his Hortus Kewensis, had spoken favorably of it in 1789, now a century ago, and twenty-seven before we find Mr. Hooker commending it to the favorable notice of his society; suggesting, then, as now, that there is slowness in the movement of "large bodies."

We have thus traced, with considerable accuracy, and a good degree of certainty, the English Williams' Bon Chretien, back to its origin as a seedling, in the garden of Schoolmaster Wheeler at Aldermaston, in 1769. We find in the descriptions given by both Aiton and Hooker, a close resemblance to our Bartlett, and the question for our consideration is this —Are they identically the same, and was that the origin of our pear?

I trust I shall be pardoned the seeming egotism when I state, that being in England the past summer, and having good facilities for examination, I investigated the question quite thoroughly, examining both trees and fruit, and I was fully convinced that the fruit was identical with our pear. I think there is an absolute agreement. We now take one step more. Mr. Robert Manning, the well-known pomologist of Salem, writing in 1830, remarks as follows:

"I procured in the spring of the present year two trees of Williams' Bon Chretien, one from William Prince of Flushing, who received it from Mr. Bradick, the other from Buel & Wilson of Albany, by whom it was imported from the London Horticultural Society." So it seems that Mr. Hooker's recommendation to the Society had been heeded, and in this year, fourteen later, the venerable Society had aroused from its slumbers, and was dealing in the trees.

Mr. Manning continues, "As soon as the leaves expanded I perceived those two were alike, and possessed all the richness and beauty of foliage which distinguishes the Bartlett, and were so perfectly similar to it in every respect that no person would hesitate to recognize them as the same." Mr. Manning either had his attention called to the fact of this similarity, or had discovered it himself, and considering the fact that he was a painstaking observer, and a constant investigator of matters pertaining to fruit, it is not too much to assume that he himself made the discovery. Not content with the observation and conclusion to which he had arrived, he determined to investigate further, and if possible trace back the Bartlett to its source. He says, "I was told that Mr. James Carter of Boston, had procured trees from England for Mr. Brewer, the former owner of the Bartlett estate in Roxbury. I called on him. He informed me that he was in London about twenty-five years ago, and purchased pear trees for Mr. Brewer, and as his object was to obtain what was then rare and valuable, there can be no doubt that the tree now called Bartlett was in the collection."

Assuming the words, "about twenty-five years ago" to have been a correct statement, then the tree was procured in 1805, eleven years before Mr. Hooker's investigation, and sixteen after Mr. Aiton's notice of it in the Hortus Kewensis and about twenty-six years from its first fruiting, assuming for our purpose, that it was a young seedling in 1769, and bore its first fruit ten years later. Of course our data not being clear, we are not sure in our conclusions; enough however has been named to show that it was a new pear, and had received favorable mention by Aiton and Forsyth; that Mr. Carter had procured trees for Capt. Thomas Brewer, and was of the opinion that "the Bartlett was probably among them, as he had endeavored to obtain what was then—in 1806, 'rare and valuable.'"

Now, what was the opinion of Mr. Manning after the further investigation, and perhaps, and probably when he had seen the original tree, and compared it with his own, the Williams' Bon Chretien? These are his remarks:

"In my own mind I am fully convinced. Those gentlemen who may entertain a different opinion will not easily account for the appearance in this country and in England, of two pears so nearly resembling each other in the wood, the leaf, the fruit, and the time of ripening. I would recommend to such as are less confident than myself, to insert buds of both pears in the bearing branches of the same tree. In two or three years they will find that the best of all summer pears and Williams' Bon Chretien are alike."

From the foregoing I think we may, with a good degree of certainty, make this synopsis.

The Williams' Bon Chretien, and the Bartlett are one and the same. It sprang up as a seedling in Mr. Schoolmaster Wheeler's garden at Aldermanston, in 1769. "Proved the value of its fruit" about 1779, was brought to Brewer's garden in our Roxbury about 1806 by Mr. Carter, and finally no name being attached to the fruit, and being new and valuable, it received the name of its owner, Mr. Bartlett.

Next a few words in relation to the American trees and their owners. Capt. Thomas Brewer, the original American owner, built his house, and improved the estate by making his orchard in 1805. He was lost at sea, in the ship Laura, in 1812, while on a voyage from the Cape of Good Hope to Sumatra. Mr. Enoch Bartlett, a well-known merchant of Boston, became owner of the estate, and resided on it from 1822, to the time of his death in 1860. He was greatly interested in horticulture, and was one of the first four vice-presidents of the Massachusetts Horticultural Society. He was in office from 1829—the year the society was formed, till 1839 inclusive; a period of eleven years. As soon as he had purchased the place and discovered the unusually good and even popular qualities of the fruit, he exhibited it. The secular papers of the day make mention of these exhibitions and the great favor with which it was received by persons of good judgment and experience in fruit raising. By common consent of horticulturists, and doubtless well approved by the society of which Mr. Bartlett was an honored vice-president, it took his name, and now for over sixty years has done it honor.

The Bartlett estate was on Dudley street, at Roxbury, and is now the site of the institution of "The Little Sisters of the Poor." The mansion house erected in 1805 was demolished to make room for the new edifice about 1871. There were originally two trees of this pear, one of these died, or was destroyed, and the other at this time of writing, 1890, remains, and is healthy and in bearing condition. It is about ten inches in diameter, and originally consisted of two main limbs, parting from the trunk about eighteen inches from the ground. One of these was broken off some few years ago, leaving the other in good condition, and as care has been taken to properly cut off the splintered wood and otherwise protect it, the prospects are that it has yet a long and useful life before it. The large limb having been taken off, the remaining one receiving all the sap, a new and vigorous growth is being made.

In closing, I feel compelled to make a statement I should prefer not to make, but facts demand it. And it is this. It is by no means true that all Bartlett pear trees of New England or America, as is generally supposed, can trace their origin back to these trees of Mr. Bartlett. The nurseryman had the English Williams' Bon Chretien for sale; Mr. Robert Manning of Salem, the eminent pomologist, informs us, as before quoted, that as early as 1830 he procured trees from Prince at Flushing, and that he had procured them of Bradick (an English nurseryman) also, that he procured others from Buel & Wilson of Albany. Mr. Manning made pears a specialty, and doubtless freely circulated scions, and trees produced from the original English trees.

As fruit culture in New England received great impulse by the formation of the Massachusetts Horticultural Society, and as Mr. Bartlett was an active vice president, and was in possession of the "new and famous pear," without doubt very many trees were grafted from his, but we must presume that, as Mr. Manning was convinced of the fact that his Bon Chretiens were identical with the Bartlett, he hardly troubled himself to go outside for grafts, but was entirely willing to accept the name Bartlett, as it was being generally received, and by common consent adopted as a new name for an old pear. It is quite an interesting fact, that while Prince and Buel I. Wilson, and other nurserymen of repute, all sold Williams' Bon Chretiens, and supplied thousands of gardens, yet the Roxbury name, Bartlett, gradually crowded out the other, and now anywhere and everywhere the original is so little heard of or honored, that explanations are made, and the public have to be informed that the two are identical.

KIEFER—Originated near Philadelphia, from seed of the Chinese sand pear, accidentally fertilized with Beurre d' Anjou, or some other kind grown near it. The tree is vigorous, having large, dark green, glossy leaves, and is an early and prolific bearer. The fruit is of large size, golden yellow, sprinkled thickly with small dots, and often tinted with red on one side; flesh a little coarse, juicy, with a pronounced quince flavor.—*Condensed from Catalogues.*

PLUMS.

Bradshaw, Greely, *Green Gage*, Jefferson, Kingston, *Lombard*,* *McLaughlin*, Moore's Arctic, Niagara, Pond's Seedling, Prince's Imperial Gage, Purple Gage, Rivers' Blue Prolific, Shropshire Damson,* *Washington*, Yellow Egg.

DESCRIPTION OF VARIETIES.

BRADSHAW—Tree an upright, vigorous grower; branches smooth, brownish; fruit large, oval, obovate, sometimes with a slight neck; suture half round, broad, shallow; apex a little sunk; skin reddish purple, covered with a light blue bloom; stalk rather stout, curving, set in a small cavity; flesh yellowish, coarse, juicy, brisk, pleasant; adheres partially to the stone; good to very good.—*Downing.*

NIAGARA—New, origin uncertain; very large, reddish purple, entirely covered with gray bloom; resembles Bradshaw, although a stronger grower, more hardy and far better bearer; vigorous middle of August.—*From Trade Catalogue Description.*

[The above description of the Niagara is published for information only. As yet we are not prepared to state that the Bradshaw and Niagara are identical or not. Many inquiries have been raised regarding them among Maine fruit growers, and pending investigation we publish the most reliable information at hand —SECRETARY.]

GREELY—Mr. S. R. Sweetser of Cumberland Center writes that "The original tree was procured by Captain Greely of Portland from Montreal. The trees in this vicinity have been mostly propagated by root sprouts, which bear the same variety as the original. The plum is purple, resembling the Bradshaw, but larger I think. It is a very prolific tree and were it not for black knot, would be very profitable to cultivate. From the original tree and one sprout from the roots, Captain Greely sold, in one year, seven bushels for fifty-six dollars besides what were given away, which was no small amount. The plum took its name from Captain Eliphalet Greely, who was Mayor of Portland a number of years."

Mr. O. K. Gerrish of Portland has been introducing the Greely plum for several years, and he says of it, "Having thoroughly tested the 'Greely,' both tree and fruit, I believe it to be *the best plum grown.* For hardiness, early and bountiful bearing, size, quality of fruit, etc., I think the Greely surpasses any plum I have ever known. The fruit is very large, freestone, of a rich wine color and delicious."

[So far as we are able to learn the trees of this variety sent out to Maine parties have not proved hardy, and very few, except those propagated from suckers and scions in the vicinity of Portland, have yet come into bearing.—SECRETARY.]

CHERRIES.

Black Heart, Black Tartarian, *Common Native*, *Early Richmond*, Governor Wood, Mayduke, Ox Heart, Rockport.

DESCRIPTION OF VARITIES.

The description of the Spate Amarelle, Schatten Amarelle, Cerise de Ostheim and Orel, are taken from the bulletin sent out from the Iowa State College by Professor Budd:

"SPATE AMARELLE—Much grown for dessert and culinary use in East Poland and North Silesia where it is noted for its regular and bountiful crops. Tree smaller than the English Morello with pendulous habit. Our trees from five to six feet in height were bending with the weight of fruit this season. Fruit, medium to large, dark purple when ripe. When first colored red the fruit has a bitter taste. At this stage of its growth it is excellent for canning, and when fully mature is desirable for dessert use."

"SCHATTEN AMARELLE—The word Schatten is said to mean shadow. Hence we send it out as Shadow Amarelle. Much like the above variety in size, shape, quality and season. Trees were laden this the 'off' year."

"CERISE DE OSTHEIM—It fruits earlier and is hardier than what is known as the Minnesota Ostheim, and bears larger, earlier and better fruit. Pitt small; flesh and juice red, tender, juicy, and when ripe pleasantly sub-acid."

"OREL—Belongs to the Vladimir race with small leaves and close habit. It comes into bearing when from three to four feet in height; fruit larger than the Montmorency, nearly black when ripe, very mildly sub-acid in flavor; promises to be very valuable for the north."

MONTMORENCY ORDINAIRE—Thus described by Mr. Barry, "French origin; medium size, of a beautiful light color; flesh juicy, melting with just enough acidity to be refreshing; tree makes a handsome growth, and is extremely hardy and productive; about one week later than the Early Richmond; unsurpassed for cooking or canning."

DYEHOUSE—Origin unknown; found on the farm of a Mr. Dyehouse in Kentucky; fruit medium, oblate or roundish oblate, slightly depressed, without suture, apex, slightly depressed; skin bright red, dark red in the sun; stalk of medium length, slender; cavity, rather large, smooth; flesh, soft, juicy, tender, sprightly, sub-acid, rich; pit, very small; sometimes the stalk adheres to the pit.

WINDSOR—Originated with James Dougall of Windsor, Canada, and is thus described in the *Country Gentleman*. "Tree hardy, vigorous, an early and good bearer. It is a variety of high promise; fruit, obtuse, heart-shaped, dark purple or nearly black; the flesh quite firm, fine in texture and rich in flavor; ripens late, after all other sweet cherries."

THE SMALL FRUITS.

STRAWBERRIES — *Crescent*,* Downing, Kentucky, Manchester,* *Sharpless*, Wilson. The following are recommended for trial,—Bubach,* Pineapple, Ohio,* Belmont, Haverland,* Cloud.*

Those in *italics* are early, and those marked with a star (*) are pistillate and require some of the perfect-flowered varieties set near them to pollenize the flowers.

DESCRIPTIONS OF VARIETIES.

CLOUD*—The Cloud is pistillate and requires another variety near it to fertilize its blossoms. It is an early berry, of good size, productive, good color, good form and firm, and ripens evenly on all sides at once. As compared with the Crescent and Wilson, it is earlier, larger, better in quality than Wilson, and more productive than either.—*Abridged from Green's Catalogue.*

HAVERLAND*—A new variety of great promise. It is of the Crescent class, exceedingly productive, vigorous plant, pale green, large leaves, makes plants fast but not as fast as Crescent. The fruit is elongated and quite large and firmer than Crescent. For home use and a near market it is highly endorsed.—*Abridged from Green's Catalogue.*

RASPBERRIES—*Red*—Cuthbert, Turner; *Yellow*—Golden Queen: *Black*—Gregg. Ada and Carmen are recommended for trial.

BLACKBERRIES—Agawam, Snyder. For trial, Bangor and native varieties. It is thought by some fruit growers, that the influence of cultivation upon our best native varieties, selected for quality will give us something hardy and of good quality.

CURRANTS—*Red*—Fay's Prolific, Red Dutch, Victoria; *White*—White Grape; *Black*—Lee's Prolific.

GOOSEBERRIES—Downing, Houghton Seedling. Smith's Improved and Industry are recommended for trial.

GRAPES—Brighton, Champion, Delaware, Hartford, Prolific, Lady, Moore's Early. True's Early a Maine Seedling, is recommended for trial.

From T. S. Hubbard & Co.'s pamphlet "on Grape Vines and Small Fruits," we select the names of a few of the earliest grapes, and arrange them in the order of earliness; those printed in *italics* are regarded by them as the best in quality; the figures refer to hardiness of foliage and vines, the lowest numbers being the hardiest. Several published in their list are hardier but are later, hence none in the list are hardier than those marked "2."

Jessica (3), Champion (3), Dracut Amber (2), Moore's Early (2), Cottage (2), Lady (3), *Lindley* (4), Massasoit (4), Hartford (3), Hayes (3), Worden (2), *Brighton* (4), Wyoming Red (2), *Salem* (5), *Delaware* (3).

THE SECRETARY'S PORTFOLIO.

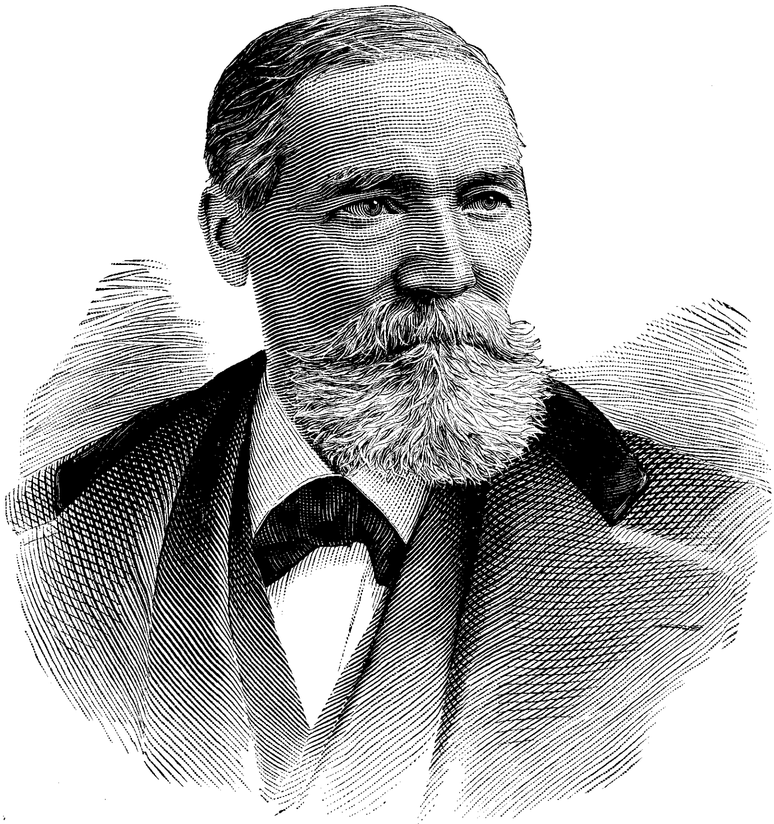
CONTAINING

Original and Selected Scraps, Contributed by Maine Fruit Growers, and Collected from Various Sources.

"Spake full well in language quaint and olden,
One who dwelleth by the castled Rhine,
When he called the flowers so blue and golden,
Stars that in earth's firmament do shine.

"Wondrous truths and manifold as wondrous,
God hath written in those stars above;
But not less in the bright flowerets under us
Stands the revelation of His love.

"Bright and glorious is that revelation,
Writ all over this great world of ours—
Making evident our own creation,
In these stars of earth, these golden flowers."



PETER HENDERSON.

THE SECRETARY'S PORTFOLIO.

PETER HENDERSON.

Peter Henderson, business man unsurpassed, the beau ideal of what a florist may become; practical, persevering, and with a name unsullied among men, a fluent writer, and a man who has probably done more toward the advancement of the Art of Horticulture in this country than any other one man, has left for all time his desk, his family and his friends.

Mr Peter Henderson was born at Pathhead, a small village about ten miles out of Edinburgh, Scotland, in 1823. He left school at the age of fifteen, having received as fair an education as the schools of Scotland could give at that time, and he was indentured as an apprentice to a gardener for four years. He quickly showed the enterprise and ambition that have characterized his life. For although he commenced his apprenticeship in a company of ten, before he was eighteen years of age he had twice successfully competed for the medals given by the Botanical Society of Edinburgh for the best herbarium of native and exotic plants. This competition was open to the whole of Great Britain. This gave him a practical knowledge of botany, which has been of immense benefit to him as a horticultural writer in after life.

After serving his apprenticeship in Scotland, he emigrated to this country, arriving in New York at the age of nineteen. He worked for one year at Thorburn's nursery in Astoria, Long Island, and another year with the late Robert Buist of Philadelphia. Mr. Buist, Sr., was a life long friend of Mr. Henderson, and he has often said that the man that has since become so prominent as a horticulturist was one of the best workmen he ever had. From Mr. Buist, Mr. Henderson went to Mr. Charles Spang, Pittsburgh, Pa., to erect a range of graperies and greenhouses, and to generally superintend his private grounds.

Mr. Henderson considered that up to that time his prospects were not very "rosy," and a regiment was being raised in the neighborhood for service in the Mexican war. So he made up his mind to enlist, and one day putting his spade in the ground, he went into Mr. Spang's library and told that gentleman of his intention. Mr. Spang turned round to him and said, "Young man, if I mistake not there is something in you that will make you a prominent man in your calling in this land of your adoption. Don't do any such foolish thing. You may think that your prospects and your position with me are perhaps not as good as you have a right to expect; go back to your work, and whenever you have an opportunity to better yourself don't study me in the least."

Mr. Henderson always considered this the turning point in his life, and he never could think enough of Mr. Spang for his kind advice at that time.

He started as a market gardener, in Jersey City in 1847, and for many years this was his principal business; gradually, however, as the taste for ornamental work increased, his early botanical training came in use, and the market gardening part of his business was abandoned. He had already written his famous book, "Gardening for Profit," of which considerably upwards of 100,000 copies have been sold. This book has helped thousands of gardeners and farmers in every state and territory in the Union to comparatively easy and profitable business. Mr. Henderson abandoned market gardening some twenty years ago, and since then placed all his energies into the business of florist and seedsman. His greenhouse establishment now covers over five acres of glass, and on an average 100 hands are employed in this department throughout the year. Up to the time of his death it was entirely under his personal management.

The seed department, which is one of still greater magnitude, is one of the largest and best equipped in the United States. This is managed by his two sons, Alfred and Charles.

Peter Henderson's name, we need hardly say, is perhaps as widely known as any horticultural author in the country. He has been before the public as a horticultural writer for nearly forty years, during which time, besides his books, he has written many hundred magazine articles.

The wonder is that with the large amount of business and the immense quantity of correspondence daily involved thereby, he found time to write so much, but he inherited an excellent constitution, was extremely temperate in his habits, and possessed the power of quickly deciding on the most important subjects. He, was, therefore, able to do an immense amount of work with comparative ease. It was always Mr. Henderson's unswerving practice to spend two or three hours daily in the open air. A fortnight before his death, he was in his office, and felt a little cold coming on, but did not think it serious. The following day he was laid up with la grippe, but he thought he had got over that, and was able to go out for about ten minutes and take a walk around his grounds in Jersey City Heights. When he came into the house he felt he had got a chill, and had a relapse, which shortly developed into pneumonia. All the aid that human skill and forethought could summon was rendered, but he died peacefully after only a few hours' suffering, January 17, 1890.—*Condensed from Florist's Exchange.*

CHARLES GIBB.

"No man was doing more for his country and ours than he."

We are indebted to Mr. L. Woolverton of the *Canadian Horticulturist* for advanced sheets of that magazine containing a sketch of Mr. Gibb. From this excellent sketch we abridge the following:

"Mr. Charles Gibb was born at Montreal on the thirtieth of June, 1846. He received his early education at Bishop's College, Lennoxville, and went from there to McGill College, Montreal, where he graduated B. A., at the age of nineteen. The application necessary to complete a college course successfully at so early an age, not only injured his eyesight, but also much impaired his health, and he was told by physicians that he had only a few years, perhaps only a few months to live, and they advised him to seek recuperation in foreign travel. This he did, going abroad in company with his uncle for two or three years to Egypt, the Holy Land, and afterwards Switzerland and Europe generally.

"On his return he engaged in the cultivation of fruit, in the State of Pennsylvania, no doubt because he rightly considered it one of the most healthful, as well as one of the most interesting departments of agriculture. The climate of Pennsylvania not agreeing with him, he returned to Canada, and purchased the farm on the slope of the Yamaska mountain, at Abbottsford, so well known to us all of late years, on account of the interesting experiments with Russian and other hardy fruits which he has carried out there.

"In 1873 he made repeated trips to the United States, studying the pomology of that country, bringing everything worthy of trial to his farm, not merely in sufficient quantities to stock his own farm, but also enough to make free distributions of trees and plants to his neighbors.

"In 1882 Mr. Gibb, in company with Professor Budd of the Iowa Agricultural College, went to Russia in quest of the most hardy fruits which might be expected to endure the extremes of temperature to which the northern parts of Canada and the United States are subject. Professor Budd had already made a large collection of hardy fruits at Ames, but so little was definitely known of the names and values of the various Russian fruits that it seemed necessary that some one should go to Russia charged with this errand. Speaking of it afterward Mr. Gibb, with his characteristic modesty, said,

" 'Northern horticulturists were looking with great hopes to Russian fruits. The work could not be allowed to rest. Some one must go to Russia; Mr. Budd and I went.'

"Mr. Gibb, it is well worth noting, took this costly journey at his own expense. This trip was followed by importations of trees and seeds which were distributed to the members of the different Fruit Growers Associations of the Province of Quebec, and seeds of which were sent to the Experimental Farm, Ottawa, and to the Botanic Garden at Montreal.

"In 1887 he went alone over the same ground, to verify his previous work, visiting in addition, Norway, Sweden and Denmark. Other trips were made in the interests of horticulture to the North-West, British Columbia, California, etc., and in July, 1889, he left for his last one around the world, taking in especially Japan, China, India and other countries.

"Freighted with much valuable information, he was on his way home when his death occurred on the eighth of March last, in Egypt. He contracted la grippe at Aden, which developed into double pneumonia. His remains were interred in the British Protestant Cemetery at Cario, on the tenth, the funeral being attended by several friends.

"Cut off in the prime of life, his life work apparently only fairly begun, he has yet left many works which will be a lasting monument to his memory."

The following list of books and papers by him are deserving of a place in this brief sketch of his life: "Notes on the Trees and Shrubs of Europe," "Russian Fruits," said to be the best description extant of Russian apples imported by the United States Department of Agriculture in 1870, "Hardy Fruits for the Cold North," "Nomenclature of Russian Apples"

PATRICK BARRY.

Just as we are going to press the sad news of another pomologist's death reaches us. His name has long been identified with fruit growing in this country, and in no one engaged in the propagation of fruit has the public had greater confidence than in the firm of which he was the senior member. The following clipping is from the *Rochester Post Express:*

One of the leading citizens of Rochester, Patrick Barry, has passed away.

For many years he has been identified with the business of the city in various ways, and was as powerful a factor in its growth and prosperity as any individual man might be.

Though he was active in financial affairs, and as one of the owners of the street railway system, which has become the means of keeping all parts of our wide-spread city in easy communication, his greatest work was done in the nursery business. He was one of the founders of a firm which has long taken rank among the largest nursery houses in the world, and so contributed not only to the beauty and prosperity of Western New York, but to the improvement of the whole country. His influence has been felt wherever fruits and flowers are grown.

Mr. Barry was a man of exceptionally strong character. The slightest contact with him elicited some manifestation of personal power. He was straightforward in his methods, honorable in his purposes, and of an integrity that would not tolerate even the suspicion of indiscretion. In private affairs and in public affairs he was a stern, aggressive personality whose influence went always for what was honest, genuine, and true, and in his loss the community loses not simply an individual life but a moral force.

Mr. Barry had great abilities. He was not only a master of business details, a worker of exact habits and untiring industry, and a man of enterprise and financial courage; but he was one equipped for instruction as well as for action. As a writer on horticultural subjects he was wonderfully clear and interesting, and had a good style, without perhaps ever giving a conscious thought to mere expression. As a speaker on any topic, he was forcible and fluent; but he seldom spoke except for instruction and never for display.

He was successful in accumulating a large fortune, but it may be said it was a fortune in the collection of which every dollar gained for the individual represented many dollars' worth of good done. He prospered on the plunder of no other man, but on the prosperity of others—on the improvement of land in all parts of the country, and on the growth of this community. He made himself wealthy, but he left the world far wealthier through his labors.

FRUIT GROWING IN AROOSTOOK.

As I looked over the fine specimens of fruit on exhibition last winter I became more interested in fruit growing then ever before, although at first thought it would almost discourage any one from Aroostook county, seeing those fine varieties of apples so delicious to the taste, and to think it would be impossible for us to try to raise them in our county; but I have all the courage in the world to believe the time is coming and is not far off when we can raise plenty of good fruit to carry us through the season. In 1858 we came to this county from the town of China, Kennebec county, there we had plenty of fruit. We boys missed that more than anything else. They told us then that we never could raise apples here. At that time there were a very few native crab-trees and once in a while you would find a hardy seedling that would make a pig squeal if he ate one. But in a few years there was a change. They told us we could raise the Duchess of Oldenburg. We tried a few and they stood our winters first rate. Some other kinds did quite well. The Fameuse and Alexander and Tetofsky, and they were shortly followed by the ironclad Wealthy from Minnesota, also the Yellow Transparent and Montreal Peach; then came the Dudley apple, which keeps nice until April. The tree is an ironclad and a very prolific bearer. I have several other varieties that I am testing, among them is a sweet russet, an apple of very fine quality and a good keeper. There are seedlings in Northern Maine and New Brunswick that are worthy of propagation, and I believe if thoroughly tested would give us fruit the year round and of fine quality, good enough for a king. Knowing these things and having the experience of such men as Mr. Gideon of Minnesota and Dr. Hoskins of Newport, Vermont, I think we have every reason to feel encouraged in fruit raising in the cold north.

Ironclads grow finely in our section. I am preparing to set more and intend to make a specialty of fruit raising. If there is any money in it, I think the place to begin is where they are obliged to import nearly all they use, for if we raise less fruit we can get higher prices for it. We are now obliged to pay freight on our apples from the older parts of the State. So, instead of leaving our county and going to the older parts of the State to grow fruit, I say stay here and use what opportunities we have and I am sure we shall succeed.

J. W. DUDLEY.

Castle Hill, Aroostook County.

The varieties of apples that have done well with me, are the Duchess, Alexander, Fameuse, Red Astrachan and Wealthy. I raise a few other varieties, but those named do the best. The Dudley trees are not on the market yet. I have watched the original tree since it first fruited, and have great hopes concerning it.

Of course there will be other choice varieties originate here as there are many seedling trees not yet come to bearing.

The same variety raised here will keep later than when raised farther south, and in some cases, notably the Duchess, the quality is better. My Alexanders are at their best now, (December 10th.)

There are many trees being set in this county the last few years, and as the farmers are using more care in selecting varieties, and in caring for the trees after planting, we have faith that more fruit will be raised here in the future than in the past.

EDWARD TARR.

Castle Hill.

THE WEALTHY FAR NORTH.

We have felt a deep interest in the results of the trials with the Wealthy apple in Aroostook county, and are pleased to note that up to date, in all localities where planted, it is proving hardy enough to stand the rigors of that northern section. Mr. James Nutting of Perham, a town located on a parallel with Caribou, and as far north as fruit trees have ever been tried at any point in the State, has a large orchard of them growing, and which has already commenced bearing. He reports that it proves perfectly hardy, not a tree among the large number planted having shown any signs of winter killing. Side by side with the Duchess, it stands the climate equally well with that world famous ironclad. In so short a season as that of 1888, Mr. Nutting reports that the fruit did not have time to ripen up into its full perfection of flavor, though the growth and size were entirely satisfactory. The past season, however, 1889, the fruit attained complete perfection, and in every way appears to be equal to that grown in lower latitude. A specimen grown by Mr. Nutting measured twelve inches in circumference, and weighed ten ounces when it came off the tree. This variety grown in that northern section keeps well through the winter. Should further experience corroborate the present success with this variety, the people of that locality need not feel very bad if their list of varieties is narrow. The Wealthy is a fruit of high quality, both on the table and in the cook-room.—*Maine Farmer.*

THE APPLE-TREE BORER.

This pest is very common in Maine, and one that demands constant care on the part of the orchardist. There are two varieties of this pest, round-headed and flat-headed borers. The latter is the one of which I will speak as his work can be detected in the winter season when the snow covers the ground. The damage is on the trunk of the tree where it can be seen. The borers commence their destructive business on the sunny side of the trunk and if the tree leans to the north or crooks so that the rays of the sun strike directly upon the tree, there is the place where they will be found. The damage done by these borers is very often attributed to sun scald. Sun scald to injure would affect the inside of the bark; but this will not be found to be the case, if the damage is caused by this insect, at least for quite a while. One man, whose trees were very much injured thought the injury was caused by the oil from the wool of sheep that were pastured among the trees, but a close examination convinced him of the true cause of the trouble. This trouble must not be confounded with canker which will attack the north side of the tree as soon as the south. Trees are never troubled by this borer when the trunk is well shaded. If the borer is not destroyed it will eat into the wood, and others will be lodged around the first colony and will continue to spread until the tree is destroyed. The beetle makes its appearance early in the summer, and lays quite a quantity of eggs, and for this reason one of the best remedies is to keep the tree smooth by good cultivation, and scrape off all moss and flakes. If the tree shows any signs of the work, shave the bark slightly so as to destroy all that may be lodged there.

Of the round-headed borer, that does its work very near the ground, and cuts down and destroys very many trees, not so much may be said of him at this season of the year, for his work is hidden for the present and also is better known by most that have the care of trees. In his operations he dislodges large quantities of saw-dust, and unlike this cousin, the flat-headed borer, is not confounded with other troubles. After close observation I think real cases of sun scald are very few. D. P. TRUE.

Leeds Center.

HOW SHALL WE MAKE OUR ANNUAL EXHIBITIONS MORE USEFUL?

By W. P ATHERTON, Hallowell.

Only a few points will be presented and those very briefly.

First, simplicity of arrangement. This will be accomplished best by having ample space for the tables, so that visitors as well as exhibitors shall have free passage around them; the tables themselves should not be crowded with fruit, but ample space given to every exhibitor, and under no circumstances in a general collection—competitive of course—should the duplication of varieties be allowed, and except as wherein allowed by the rules of the Society should a plate contain more than five specimens of apples. If, from a want of space tables are crowded with plates, and plates themselves are crowded with specimens, confusion will arise, mistakes occur and those useful lessons sought to be obtained by a careful study of the different specimens will be lost.

Second, all abnormal growths in either fruits or flowers should be ruled out entirely, or in *some* way discouraged. A premium should *never* be awarded to an abnormally grown specimen. If it *is*, the effect will be to discourage all honest efforts. But *how* shall we distinguish between normal and abnormal growth? I know of no other way than by having a correct knowledge of what constitutes a healthily grown specimen. A good gardener *ought* to know whether a big pumpkin or squash has been fed on buttermilk or has derived its growth wholly from natural sources. A good orchardist *ought* to know whether a Northern Spy or a Hubbardston has had fair honest orchard culture or has had the contents of a privy or a pig-pen or a hen-yard to feed upon. When specimens grown under these or any other *extraordinary* conditions are awarded first premium as I have known them to be, the useful lessons which the Society would teach by its annual exhibitions are of doubtful utility to say the least.

Third, varieties of fruits, which are really excellent but which unfortunately have but a local reputation, should in some way receive greater recognition. Allow me to suggest that possibly this might be brought about by setting apart one table for purely local varieties and offering a small premium or medal for the best individual display. Again, I am not sure but that the interests of our Society would be best subserved by doing away with all cash premiums and adopting instead a reward in diplomas or medals.

Lastly, our Society would do a good work by offering some encouragement to the originators of new fruits. Let the Society offer a gold medal to the one who shall originate and exhibit for five or ten years, the best summer, autumn and winter apple or pear, and a greater interest in our annual exhibitions will at once arise and a better knowledge of fruits be disseminated.

THE SCHOOL GARDEN.

The school garden should be a place for observation and experiment. Budding, grafting, various ways of propagating, cross-fertilization, and conditions favorable to plant growth could be taught by seeing and doing. Much of this kind of work is already done by the pupils of the George Putnam school in Boston, which includes the work of drawing from natural specimens and making original designs. These pupils are learning to see as never before, and are acquiring facility and power in representing objects that will add much to their usefulness and happiness and are working toward horticulture. Their written descriptions and drawings of wild flowers serve the legitimate purpose of the school work and continually suggest nature.

What an influence for horticulture might be felt if the common schools throughout the country should make good use of school gardens. The ordinary Sahara-like school yard could be made to look like a paradise. Representatives of the various classes of vegetation could be grown, the flora of the vicinity could be obtained and for every purpose the school would serve better than cultivated flowers. The effect on the health of the children would be beneficial. Why not convert gymnastic wands into garden hoes?

A large majority of our public schools have done little or nothing for the study of plants, insects, minerals and soils, alleging that such study is not practical, but the conning of books and the figuring on slates they claim to be practical. What is the opinion of agriculturists? Are not potatoes and wheat practical things? Is there anything theoretical about the potato bug and currant worm?

The right kind of men should be placed upon school committees and teachers secured who are known to have an interest in horticulture. The collection and study of native plants is especially interesting and instructive to teachers.

The address closed by urging the Society to offer premiums for school gardens.—*Henry L. Clapp, before Massachusetts Horticultural Society.*

GARDENS FOR SCHOOLS.

During the last ten years the State of Austro-Hungary has reserved ground in connection with each school to be used as gardens, where boys and girls may have an opportunity of growing plants from seed. The expense connected therewith has been defrayed by the state.

We think it might be well for America to emulate this foreign state in this one respect. "As the twig is bent so the tree inclines." To foster and encourage a love for the growing of plants by children at our public schools, would in our opinion tend to elevate the moral standard of the people generally, for the man rarely amounts to anything who hates music, the laugh of a child or the cultivation of flowers. In cities like New York, it might, perhaps, be somewhat difficult to obtain a plot of ground with each school for this purpose, but in the country there need be no such difficulty. There are several seedsmen, who make a specialty of seeds for boys and girls who choose to devote some of their spare hours to horticulture.

We should be pleased to know what the great brotherhood of florists have to say on this subject, and whether any of them can stir up the powers that be, to do something towards initiating a course of horticultural instruction at our public schools.

MAINE FRUIT AT THE BAY STATE.

It was a capital idea sending samples of Maine apples to the Boston exhibition, and the Pomological Society is entitled to compliments on its enterprise. The collection made a fine showing, not only in itself, but also in comparison with the Massachusetts samples, as the many premiums taken fully testify. It is to be regretted, however, that more time could not have been given to the matter and a more complete list of varieties grown in the State made up for the tables, and in case of some of the kinds, larger samples selected. The plate of Baldwins, for instance, while perfect in form and coloring, were not so large as could have easily been selected and with equal perfection, while several of our choice apples, native to the State, were not in the collection.

It was no small honor to Maine fruit that we should carry off the highest honors on dish of Kings in so strong a competition and with one of the most popular fruits in the whole list, as this kind through its fine color, high quality and large size has now become. E. H. Keniston, Dixmont, grew the samples taking the honors. Mr. E. W. Wood, the superintendent in charge of the fruit tables, well and widely known in connection with the Massachusetts Horticultural Society and chairman of its fruit committee, paid us the high compliment of admitting that Maine can grow more perfect fruit of this justly popular variety than can be done in that State; and he further stated that it was conceded that although the Baldwin was a native of that State, yet Maine grown Baldwins were superior to those produced in its native locality. The superiority of Maine apples is chiefly in their perfection. While selected samples hardly run as large as those grown in Massachusetts, yet in freedom from imperfections in coloring and in that gloss and finish which renders our Maine apples so attractive in appearance, as well as in firmness and flavors, our Maine fruits are not matched by anything grown in more southern latitudes or on lower altitudes. This could have been further proved by numerous varieties not on the tables at Boston.

But our parent State can beat us out and out on pears. Of the later kinds there was a fine display. The most remarkable showing, however, were the nineteen platters of Duchess, varying so little in size that the committee had to resort to the scales to place the premiums. The extremes in the prize dishes, twelve specimens, were thirteen pounds and fourteen ounces for the first to twelve and three-fourths pounds for the third. Just think of grappling a Duchess pear weighing a pound and a quarter!—*Maine Farmer.*

The fruit display was exceptionally fine, notable among which contributions was that of the Maine State Pomological Society, which was represented by Mr. Henry W. Brown of Newburg, Me. —*Roxbury Gazette.*

The Maine Pomological Society is entitled to thanks for its enterprise in sending an exhibit to the Bay State fair and also for its thoughtful spirit of fraternity.—*New England Farmer.*

TRANSPLANTING HERBACEOUS PERENNIALS.

A good portion of the hardy herbaceous perennials, if properly cared for, can be transplanted with better results in the latter part, or even the middle of summer than late in autumn. Early flowering plants, which start into growth as soon as the snow is off in spring, make their preparation for this the previous autumn. If we will examine closely our beds of such early plants as the Trilliums, Claytonias, Early Anemones, etc., just before winter, we will find the flower buds for the coming year well formed, ready to start into growth the moment spring arrives. The middle or last of August is not too early to set such plants. It is much better to set them early, so that they can make their autumnal growth where they will remain through the winter, than to transplant them just before winter. There is always more or less loss of fibrous roots in lifting such plants, and, when the transplanting is done early, the plant can recover before winter.

It frequently happens that the driest part of the year comes at this time, and, if such is the case, sufficient moisture, which is very necessary, should be artificially supplied until the plants become well established.

Most of our bulbs for fall planting do better when set early. A new growth of fibrous roots is formed, which enables the plant to start sooner and stronger in the spring. We have had better success with lilies which were planted early. In fact, we prefer wintering them in a cool cellar to a late setting. Many plants, especially lilies are greatly reduced by seed-bearing. Plants of L. Canadense, taken up while in flower and the bulbs then replanted, will give better blooms the following year than if left to seed in their original location. The same may be said of others. As soon as the seed vessels begin to form there is a great demand upon the bulb. Those who do not allow their lilies to go to seed will get more and better flowers the next season.—*Garden and Forest.*

SHRUBBERY IN NEW ENGLAND.

We plant for the summer only, while our cousins over the sea plant for the whole year. Some will reply to me that we have few good evergreen shrubs fit for our climate, or broad-leaved evergreens, such as rhododendrons, laurels, etc. I reply to all such that we have the finest ones in existence, growing wild in quantities, and we have overlooked them for so much of our national existence almost wholly, while Europeans have always used them with lavish hand, and our own native broad-leaved evergreen shrubs, the lack of which leaves our lawns so barren looking all winter, are the very plants that make England's gardens so rich and so constantly green. Two species of rhododendrons, of absolute hardiness and superb beauty, three of kalmias, one of them our lovely mountain laurel, two native hollies, are all evergreens, and should be found in thousands in the gardens of New England Of these seven species, the first two and the mountain laurel are the best, and would serve all necessary purposes, and their free and general use would so metamorphose our shrubberies, now leafless so long, that one would soon fancy himself in the green shrubberies of the mother land. Why do we not appreciate our own unequaled native shrubs? Why should we cross an ocean to see places made famous by beauties derived from generous use of American plants which grow wild and unconsidered here at home? The sensible man who should plant his spacious grounds with these charming native shrubs in a really liberal way would not only have in time the finest grounds to show, but be a public benefactor and educator—*F. L. Temple in Boston Journal.*

THINNING FRUIT.

The practice of removing the surplus fruit from trees which have ambitiously undertaken more than they can properly perform without injury to the present crop, and permanent injury to the trees themselves in many cases, is an operation which needs only a careful, thorough trial to commend itself to all painstaking fruit growers. Many who acknowledge that the crop after thinning will sell for more money per tree than if not thinned are still unwilling to admit that the gain will pay for the extra labor involved. Well, about how much for time is required to remove 500 apples, pears or peaches in June and 500 more in October, than would be occupied in picking the entire 1,000 in October?

Further than this, it is a well-known fact that the production of the seed of a fruit causes by far the greater draft upon the vitality of the tree than the formation of the pulp surrounding it; also that 1,000 small apples will contain nearly twice the weight of seeds found in 500 specimens double their size of the same variety, and thus be much more exhaustive to the tree. An incidental benefit which may result from thinning of fruit: The horticulturist may, in thinning the fruit, notice many young shoots that by pruning-time next spring will become stout limbs to be cut off; whereas now they may be easily rubbed off, while the plant-food required for the formation will be saved for the tree and fruit.—*Popular Gardening.*

TOO MANY KINDS OF APPLES.

The mistake that most every orchardist or fruit-grower makes is that of setting out too many kinds of fruits. It is well to have different kinds enough to supply a succession of fruit throughout the year for home use; but for market purposes the varieties should be few, and those of the best and most salable kinds. The greater part of the different kinds of apples raised in any one locality might be termed local varieties, not well known to the trade. The Baldwin, Rhode Island Greening, Roxbury Russet, Northern Spy, Fameuse and a few others, are the best known to the trade generally, and in localities where they flourish, are safe to raise. The Baldwin, for productiveness, profitableness and salability, stands at the head of market varieties. In sections where it thrives, more money can be made from it than from any other apple. Baldwin trees will produce more apples, with fewer of second quality, than any other variety. Two or three varieties are sufficient for a large market orchard.—*Exchange.*

THE ROLFE APPLE.

This fine Maine apple, regarded as equal to the Gravenstein in all points, and a month longer keeper, is a round, smooth, regularly shaped fruit, striped, splashed and almost covered (on a light yellow ground) with pale red, brightest in the sun. It much resembles the Gravenstein, though larger and more regular in form. The flesh is delicate and crisp, with a rich melting flavor, sprightly and juicy, and in my judgment it is nowise inferior to Gravenstein. As a later apple, so close in all points of resemblance, and so considerably prolonging the season, it strongly recommends itself to orchardists who seek to supply the market for "fancy" fall fruit.—*Orchard and Garden, December, 1889.*

IN OREGON.

One of our life members, James A. Varney, now President of Second Eastern Oregon District Society, The Dalles, Oregon, writes under date of January 16, 1890:

"We are having snow this winter enough to secure good crops another year, no severe weather yet. We look for good fruit crop next year. The past year's crop was large in fruit, but injured by drought and codling moth. It has come to this, that he who sprays not will reap not in Oregon. Our long dry seasons give us bugs all the way from April to November. Good sound apples are retailing to-day in this city at $3 per box (40 pounds), and Eastern apples are selling in Portland market to-day notwithstanding they may be grown much quicker and cheaper than in Maine."

The apple is one of the best fruits. Baked or stewed apples will generally agree with the most delicate stomach, and are an excellent medicine in many cases of sickness. Green or half ripe apples stewed and sweetened are pleasant to the taste, cooling, nourishing and laxative, far superior, in many cases, to the abominable doses of salts and oil usually given in fever and other diseases. Raw apples and dried apples stewed are better for constipation than liver pills.—*Hall's Journal of Health.*

Some of our desirable old apples are no longer reliable, and we have no substitutes possessing their peculiar rich flavor. Newtown Pippin, Bellefleur, Rambo, Pennock, and some others, are good examples. Is this degeneracy, or lack of proper nutriment in the soil? Facts leading to the latter hypothesis crop out frequently. All the above-mentioned varieties show their appreciation of high culture, by improved yields, which if not equal to the "good old times," are certainly superior to the average fruit of our uncultivated orchards. —*N. Y. Tribune.*

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