AGRICULTURAL AND NATURAL HISTORY BUILDING, STATE COLLEGE.

AGRICULTURE OF MAINE.

THIRTIETH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Maine Board of Agriculture,

FOR THE YEAR

1886-7.

PRINTED BY ORDER OF THE LEGISLATURE.

AUGUSTA:
SPRAGUE & SON, PRINTERS TO THE STATE.
1887.

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 ending June 1, 1887.

Z. A. GILBERT, *Secretary.*

AUGUSTA, June 1, 1887.

MAINE BOARD OF AGRICULTURE—1886.

OFFICERS.

NELSON HAM, President.

B. A. BURR, Vice President.

Z. A. GILBERT, Secretary.

Members Chosen by County Societies.

			Term expires Dec. 31,
Lincoln County,	J. J. A. Hoffses,	Jefferson,	1886
Androscoggin "	Nelson Ham,	Lewiston,	1886
Kennebec "	John E. Brainerd,	East Winthrop,	1886
Waldo "	D. B. Johnson,	Freedom,	1886
Washington "	A. R. Lincoln,	Dennysville,	1886
Cumberland "	W. W. Harris,	Cumberland Centre,	1887
Sagadahoc "	S. L. Holbrook,	Brunswick,	1887
Oxford "	A. O. Pike,	Fryeburg,	1887
Somerset "	Geo. F. Moore,	North Anson,	1887
York "	J. M. Deering,	Saco,	1887
Aroostook "	Francis Barnes,	Houlton,	1888
Piscataquis "	Thomas Daggett,	Foxcroft,	1888
Penobscot "	B. A. Burr,	Bangor,	1888
Franklin "	E. J. Gilkey,	Strong,	1888
Knox "	A. J. Tolman,	Rockland,	1888
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—1887.

OFFICERS.

J. M. DEERING, President.

B. A. BURR, Vice President.

Z. A. GILBERT, Secretary.

Members Chosen by County Societies.

				Term expires Dec. 31,
Cumberland County,		W. W. Harris,	Cumberland Centre,	1887
Sagadahoc	"	S. L. Holbrook,	Brunswick,	1887
Oxford	"	A. O. Pike,	Fryeburg,	1887
Somerset	"	Geo. F. Moore,	North Anson,	1887
York	"	J. M. Deering,	Saco,	1887
Aroostook	"	Francis Barnes,	Houlton,	1888
Piscataquis	"	Thomas Daggett,	Foxcroft,	1888
Penobscot	"	B. A. Burr,	Bangor,	1888
Franklin,	"	E. J. Gilkey,	Strong,	1888
Knox,	"	A. J. Tolman,	Rockland,	1888
Androscoggin	"	L. H. Blossom,	Turner Centre,	1889
Lincoln	"	E. W. Stetson,	Damariscotta,	1889
Waldo	"	R. W. Ellis,	Belfast,	1889
Kennebec	"	S. C. Watson,	Oakland,	1889
Washington	"	D. W. Campbell,	Cherryfield,	1889
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, 1886.

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 20 and 21, 1886, and was called to order by Vice President Nelson Ham at 10.30 o'clock. The published call for the meeting was read by the Secretary, after which, on motion of the member from Washington, a committee on credentials was appointed, as follows:

A. R. Lincoln,
A. O. Pike,
S. L. Holbrook, } *Committee on Credentials.*

This committee subsequently reported the following new members duly elected:

Piscataquis County,	Thomas Daggett,	Foxcroft,
Franklin "	E. J. Gilkey,	Strong,
Penobscot "	B. A. Burr,	Bangor,
Knox "	A. J. Tolman,	Rockland,
Aroostook "	Francis Barnes,	Houlton.

The report was accepted and the members named were declared duly elected and entitled to seats on the Board for three years.

On motion, the chair appointed J. E. Brainerd and J. M. Deering a committee to receive, sort and count votes for President of the Board. Having attended to that duty, they reported all the votes cast for

Nelson Ham, *President.*

The same committee were directed to receive, sort and count votes for Vice President and reported all votes cast for

B. A. Burr, *Vice President.*

On motion of the member from Cumberland, it was unanimously

Voted, That M. C. Fernald cast the vote of the Board for Secretary and that it be for Z. A. Gilbert.

The duty was performed in accordance with the vote, and

Z. A. Gilbert, *Secretary*,

was declared elected for three years from election.

On motion, the chair appointed

J. M. Deering,
J. E. Brainerd,
Francis Barnes, } *Committee on Pay Roll.*

An advisory committee was elected, consisting of

B. A. Burr,
M. C. Fernald, } *Advisory Committee.*

The Secretary made a verbal report of work of the year, and stated that $1,276.77 had been expended in holding institutes.

The member from Aroostook presented the following resolution, which was tabled and assigned to Thursday, at 10 o'clock, for consideration.

Resolved, That the Board of Agriculture commends the course of the Secretary in his conduct of the institutes; and in order that the efficiency of these may be increased and the scope of their usefulness enlarged, the Secretary is hereby requested to seek for the necessary aid for the institutes from whatever source he deems most expedient.

Adjourned to 2 o'clock P. M.

AFTERNOON.

Met agreeably to adjournment, the President in the chair. The business of the afternoon was a discussion of Ticket System at Fairs.

Member from Sagadahoc read a paper on Life Members' Tickets.

Member from Kennebec read a paper on Complimentary Tickets.

Member from Androscoggin read a paper on Family Tickets, after which it was

Voted, That the matter of Tickets at Fairs under discussion at this time be referred to a committee for consideration, with instructions to report on Thursday. S. L. Holbrook, A. O. Pike and M. C. Fernald were appointed that committee.

THURSDAY, JANUARY 21.

Met at the State House agreeably to adjournment.

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

The resolution of the member from Aroostook came up by assignment and was called up for discussion. The resolution was fully and freely discussed by all the members, and a vote being called for, it was refused a passage by a strong vote.

The member from Sagadahoc, from the Committee on Ticket System at Fairs, reported the following resolution:

WHEREAS, In the management of agricultural fairs abuses have grown out of the system of life-membership and family tickets to such an extent as to embarrass the agricultural societies and thus limit their usefulness, therefore,

Resolved, That in the judgment of this Board, these societies, both State and county, while fully recognizing and respecting the obligations already incurred relative to certificates of life-membership, will find it to their advantage to discontinue the issuing of tickets granting so broad privileges, and will improve their financial condition by adopting the system of individual tickets for all admissions to their fairs.

On motion of member from Oxford, the resolution was accepted, and it was further

Voted, That the Secretary be instructed to forward a copy of this resolution to the secretary of each agricultural society in the State.

Adjourned to meet at Cony House at 2 o'clock P. M.

AFTERNOON.

Met agreeably to adjournment.

On motion of member from Washington, the matter of the disposition of the State bounty to agricultural societies was taken up for consideration.

The Secretary made report of the action of agricultural societies, in compliance with the requirements of last year.

After the matter was fully discussed, on motion of M. C. Fernald, it was

Voted, That in the disposition of the State aid to agricultural societies, we re-enact the action of last year.

The action was as follows:

Voted, That the several agricultural societies receiving aid from the State are hereby directed to expend that portion of the State stipend under the control of the Board of Agriculture in special premiums as follows:

1. For the best system of farm improvements and general farm management; or,

2. For the best farm accounts; or,

3. For best experiment in feeding and growing steers, for one, two or three years.

CONDITIONS.

In any of the foregoing classes a first, second and third premium may be offered, and may be continued for one, two or three years.

Classes 1 and 2 shall be open to general competition.

Class 3 shall be open to boys between fourteen and twenty years of age.

In class 2 the awards shall be based upon that system of farm accounts which most simply and accurately represents the business of the farm for the year, and in this class the books of account shall constitute the requisite report to the society.

In class 3 the experiment shall be reported and the awards made annually.

In all cases complete and specific reports shall be made by competitors to their society, and the same, together with report of awards, shall be forwarded to the Secretary of the Board of Agriculture, the receipt of which, in satisfactory form, shall be evidence that the specified conditions have been fulfilled, and shall entitle the society so reporting to its full apportionment of the State bounty.

The following instructions were issued, with a copy of this action, to the several agricultural societies in the State:

INSTRUCTIONS.

Where the amount of money covered by this action is larger than is needed in a single class, premiums may be offered in any two of the classes, or in all of them. It is recommended that the premiums offered be so liberal in amount as to invite a creditable competition. The action of each society, with the premiums offered and the awards on the same, will be published in the annual report of the Secretary for the year.

In class 1, the premiums are to be awarded on improvements made during the time for which the premium is offered, and on the general farm management for the same time; and in offering these premiums it should be stipulated that an intention to compete must be entered with the Secretary of the Society, at an early date named, and this shall constitute the entry for the premium. A committee should be raised (and paid, if need be, out of the funds under consideration), to inquire into the proposed improvements and examine carefully the general farm management, and at the expiration of the time specified in the offer report upon what has been done in improvements and what has been found in the management of the farm, said report to be forwarded to the Secretary of the Board of Agriculture by the first day of January, and the same to appear in the transactions of agricultural societies in the annual report of agriculture of Maine.

In class 2, the premiums are to be offered for, and awarded to, *the best kept accounts*, or those which in the most comprehensive manner and in the most simple form represent the actual business of the farm for the year. In view of the importance of more attention on the part of farmers to the keeping of systematic accounts, it is earnestly urged that societies take special effort to encourage competition in this class. No premiums should be awarded on accounts that are not in creditable form, or that do not clearly represent the business of the competitor.

In class 3, an entry of intention to compete should be required, and it should be stipulated by the society that an *accurate record* shall be kept of the feed given, and the value of the same, and also that *a weekly or monthly record shall be kept*, by girth or weight, of the growth of the steers.

Special attention is called to the last clause of the requirements of the Board, and secretaries of societies will govern themselves accordingly.

On motion of M. C. Fernald, the following resolution was passed by a unanimous vote:

Resolved, That the thanks of the Board are hereby tendered to the management of the Maine Central, Knox & Lincoln and New Brunswick railroads for courtesies tendered the members; also that the thanks of the Board are presented to the proprietors of the Cony House for reduced rates during the present session.

Adjourned without day.

Z. A. GILBERT, *Secretary.*

ANNUAL MEETING, 1887.

The annual meeting of the Maine Board of Agriculture was held at the office of the Secretary, at the State House, in accordance with the provisions of the statutes, January 19 and 20, 1887. Vice President B. A. Burr called the meeting to order, and the minutes of the last meeting were read by the Secretary.

On motion, the chair appointed a committee on credentials, as follows:

S. L. Holbrook,
Thomas Daggett,
A. O. Pike, } *Committee on Credentials*,

who subsequently reported the following new members chosen and entitled to seats on the Board for three years:

Androscoggin County,	L. H. Blossom,	Turner Centre.
Kennebec	"	S. C. Watson,	Oakland.
Lincoln	"	E. W. Stetson,	Damariscotta.
Waldo	"	R. W. Ellis,	Belfast.
Washington	"	D. W. Campbell,	Cherryfield.

On motion of the member from Sagadahoc,

S. L. Holbrook,
A. O. Pike,
Thomas Daggett,

were appointed a committee to receive, sort and count votes for President and Vice President.

Proceeded to ballot for President and the committee reported a unanimous vote for B. A. Burr, who declined to accept the office, and a second ballot resulted in the choice of

J. M. Deering, *President*,

and he was declared duly elected.

The same committee collected votes for Vice President, and reported every vote cast for

B. A. Burr, *Vice President*,

and he was declared duly elected.

On motion, a committee on pay roll was appointed by the chair, as follows:

Francis Barnes,
Walter Balentine, } *Committee on Pay Roll.*
A. O. Pike.

On motion, it was voted that an advisory committee be appointed by the chair.

M. C. Fernald,
B. A. Burr. } *Advisory Committee.*

The Secretary made a verbal report of the work of the Board for the year at some length.

The member from Sagadahoc, Mr. Holbrook, presented the following:

WHEREAS, An order of inquiry has been introduced into the Legislature, looking to a possible change in the method of selection of the Secretary of the Board of Agriculture, therefore,

Resolved, That as an expression of the judgment of this Board, the choice of its principal executive officer should remain where it now is, under the control of the membership of the Board.

The member from Lincoln moved to give the resolution a passage, and after remarks in favor by the member from Oxford the vote was unanimous to give the same a passage.

On motion, a committee of three was raised to present the resolution to the Committee on Agriculture of the Legislature at 2 o'clock this day, and the chair appointed as that committee,

W. W. Harris,
E. J. Gilkey,
B. A. Burr.

Adjourned to 2 o'clock.

AFTERNOON—WEDNESDAY.

Met according to adjournment, at 2 o'clock, at office of the Secretary.

On motion, voted to adjourn to the House of Representatives.

Assembled at place of adjournment and on motion, voted to adjourn to 4 o'clock, for the purpose of attending the hearing before the Legislative Committee on Agriculture.

4 O'CLOCK P. M.

Met as per adjournment and Prof. W. H. Jordan, Director of Experiment Station, gave a lecture on Valuation of Fertilizers—Why and How, after which adjourned to meet at office of Secretary, at 9 o'clock Thursday morning.

THURSDAY, JANUARY 20.

Board met at time and place of adjournment, Vice President Burr in the chair. The first business was the reading of a paper on

STATE AID TO AGRICULTURE,

By J. M. Deering.

In responding to the proud honor of attempting to perform the duties laid upon me, I fear I will fall far short of the mark. And yet, fellow citizens, I am not altogether unable to comprehend the situation. Born and bred to the profession of agriculture as my only inheritance, I would be unjust to my manhood did I cease to feel an interest in the welfare of my toiling brother farmer. I think I know the farmer's lot—his wants, his needs and his sympathies—and I ask your attention while I voice a few thoughts of what the farmer used to be, and what he is, or should be, to-day. The old brutal notions are being lived down that the farmer needs only to be a huge mass of meat and bones, six feet two, that can hold a plow, fat a steer, feed a pig, or be an expert with the goad stick. The farmer used to be valued like the bullock, for the size and toughness of his muscle, and the number of pounds he might chance to weigh. The voice of history, from the days of Grecian and Roman helots down to the last half of the present century, proclaimed the truth that the world estimated brute force and power of brute endurance, as all the farmer needed to enable him to accomplish his mission, and that mind and thought and education were as useless to the farmer as the fifth wheel to a coach. To dig and delve for a living, to drudge like a slave, live like a miser, and die like a brute, with no higher conception of life than that it was a little span in which to hoard mammon and be filled with greed — such was the verdict pronounced upon the toiling farmer, who made the earth bloom with perennial beauty and autumnal fruitfulness. Hence, serfdom, servitude and drudgery, clownish countrymen, mudsills, and small fisted farmer's pursuits, that degraded and animalized the soul, together with other patented utterances, were flung at the farmer and his mission in the by-past times.

There were other causes which tended to rivet the low conception to the farmer's mission upon public sentiment. Professional men were too prone to get perched upon high towers of self conceit, and instead of aiding with tongue and pen and influence to enlarge and liberalize the mind of the toiling farmer, their policy was to keep their noses fast down to the grindstone, arrogating to themselves the proud assumption that all knowledge was shut up in a learned profession, and was only charmed thence with the magic influence of the college sheepskin.

How did the farmer awaken to the realizing sense of his mission as a man of the age? The answer is at hand—by remoulding those wrong conceptions of farming, which regarded it as a sort of chattel-hood; by impressing upon the public mind the fact that it was not the man's calling or profession that made him a nobleman, but the amount of mind and thought, and honor and power of manhood he brought to bear upon that calling or profession. Thus did farming begin to arise to its true dignity, and accomplish its true mission.

Day by day, as the farmers have become better educated, labor and intelligence have been conquering all things with its strength and patent skill, and the sons of toil have embodied the attributes of true manhood, rising above the miserable expedients of color or sect, conquering the stern duties of life with their sweat and toil. This is the magnet that has linked humanity together in the bonds of kindred brotherhood and sympathies. The freedom and enlightenment, the dignity and ennoblement of this, is the great truth that lies at the foundation of all progress and reform, hence to educate the boy is to make the man; to make the man is to fix and determine his worth to himself, his friends and the world. When we stop to reflect that about nine-tenths of the solid wealth of this great nation, and nearly all its prosperity depend upon its agricultural resources and development, it seems to be sufficient evidence that it is necessary for those who are engaged in farming, as a mission, to be liberally educated. Political economy, with its strongest maxims, claims that the producers call into existence all the wealthy, build up money-kings faster, support professional life, and keep in motion the locomotive and merchant ships. Finally, it is the life of an oceanic and inter-State commerce. Why, every railroad that checkers our broad land would be bankrupt, all property would depreciate to nothing in value, and the land would be filled with beggars and idlers, instead of a well-fed, industrious people, if not for a prosperous agriculture. Hence, earth tilling is the great basis that supports every business and calling of life. The exchange of its productions creates wealth and prosperity, and makes us all rich or poor. Why should not government bestow its fostering care upon this most important industry? It is not my purpose to criticise government, either State or national. With the utmost confidence in our legislators, that if called upon to aid by legislation to foster and improve our agricultural interests whereby the farmers could become better educated, I feel assured that there would be but few who would fail to recognize it as a paramount duty to the race. The first and purest inspiration of the statesman should be to aid it, the most cheerful duty of the people to pay for it. No burden is oppressive to the intelligent tax-payer that is carried on in the interests of popular education.

Success or failure in life, as I believe, is more a question of education than of original endowment, inasmuch as God creates nothing in vain. Not a human being of normal birth but is capable of filling some position with honor to himself, and benefit to the world, if fitted for the duties of that position by proper training. The farm is a great school of study. It takes sound judgment and long experience to master the rotation of crops, the relative merits of labor-saving machinery, the mysteries of sub-soiling, plowing, planting and harvesting field crops, raising and improving and feeding stock, the culture of fruits and flowers, the knowledge of compost manure, the value of commercial fertilizers, and the chemical properties of the soil, the philosophy of vegetable physiology, the millions of microscopic insects that invest the products of the garden and farm, the power to turn experience and observation into practical use—these are vast themes for the farmers' attention, mastered only in a life-time. Farmers should have a knowledge of all that immediately concerns their calling. They should understand how to grow large crops, and how to dispose of the same as to the best time and advantage. This is education; to learn to think and make the most of life, to become live farmers, and the live thinkers whether having a corn-field or governing a nation always lead. Then, fellow men, ignorance is the only slave; God ever made intelligence the only king.

The new customs and fashions of the people engaged in other industries demand that agricultural products shall be of a higher type and better quality. It is almost an impossibility to dispose of an inferior article of farm productions. The cry is more gilt-edge butter, better beef, potatoes, fruits and whiter flour. Yet in this, as in many things, education lags far behind conception, and supply responds slowly to demand. To some extent this is true in the application of this element of education of agriculture. If I should ask the question here to-day, Is agricultural education necessary? every one present would answer, Yes. If I should ask the men who believe that the profession of agriculture exempts from the conditions of skill and science required for success in other pursuits, to stand up, all would remain seated. Educational fitness for this is, as for all pursuits of life, *theoretically* admitted. The time demands that in whatever profession man is engaged he should be educated to that profession. Now, who will tell me that it is less important for the farmer to understand the composition of his soil that produces a certain vegetable or grain, than it is for the painter to know how to combine colors, so as to produce one unlike either of its constituents and more desirable than all of them separated?

Who will tell me that it is more unfortunate for the farmer to neglect through ignorance the vital condition to the perfection of a crop from the soil, than for a lawyer to try a case and send it to the jury in ignorance of the repeal of the statutes upon which the claim of his client rests? Will any one tell me how the farmer can overcome or guard against the multitude of diseases that assail vegetable life, without a knowledge of the principle of growth and condition of health in tree and plant, better than the physician can treat corresponding derangements in the human system, without the knowledge of physiology and the cause and nature of diseases?

It seems quite impossible that any sane man should question the necessity of a special course of training for intelligent husbandry, and when the necessity is admitted, it is both irrational and cowardly to rest until a want of such magnitude is relieved by an adequate supply. It is certainly inconsistent with the American character, to yield without the mastery of the problem. Above all, it would dishonor us as a State to neglect our duty. Maine is the synonym of leadership in the history of bold and unflinching progressiveness: if not at the front in this, we are nowhere to our honor.

No State has a deeper interest in the subject than ours. Maine is emphatically a good agricultural State, and capable of supporting a greatly increased population when its latent powers of production are brought out by scientific methods and practical work; but with our present management or mismanagement, our young men are disposed to break away from the endearments of home, the scenes of their childhood, and leave the graves of their fathers and mothers, and seek a home in the far West. If they could be convinced that by an expenditure not so great as they will be obliged to make in removing to a new country, and there building up meeting-houses and school-houses, and roads, and other public improvements, they will be less inclined to leave the scenes and the friends of their youth, to encounter the hardships and privations of a new country. This is one thing that should quicken our people to action, and a good reason why we should see prompt and earnest work in the interest of agricultural education in our State. Why leave a stone unturned that will tend to develop our own home industries? We have sixty-four thousand farms, and land enough for as many more. Why suffer the States of Minnesota and Wisconsin, through their legislators, to throw out stronger inducements for their agricultural interests than we, and draw our young men away from us, when our climate is as good and better than theirs, and the moment our productions are produced, they are worth double in our market what theirs are in their home markets.

Look at the cities of Chicago, St. Paul, Minneapolis, and many other western cities, and what would have been those vast cities of to-day had it not been for Maine and New England influence? Consider for a moment the brains and the energies that have gone out from us into those frontier towns of the West, and what would have been that vast region to-day if not for Maine and New England sons? Recently, while passing through the West, I was constantly coming in contact with Maine men. Yes, Maine sons are scattered broadcast throughout the West, playing an active part in the agricultural and manufacturing interests, and also in the political affairs of the nation. Why stand we still with folded arms, unconcerned, and allow this to go on until our own resources and industries are developed? Some one may ask, "What can we do?" Why suffer our young men to repair to the cities, and fill the workshops to overflowing with their muscle, causing discontentment and dissatisfaction between themselves and their employers, by being obliged to work just so many hours for a bare existence, as it is called, when there are millions of acres of land mourning for the plowshare, capable of producing the necessaries and the comforts of life, where they can enjoy the pleasures and emoluments of an honest yeomanry such as the world has never seen, being their own boss, making their houses as long or as short as they please, being an honor to themselves, their friends and the world? Some may ask, "What can we do to obviate this?" My answer is this: The times, the fashions and customs, and the state of affairs demand that we do something. Let us build up our agricultural interests by education. Let us build a structure that will be an honor to ourselves, our State and country. Let us throw out such inducements as will smother the idea that there is a better spot on God's green earth in which to live, all things considered, than our own State. Of the three great industries of our country, agriculture comes first upon the list; let us foster other interests, but by all means build up agriculture first. Who can deny the fact that a prosperous agriculture is the foundation stone of a prosperous community or State?

Assuming no wisdom above others, I am still free to declare my convictions that in order for the farmers of our State to receive such an education as the fashions and the times demand, we must have means adapted to the end or fail. We should have our college farm stocked. No sensible farmer would think he was carrying his farm on judiciously unless it was stocked with cattle of some kind. He who cultivates his library and neglects his fields until hunger drives him between the plow handles, will find to his sorrow the mastery of pure science, the higher mathematics and the classics cheap accomplishments, to be gladly exchanged for a moiety of learning in the fields of applied science. To make an agricultural school of real value it must embrace a course of instruction and system of teaching covering the whole field of agriculture. It must be a school of itself, brought down to the solid footing of plain instruction in science and practice, and sealed by the sweat of the student's face upon the farm. There are other means of agricultural education than schools and colleges which commend themselves to the thoughtful and observing, which are our agricultural societies: they are schools of observation and incentives to study, yielding a rich return to those who labor so generously in their behalf. No other means have been more effective in infusing pride and awaking a spirit of emulation among farmers that they should be conducted with a closer reference to the elucidation of facts. They should be in close sympathy with the largest portion of our people, the producers. The public heart should throb in their behalf and answer every reasonable demand of those who live by labor and desire to educate themselves in the most intelligent and acceptable methods of farming. The farmer who carries away the prize is always proud of it, and should have the credit of taking a forward step in advancing the standard of agriculture. Not wishing by any means to recommend, only as a suggestion, sir, it is my opinion that our State agricultural societies should be state institutions, then strictly audited accounts would be kept and free to be carefully looked over by any member of the society who wishes to do so. Then the few devoted souls who have shouldered the burdens of the institution, and have been carrying it along year after year by their persevering and untiring efforts, would be free from the upbraiding of the inquisitive and interested public.

It is too bad for our State Agricultural Society to be struggling through a financial depression. The farmers of Minnesota were delighted and too glad when the State appropriated $100,000 for the establishment of a State fair, notwithstanding it was their own hard earned dollars that paid the bill. Their legislators seemed to be aware of the fact that these agricultural interests were the backbone and the foundation of their prosperity and success as a State. Hence, I think our agricultural societies should be harrowed over that they may be made more productive and bear better fruit.

Our institute work is accepted by the farmers with good grace, and in my experience is satisfactory. It has been the endeavor of our Secretary to provide something new for discussion, and by all means something true. These meetings are more particularly for the benefit of men of my age, and like myself, whose school days have passed, and who failed to obtain a scientific training, and, with the cares of life upon their shoulders, can only glean information by their own practice and by reading our agricultural reports and papers. I feel as though the class should be looked out for, or in other words they should look out for themselves. They are the ones who are fighting life's battles to-day, and while we should practice economy in all our business affairs, we should not be so cautious as not to invest when we are sure of receiving for our investment a good revenue. Now we have to pay a trifle for what reports we have at present, and only one in six farmers with the present number can receive one, and as they will tend to educate the farmer, showing what the Board of Agriculture and our experiment station are doing, why not invest a little more in institute work and reports? I have heard the remark made, What good does the Board of Agriculture and experiment station do me: I never get a report? And as proud and pleased a man as I ever saw was a farmer carrying away a handsomely bound report; he felt as though he had received something equivalent to what he had been paying out. There is certainly not enough reports to meet the demand, there is only enough for the favored few. There is one thing more I can hardly endorse, although I speak with all honor and respect to our worthy Secretary, but our agricultural interests receive only his divided attention. Will not sixty-four thousand farms justify us in paying a secretary of the Board of Agriculture sufficient to enable him to give our agricultural interests his undivided attention?

There is a demand for more institute work, more reports, and more attention from the Secretary. This means an appropriation sufficient to meet the demands. The Board of Agriculture are doing all they possibly can with the present funds they have to work with. Not wishing for any to think I am here to-day on a begging mission, for certainly the farmers of our State would not justify me in that, yet as I understand business, it is simply this, first find out what we want, and then go ahead and do it. And I feel justified in saying that if this honorable body should recommend to our Legislature, and they should appropriate sufficient means to stock our College farm, increase our institute work, pay our Secretary sufficient to enable him to give our agricultural interests his whole attention, or any measure whereby the farmers would become better educated, it would be a profitable investment, by causing our productions to be of better quality, the cost of producing would be less, this being an advantage to the consumer as well as the farmer. We ask for nothing more than our equal rights with our fellow men in intelligence and in adaptation to circumstances. There is an increasing demand for a more thorough education on the part of the farmers. They desire to become better citizens, better farmers, wiser, more influential and more useful men. In order to accomplish this we must go out of our selfhood and toil for something nobler than greed. Let us feel it an honor to place the fame where it belongs, upon the right side of the great ledger book of life. Adjust and adopt the truths laid down in the platform of our farmers' organization. Labor to encourage schools, colleges, fairs, libraries, and not forget the agricultural press. Do our duty and be faithful to our calling, then we shall have accomplished our mission, then we can proclaim the farm the loveliest spot for the human affection to display its sweetness, for beauty to manifest itself in the growing tree and tinted flower, for the small and well-selected library to be well read and thought over, for a race of yeomanry such as the world has never yet seen, and to cherish all that makes life lovely and brave. When mind animates toil, and sentiment beautifies it, when deep-rooted love sanctifies, routine life truly becomes a delight, though genius may charm and poetry burn, and eloquence kindle into great thoughts and deeds ; when this mission is done, who wonders they sigh for the rural quiet of the farm. In the millennium of farming, when society shall demand higher types of men, they will come from the ranks of the farmers, and the rustic and rural crown shall take the place of the civic and moral ; farmers will then be crowned and sceptred, around them the triumphs of genius and the accomplishments of art, symbolized in the plow.

Every political party has its platform, and has its creed, but the day has gone by when party lines divide the farmer's interests. They are knit together in this grand resolution. If we employ a man to do our business, the first question to settle is, Is he honest, will he be faithful to his charge? Men of all parties are hovering around the camp fires of protection, and the important measures now pending before Congress, are the Hatch bill, recommending appropriations for an experiment station in every State in the country, and the Cullom bill, adjusting inter-State commerce. Every farmer in this country is interested in these bills and is looking forward with high anticipation for their passage. I understand both these bills passed the House once and met with opposition in the Senate, and were hung upon the calendar to dry, but they have been taken from the calendar and moistened by the tears of the grieved farmers and again will be placed before that tribunal, and whoever the Senator may be, whether he be a republican or democrat, whether he hails from Maine or California, or any spot between, if he place himself on record against either of these bills, he is a marked man, and the days of his political life, as the hairs upon his head, are numbered. As farmers, as producers, as workingmen of this rich nation, we are bound to have our rights and accomplish our mission.

In conclusion, I plead for more thought from the professions, more support from the legislator, more solicitude from the people, for more and better education in the great art of agriculture, the art of arts, the science of sciences, which is the only enduring foundation of commerce and manufacture. This life pursuit followed in wisdom and faith by a God-worshiping people is the source of national worth, wealth and prosperity.

Following the reading of the paper the member from Penobscot presented the following resolution and supported the same by remarks:

Resolved, That in view of the recent calamity at the farm of the State College of Agriculture and the Mechanic Arts, involving the destruction of its valuable herd, this Board recommend that the sum of $5000, as asked by the Trustees, be appropriated to repair the loss, and that it commends the contemplated policy of the Trustees, to include two or more different breeds in the new herd.

Resolved, That this Board commends the College, in all its interests, to the generous support of the Legislature.

The member from Oxford, Mr. Pike, followed Mr. Burr by way of inquiry as to the necessity of stocking the College farm.

The member from Cumberland, Mr. Harris, followed and dwelt on the importance of stock-husbandry at large and referred to the fact that a farm cannot be run without stock. In purchasing this stock he would endorse the resolution in its recommendation of the introduction of two or more breeds.

The member from the College, President Fernald, stated that the policy of the Trustees from the start had been to introduce several breeds of stock upon the farm, and that they had been prevented from carrying that policy out only from lack of means to do so. The Jerseys were introduced as affording the best means for immediate returns with which to meet running expenses of the farm.

Further remarks were made by the member from Washington.

The member from Knox moved that the resolution be given a passage, and it was passed unanimously.

On motion, it was voted to take up the matter of State bounty to agricultural societies, and it was finally

Voted, That the disposition of that part of the State bounty to agricultural societies subject to the control of the Board be left in the hands of the several societies, the purpose or purposes for which the same shall be expended being subject to the approval of the local member of the Board, and not in any case to conflict with obligations already binding on societies.

The member from Sagadahoc brought up the recommendation of the paper read by the member from York, recommending an increase in the number of the annual reports of the Board. The Secretary was called upon to explain the law in relation to the distribution of the reports, and it was done.

The member from Androscoggin moved and it was

Voted, That a committee of three be raised by the chair to take into consideration the paper read by the member from York, and make report to the Board at 3 o'clock in the afternoon on its recommendations. The following were appointed that committee:

S. L. Holbrook,
D. W. Campbell,
R. W. Ellis.

Adjourned to meet at 2 o'clock.

AFTERNOON.

Met according to adjournment. A paper was read on the

JURISDICTION OF THE BOARD OF AGRICULTURE,

By S. L. Holbrook.

We might compare our agricultural interest to a magnificent tree, with its various branches, its minor limbs and its foliage. A tree, that in order to keep it in a flourishing condition, in such a condition that it will bear its fruit every season, will need the fostering care of the faithful husbandman. A tree that might be compared to the palm tree of the Orient, or the bread tree of the tropics, which if destroyed or if it failed to yield its fruit every season, distress and famine would follow in consequence. Such is the importance of this great industry that if you do anything in the way of legislation, either to retard or advance it, it will be felt by every industry in the land.

The Board of Agriculture was established for the purpose of advancing our whole farming interests. During these years which it has been in existence, most nobly has it done its work. The yearly Report of its doings which the Board sends out we may well be proud of. No other State document in the land can justly claim superiority. Since the establishment of the Board of Agriculture, what advancement has been made in farming and in the management of our farming operations! What improvement in our stock husbandry, in the methods of breeding and feeding stock, and in the barns to shelter them! What improvement has been made in the implements with which we cultivate our farms! The great business of horse breeding has grown to such a degree of importance, that our State now stands in the very front ranks of this industry. In all this progress that has been made, without assuming an air of importance, the Board of Agriculture can say, I am the pioneer; I have led the way. Her counsels have always been wise and considerate, and safe to follow. While the Board has been clothed with some limited authority by which it could guard and guide our agricultural interests, we do not hesitate to say that it should be clothed with more authority. It is claimed, and we think justly, too, that the administration of our Government should always be surrounded by its friends in order to be successful. In this connection let me ask who should surround our farming interests but its friends, but the votaries of this calling. The Board of Agriculture should stand at the head of all our agricultural interests.

The Government of our State consists of three branches, viz: a Legislative, an Executive and a Judiciary. And through the wisdom of our legislators we have established certain State Institutions. In the interests of justice, and for the safety of society, we have our State Prison. In the interests of humanity we have our Insane Hospital. That our wayward boys may be taught to turn their feet into the paths of virtue and industry we have our State Reform School. Over all these Institutions the State holds complete control and we have no reason to be ashamed of the administration of the affairs of any of these Institutions. For the benefit of our industrial classes more particularly, we have our savings banks. The State grants a charter by which they can do business, but holds over them the right to call them to account. We all acquiesce in the importance of having a Bank Commissioner. Another of our State Institutions, of which I might speak, is our State College—an Institution from which should be gathered the richest and choicest fruit, not only from the soil, but that intellectual fruit which is characteristic of our Maine boys, and which is known and appreciated wherever known. We believe that this Institution should be altogether in the hands of its friends. The College has no better friend than the Board of Agriculture.

Our Agricultural Fairs are now acknowledged by all to be among the fixed institutions of the land, and one of the essential requisites for the advancement of our farming interests. But the question arises, could not their sphere of usefulness be enlarged by placing them more under the control of the *State?*

It may be well for the Board of Agriculture to look back at times to the organic act by which it was created and in which its work is prescribed. Section one of the law governing the Board specifies its object to be "for the improvement of agriculture and the advancement of the general interests of husbandry." Section seven of the law specifies what it *shall* do in order to carry out the object specified in the first section, and it reads as follows: The Board shall investigate such subjects relating to agriculture, horticulture and the arts connected therewith, as they think proper. The word "shall" there makes it the *duty* of the Board to investigate any subject relating to agriculture which in their judgment may call for attention, and through which attention the interests of husbandry may be advanced or improved. This opens the whole field of agriculture, whether found in the organized bodies connected with agricultural affairs or in the methods and practices of the practical work of the farm, legitimate objects for our investigation and inquiry. Nor are these duties to be confined to such organizations as have been incorporated by the Legislature of the State. The duty is equally binding on those organized under the general law for corporations, and even those having no legal compact, provided their work is connected with agriculture affairs. Taking this view of the duties of the Board, and there is no question but it is what the law contemplates, and the Board then becomes the guardian of the agricultural interests of the State, and is specially commissioned to study, inquire into and examine all work of whatever kind that is carried on in the interest of agriculture. And the further duty follows that in its prescribed methods it is to labor to increase the efficiency of all these instrumentalities that the interests of husbandry may thereby be promoted. The jurisdiction of the Board, then, is as broad as our agriculture, and so long as its work is kept within the scope of this industry no one can say that we are meddling with that which is none of our business.

The work of the different agricultural societies of the State, in view of the fact of their wide-spread application as well as the importance of their work, should certainly receive watchful attention from the Board. At our last annual meeting the work of county agricultural societies was critically scanned and not without an influence.

Our State Agricultural Societies are properly matters for our consideration, and even our investigation, whenever it is believed they call for attention on our part. The Revised Statutes contemplates one State Society only, yet we have a second operating under an act of incorporation, and a third is now under contemplation. How far this division of the State into territorial fairs shall go on, and whether the interests of agriculture will be promoted by this division, are questions which may properly be considered by the Board. How many State fairs can be crowded into a single State is a question of some importance.

State fairs, it may be assumed, are instruments for the promotion of agriculture, and not corporations organized for the benefit of corporators. This makes them subject to the will of the people instead of the reverse of this order. The methods of organizing and conducting State fairs have not been crystalized into a fixed form and everywhere pronounced right. Their management, then, becomes a proper matter for consideration. In fact, it is the duty of this Board to consider these things.

Our State Fair is a State institution, or is supposed to be, and there is no other authority outside the Board of Agriculture authorized to guard the rights of the public in their relations to it. The present State agricultural organization was built on the ruins of the old, and was organized under the general law governing the organization of corporations. The State, the public, the people, hold no governing power over it, save that which relates to the election of officers, and authority to hold property. Such an organization is a great way from the people, and entirely an exception to every other State institution within our borders.

In the care of these Fairs the exhibitors who make them up and the people who patronize and sustain them, have no special protection provided. They have not even the privilege to know the financial standing of the institution they are asked to sustain by their contributions and their money. Neither do the people know who are the recipients of the funds of the Society, nor where the money goes to.

Now, a proper question for the Board to raise is this: If we have a State Fair, should not the State hold some controlling power over it, by which it is made answerable to the State, that the public shall be protected in their rights in it? The Board of Agriculture is the only authorized medium of State authority to consider this matter.

In several of the Western States the State Board of Agriculture is made the managing power of the organization, with requirements to report all transactions and all receipts and expenditures to the State, and the Board is responsible to the State the same as any other State institution.

Gentlemen of the Board, the power invested in us is very limited. Our mission is a peaceful one. But we have the right to investigate and inquire, and it is our duty to do so; and by so doing we can call public attention to matters within our jurisdiction, and indicate means and methods by which they would become more useful in the work they were organized to carry on. While invested powers, then, may be weak, there are still opportunities to work in a manner which may become a power for the advancement of the agricultural interests of the State.

After the reading of the paper the following resolution was introduced by the member from Oxford:

Resolved, That the law providing for the printing of ten thousand copies of the Report of the Board of Agriculture be so amended as to provide for twenty thousand copies, and that the whole edition be bound in cloth.

After discussion this resolution was passed by a unanimous vote.

The member from Sagadahoc, from the committee to which was referred the paper read by the member from York, reported in the form of the following resolutions, which received a passage:

WHEREAS, in view of the growing demand on the part of the farmers of our State for more knowledge in regard to their business, and in view of the inadequate means of supplying that demand; therefore,

Resolved, That this Board recommend the following appropriations by the Legislature:

That the sum of $2,500 be appropriated for the holding of Farmers' Institutes in the different counties.

That the salary of the Secretary of the Board of Agriculture be increased to $800 in view of the increased amount of labor he will constantly have to perform.

This resolution was discussed at length by Messrs. Harris of Cumberland, Deering of York, and Pike of Oxford.

On motion, a committee was raised to appear before the Committee on Agriculture of the Legislature and present the matters embraced in the foregoing resolutions, as follows:

W. W. Harris,
A. O. Pike,
B. A. Burr.

The member from the State College, President Fernald, introduced the following resolution, which was passed unanimously.

Resolved, That this Board approves of the main features of the Hatch bill for the establishment of experiment stations in connection with the colleges of agriculture and mechanic arts in the several States, and requests the members of Congress from this State to favor by their influence and vote for the passage either of this bill, or of a substitute, which may promise in their judgment to secure more effectually the general objects of the Hatch bill.

After the passage of this resolution it was

Voted, That the Secretary of the Board be instructed to forward a copy of this resolution to each member of the Maine delegation now in Congress.

On motion of the member from Aroostook, it was

Voted, That the Secretary of the Board be requested to use his efforts to secure such legislation at the present session of the Legislature as shall better protect the stock interests of the State from the introduction or spread of contagious diseases.

The member from Sagadahoc introduced the following, and moved that the same be given a passage. Passed.

Resolved, That the farmers of the State of Maine, through the members of the Board of Agriculture, respectfully ask our Representatives and Senators in Congress, to use their efforts to have the postal laws so amended as to allow the several States to send their public documents through the mails to citizens of the State, at the same rates of postage allowed publishers of newspapers.

After the usual compliments, the Board adjourned finally.

Z. A. GILBERT, *Secretary*.

REVIEW OF THE YEAR.

The year 1886 may be placed on record as one of reasonable prosperity for farmers in general. Though prices of most products of the farm may be said to have ruled low in value, yet the unprecedented low cost of all commodities for the family which are purchased, and a like low expense for the needed equipments of the farm, more than offset the shrinkage in the value of products sold, so that as a rule, throughout the State, money has been easy among farmers and fairly satisfactory gains have been made. In no former year have they purchased so freely of farm implements and machinery or of commercial fertilizers; and dealers report collections easy and bills closely paid up. The contentment and prosperity found on the farm are in pleasing contrast with the discontent and disturbance seen on every hand among the laboring classes of the cities. The privileges and advantages of farm life never were more apparent than at the present time. It may also be said that they never were better appreciated by our people.

The farmers, too, are wide-awake and active in their own affairs and are looking sharply after better means and better methods through which still better results may be secured. This activity of mind never was so apparent before. Better stock is being secured in every direction and better methods of feeding it practiced; better crops are raised and at less cost; and substantial improvements are being made which add to the productive powers and real value of the farm.

Either as a cause or sequence of this general thrift and prosperity there is felt a higher appreciation of the advantages afforded by our State for a home for its people. It is being seen more plainly than ever before that the opportunities offered for successful farming are as favorable here in our State as are to be found elsewhere.

The crops of the year gave no remarkable return in any direction. The grass crop, the chief reliance of the farm, was something above an average, though not as large as the famous crops of 1882 and 1883. Comparing figures formerly given and on the same basis, the crop of the State would reach one and a quarter millions of tons. This was harvested in fairly average condition. In fact, with the equipments for haying now at hand and a greater experience in their use, the hay is secured under like conditions of weather in much better order than was the case formerly.

The early part of the summer was too cool for pushing the corn into an early growth and as a consequence the crop was somewhat reduced in yield. The area devoted to sweet corn for canning was larger than in the previous year, owing to better demand for the product. and this swelled in a measure the aggregate area of the crop in the State to a full average. With the improved culture now given the crop, the unfavorable weather was in a measure overcome and the yield was up to average results. The contract price was three cents per can of twenty-six ounces.

Potatoes were an average crop in area and in yield. Aroostook County is still the great potato field of the State. The better transportation facilities send a much larger proportion of the crop to distant markets than formerly, so that the starch industry is not on the increase in that section. In fact, starch can only be manufactured from *cheap* potatoes.

The crop of grain of the different kinds did not yield equal to the great crops of the two previous years, but was above an average. The appreciation of growing grain for home use is somewhat on the increase and the area has slightly extended in consequence. The low price of flour from western wheat is still crowding out the wheat crop and its place is being taken by other kinds of grain. What is termed "mixed grain," or a mixture of barley and oats, with wheat sometimes added, is in favor with many farmers and is now largely grown for stock feed.

The apple crop of the State was an abundant one, making the third crop in succession. This is quite remarkable in the history of apple production, the experience formerly having been that bountiful crops alternate with barren years about equally. The aggregate crop in the State at large has not widely differed in each of the last three years. The benefits of this succession of crops to the State has been sensibly felt. Some of the crop was sold early after harvesting for about one dollar and a half a barrel, but the larger part of the crop realized from two to three dollars, and for late sales the price went even higher. New orchards are rapidly coming into bearing and the business of fruit production is destined to be of still more importance among us.

Changes in the live-stock interests are chiefly in the direction of an increase of dairy stock. Breeds noted for milk and butter production are receiving marked attention. Animals of Holstein-Friesian blood, both bulls and cows, have been introduced in various sections of the State, and in numbers sufficient to soon determine from practical work their adaptation to our conditions.

Dairying is on the increase, and especially so in those sections where creameries have been successfully established. This method of work is proving to be well suited to our wants, and new enterprises of the kind are being established. During the year creameries have been started at West Paris, Acton and Livermore, and several others are being organized in still other sections.

On the other hand, the beef interests have encountered continuous low prices throughout the year, which has produced a depressing effect on the business. Seven to seven and a half cents have been the top prices for the best oxen. At such figures the business does not commend itself to the favor or the judgment of our farmers. The introduction of Chicago dressed beef into all our cities and large towns has monopolized the trade in beef through the winter months almost entirely. How long this may continue remains to be known, but if the present low prices continue the efforts which have been made to encourage the making of beef in the State will fail of expected results.

A slight rise in wool during the year gave a wave of encouragement to our sheep interests, and with good prices for lambs gave a fair season's results. The tendency is to turn attention to the mutton breeds. Among these, the different families of the Downs are taking the lead. A flock of forty-nine Shropshire Downs was imported from England in January, by Brown & Hilton of Anson.

Horses continue to receive their full share of attention, and improvement is marked and rapid. Heavier horses are wanted for business purposes and for draft, and much attention is given in this direction.

Pork products have run low the year through, the ruling price for round hog being six cents. There is no profit in the business at such a figure and the stock of hogs is being reduced down to simply enough to consume the waste of the farm.

The agricultural societies of the State are generally in a flourishing condition, as may be seen by the statistical returns herein given. They are generally officered by men who are seeking earnestly to promote the interests they represent. As will be seen by the financial returns, there are but three societies carrying any considerable indebtedness, and in each of these cases it is for recent improvements and will soon be cancelled. There were two new societies incorporated by the last Legislature, the North Washington with grounds at Princeton and embracing the territory of that section of the county, including the city of Calais; and the Androscoggin Valley in North Eastern Oxford County, embracing Canton, Dixfield and vicinity. These societies have "all the rights and privileges of other incorporated county societies."

The State Agricultural Society held its annual exhibition at Lewiston, September 21–24. No report of its transactions has been made public. The receipts from the exhibitions are large, yet the liabilities of the Society are heavy.

The Eastern Maine Society held its exhibition at Bangor in connection with the New England Agricultural Society, August 31 and September 1–3. The exhibition was full and the receipts heavy.

The transactions of the State Pomological Society will be found appended to this report and give full details of its work for the year.

The institute work of the Board of Agriculture has been conducted in the usual manner. Every institute held for the year has been under the direct supervision of the Secretary. The members of the Board have been drawn upon for a large part of the needed aid, and lectures and papers have also been given by other competent men in the State. In addition to these services expert authorities from other States have been employed to give lectures on their specialties. The institutes have been well attended and there is a call for much more work of the kind than is now provided for. The principal lectures and papers given before the institutes will be found in this report.

OFFICERS OF AGRICULTURAL SOCIETIES.

Societies.	President.	Post Office.	Secretary.	Post Office.	Treasurer.	Post Office.
State Agricultural	Rufus Prince	South Turner	A. L. Dennison	Portland	B. F. Briggs	Auburn.
Eastern Me. Fair Association,	J. P. Bass	Bangor	E. L. Stearns	Bangor	E. B. Neally	Bangor.
Maine State Pomological	Charles S. Pope	Manchester	S. L Boardman	Augusta	D. H. Knowlton	Farmington.
Androscoggin	Daniel Field	Danville Junc.	W. R. Wright	Lewiston	David Farrar	Lewiston.
Aroostook	John Stewart, Jr	Houlton	Ira J. Porter	Houlton	William Donavan	Houlton.
Aroostook, North	G. M. Park	Presque Isle	H. H. Cook	Presque Isle	J. W. Bolton	Presque Isle.
Aroostook, Madawaska	Luc Albert	Madawaska	Alexis Cyr	Grand Isle	Jean Cyr	Madawaska.
Cumberland	W. W. Harris	Cumberland Cent	J. J. Frye	Portland	John J. Frye	Portland.
Franklin County	J. W. Lothrop	Chesterville	E. A. Hall	Chesterville	P. P. Tufts	Farmington.
Franklin, North	M. C. Kelley	Phillips	M. S. Kelley	Phillips	Frank H Wilbur	Phillips.
Franklin, Central	Adam Hunter	Strong	E A. McKeen	Strong	J. H. Bell	Strong.
Kennebec County	J. Henry Moore	Winthrop	H. O. Nickerson	Readfield	C. H. Stevens	Readfield.
Kennebec, North	S. P. Abbott	Waterville	A. H. Rice	Waterville	J. G. Soule	Waterville.
Knox County	John D. Rust	Rockport	Charles L Allen	Rockland	J. A. Tolman	Rockland.
Knox, North	C. R. Morton	Union	A. M. Wingate	Union	N. K. Burkett	Union.
Lincoln County	George B. Sawyer	Wiscasset	E. W. Dunbar	Damariscotta	Ephraim Taylor	Newcastle.
Oxford County	H. L. Horne	Norway	A. C. T. King	South Paris	A. C. T. King	South Paris.
Oxford, West	Asa O. Pike	Fryeburg	B. Walker McKeen	Fryeburg	John Locke	Fryeburg.
Penobscot County	A. G. Kent	Brewer Village	B. A. Burr	Bangor	B. A. Burr	Bangor.
Penobscot and Aroostook	-	-	-	-	Sam'l W. Robbins	Patten.
Penobscot, West	S. W. L Chase	Exeter Mills	T. P. Batchelder	Kenduskeag	T. P. Batchelder	Kenduskeag.
Penobscot, North	Nathan Averill	Lee	S R. Ludden	Lincoln	F. M. Johnson	Lee.
Penobscot Central	Fred A. Thayer	West Charleston	H. W. Palmer	East Corinth	Jas. Knowles	East Corinth.
Piscataquis, East	S. D. Millett	Milo	M. L. Durgin, Jr	Milo	M. L. Durgin, Jr	Milo.
Piscataquis Central	A. M. Robinson	Dover	B. F. Hammond	Foxcroft	B. F. Hammond	Foxcroft.
Piscataquis, West	Frank Hart	Willimantic	J. F. Thombs	Monson	J. F. Thombs	Monson.
Sagadahoc	Charles E. Townsend,	Brunswick	Isaac E. Mallett	Topsham	Lyman E. Smith	Brunswick.
Somerset, East	Charles Mason	Hartland	P. H. Taylor	Hartland	G. M. Burleigh	Pittsfield.
Somerset Central	R. B. Shepherd	Skowhegan	A. R. Smiley	Skowhegan	A. R. Bixby	Skowhegan.

Somerset, West	Geo. Flint	North Anson	Benj. Moore	North Anson	Benj. Moore	North Anson.
Waldo County	S. A. Payson	Belfast	Mark A. Walton	Belfast	A. S. Redman	Belfast.
Waldo and Penobscot	Freeman Atwood	Monroe	E. H. Neally	Monroe	F. L. Palmer	Monroe.
Waldo, North	F. B. Lane	Unity	Jas. H. Cook	Unity	H. B. Rice	Unity.
Washington County	Nelson S. Allan	Dennysville	H. F. Porter	Pembroke	Peter E. Vose	Dennysville.
Washington, West	James L. Bucknam	Columbia Falls	Eben F. Allen	Columbia Falls	F. L. Allen	Columbia Falls.
Washington Central	John C. Talbot	East Machias	W. H. Phinney	Machias	M. Gardner	Machias.
York County	D. A. Burnham	Biddeford	A. L. Ricker	Biddeford	Geo. H. Boothby	Saco.
York, Buxton and Hollis	Calvin Roberts	South Hollis	Ira W. Milliken	Hollis	Elmer T. Roberts	South Hollis.
York, Shapleigh and Acton	E. A. Moulton	Shapleigh	H. Bodwell	Acton	H. A. Stanley	Shapleigh.
York Ossipee Valley Assoc'n,	B. F. Pease	Cornish	Jas. C. Ayer	Cornish	Howard Brackett	Cornish.

FINANCIAL STATEMENT OF AGRICULTURAL SOCIETIES FOR THE YEAR 1886.

	Amount Received from State.	Amount raised by Society.	Total Receipts for the Year.	Total Amount of Premiums and Gratuities Awarded.	Incidental Expenses for the Year.	Whole Amount of Disbursements for the Year.	Value of Property Belonging to the Society.	Amount of Liabilities of the Society.	Awards for Plowing at Exhibition.	For Bulls and Bull Calves.	For Working Oxen, 3 years old and over.	For Steers under 4 years old.	For Milk Cows.	For Heifers and Heifer Calves.
Maine State Pomological	$500 00	$491 00	-	$613 75										
Androscoggin	400 00	481 44	$881 44	311 00	$139 30	$450 30	$722 82	-	-	$13 00	$12 00	$11 00	$13 00	$6 00
Aroostook	54 00	424 01	-	168 49	274 99	507 07	-	$29 06	-	11 50	8 00	4 50	12 00	8 50
Aroostook, North	297 00	637 00	934 00	653 00	520 00	1203 00	1022 90	570 00	-	14 50	11 00	18 50	24 00	16 75
Aroostook, Madawaska	53 00	33 47	86 47	102 75	28 00	130 75	-	-	-	4 75	3 00	5 50	2 25	4 25
Cumberland County	-	-	-	-	-	-	-	-	-	25 00	79 00	28 00	94 00	21 00
Franklin County	117 00	1239 41	1646 50	718 45	682 35	1499 02	3500 00	300 00	-	39 75	4 50	4 50	14 50	16 25
Franklin, North	51 00	1110 10	1279 52	338 45	155 00	1207 44	1100 00	495 31	$3 25	10 50	42 00	20 00	20 00	11 50
Franklin Central	14 00	-	97 38	57 73	15 00	100 00	300 00	400 00	-	2 00	1 75	4 50	-	2 75
Kennebec County	166 00	1458 49	1624 49	726 95	1231 32	1958 27	1000 00	300 00	-	12 00	59 00	36 00	26 00	25 50
Kennebec, North	234 00	367 98	601 98	443 50	345 00	601 50	3000 00	1715 00	-	19 00	8 00	11 00	19 00	10 00
Knox County	161 00	824 57	985 57	739 25	361 96	928 62	25 00	121 09	-	9 00	32 00	16 00	32 00	18 50
Knox, North	168 00	673 07	990 94	360 70	423 59	784 29	206 65	-	-	8 50	35 00	19 50	14 50	14 00
Lincoln County	248 00	610 50	858 50	27[illegible] 45	481 39	759 84	-	-	-	8 00	5 00	9 00	11 00	11 00
Oxford County	230 00	3562 64	3792 64	1892 00	1620 89	4234 50	7500 00	1850 00	-	121 00	89 00	118 00	82 00	103 00
Oxford, West	96 00	2500 00	2596 00	781 35	528 13	3673 26	5388 00	2500 00	-	19 50	18 00	10 50	10 00	25 50
Penobscot County	27 00	184 69	211 69	114 65	-	-								
Penobscot and Aroostook	100 00	103 74	203 74	96 50	31 95	128 45	-	-	-	-	6 50	8 50	6 50	1 75
Penobscot, West	276 00	1069 40	1345 40	453 84	494 78	1083 67	2000 00	-	-	23 00	27 00	17 00	25 00	23 25
Penobscot, North	35 00	98 61	133 61	89 05	31 68	110 15	-	-	-	1 50	6 50	6 25	4 50	2 00
Penobscot Central														
Piscataquis, East	20 00	44 00	64 00	65 00	18 00	-	-	-	-	3 25	5 00	3 00	3 00	3 50
Piscataquis Central	113 00	295 24	408 24	259 25	156 41	419 39	-	-	-	11 00	17 00	6 50	17 00	6 00

Piscataquis, West...............	16 00	78 00	94 00	57 40	23 00	80 40	–	26 00	–	1 25	7 75	2 75	2 00	1 50
Sagadahoc	264 00	3300 32	3564 32	1548 19	1865 26	3413 45	5000 00	–	–	36 00	181 00	53 25	37 00	31 50
Somerset, East	63 00	1259 25	1322 25	286 35	497 68	1280 68	2500 00	244 78	–	11 25	20 00	50 00	26 00	20 25
Somerset Central	260 00	1413 45	1673 45	1094 10	749 03	1843 13	4200 00	169 68	–	33 00	68 00	37 00	44 00	63 00
Somerset, West														
Waldo County	130 00	795 65	925 65	825 00	25 00	850 00	2300 00	–	–	15 50	8 00	15 00	31 50	25 00
Waldo and Penobscot............	130 00	1668 27	1798 27	1007 45	317 70	1325 15	2500 00	–	–	41 00	39 00	24 00	30 00	20 00
Waldo, North...................	92 00	209 00	301 00	257 95	130 37	561 88	–	–	–	26 00	36 00	11 25	12 00	10 50
Washington County	137 00	1033 45	1170 45	887 17	405 24	1614 41	1922 00	–	–	33 50	12 00	20 50	25 00	27 50
Washington Central	127 00	976 75	1103 75	879 90	156 38	1116 64	–	371 19	–	37 80	15 00	23 56	26 00	32 00
Washington, West	136 00	1155 75	1291 75	752 15	545 11	1297 26	25 00	–	8 00	40 00	19 00	27 00	27 00	25 50
York County	258 00	1151 20	1409 21	1135 77	254 95	1390 72	–	–	13 00	11 50	60 00	14 00	25 00	9 00
York, Buxton & Hollis	71 00	583 39	654 39	307 15	268 00	575 15	1000 00	150 00	–	4 00	32 00	10 00	15 00	8 00
York, Shapleigh & Acton	71 00	242 40	313 40	307 50	10 50	317 50	5000 00	–	–	3 50	48 00	10 50	8 00	4 50
York Ossipee Valley Association..	200 00	1295 71	1495 71	792 00	746 55	1600 90	3800 00	231 93	–	16 00	74 82	23 49	21 42	10 13

FINANCIAL STATEMENT OF AGRICULTURAL SOCIETIES FOR YEAR 1886—*Continued.*

	For Fat Cattle.	For Trials of Speed.	For Stallions.	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.	For Rye.	For Barley.	For Oats.	For Buckwheat.	For Beans.	For Peas.	For Potatoes.	For Carrots.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Maine State Pomological ..																				
Androscoggin..	12 00	-	16 00	5 00	18 00	9 00	6 00	-	80 00	33 00	40 00	6 00	3 00	5 00	5 00	-	-	-	16 00	
Aroostook	-	90 00	12 50	6 00	34 50	8 00	12 50	7 25	70 25	53 00	50	75	-	50	75	75	75	-	1 50	75
Aroostook, North	-	350 00	9 00	9 00	50 75	16 50	-	3 50	104 75	59 75	3 50	1 50	-	-	2 50	-	2 50	-	2 50	
Aroostook, Madawaska . ..	-	5 25	4 75	3 00	14 25	2 75	6 25	-	28 75	22 00	1 20	1 20	-	1 20	1 20	1 20	1 20	1 20	1 20	1 20
Cumberland County	9 00	300 00	12 00	5 00	13 50	3 00	6 00	12 00	255 50	23 00	2 25	-	-	1 50	-	-	2 75	1 00	3 50	
Franklin County..........	8 50	232 00	17 50	7 00	27 50	6 00	46 25	5 00	234 50	55 00	-	-	-	-	-	-	-	-	-	35
Franklin, North	7 50	105 00	5 00	4 50	20 95	4 00	10 75	7 40	136 50	23 95	2 90	3 00	-	-	-	-	-	-	1 70	40
Franklin Central	1 00	3 75	1 75	1 75	4 75	-	7 50	-	20 00	11 00	-	25	-	-	50	-	-	-	45	45
Kennebec County	8 00	245 00	16 00	6 00	45 00	13 00	13 50	8 75	216 25	67 00	40 25	13 00	-	4 00	-	-	-	-	6 00	
Kennebec, North..........	5 00	176 00	75 00	6 00	40 00	3 00	10 00	7 00	92 00	61 00	2 00	1 00	-	1 00	1 00	-	2 00	1 00	2 00	
Knox County	6 00	250 00	12 00	5 00	77 00	17 00	9 00	30 00	169 50	94 00	13 75	50	-	50	50	-	6 25	1 50	6 00	
Knox, North	8 50	-	5 00	3 00	24 75	6 50	9 00	7 00	122 50	27 75	4 60	5 50	50	2 00	2 00	-	50	50	4 25	
Lincoln County	8 00	100 00	14 00	5 00	23 00	3 00	17 50	3 75	59 50	42 00	9 75	12 50	2 00	5 00	6 00	-	2 75	50	1 75	50
Oxford County............	12 00	705 00	42 00	27 00	74 00	21 00	48 00	11 00	649 00	143 00	30 00	27 25	-	6 00	6 00	-	3 00	-	17 50	75
Oxford, West..............	9 00	280 00	5 00	6 00	32 50	12 00	5 00	9 00	257 50	38 50	5 00	-	-	-	3 00	-	-	-	3 00	75
Penobscot County.........	-	-	-	-	-	-	-	-	29 50	-	-	2 50	-	2 00	6 00	1 00	3 00	-	3 00	
Penobscot and Aroostook...	-	8 00	4 00	3 00	12 75	-	10 00	1 25	33 25	15 75	50	-	-	-	-	-	-	1 00	50	
Penobscot, West	5 00	10 00	19 50	6 00	115 00	11 00	15 75	9 00	147 00	70 50	7 10	2 00	-	1 00	2 25	1 75	2 25	2 25	3 70	
Penobscot, North	2 00	87 00	3 50	2 50	15 75	1 00	3 50	6 00	28 25	21 75	75	-	-	50	2 25	-	25	25	2 75	25
Penobscot Central																				
Piscataquis, East	-	8 00	3 00	6 00	12 50	-	5 00	-	22 75	21 50	75	-	-	-	-	-	-	-	75	
Piscataquis Central	-	45 00	10 00	22 00	9 50	11 00	1 50	3 00	70 00	41 50	25									

Piscataquis, West.........	-	8 00	1 00	1 25	12 25	1 25	50	1 50	18 50	14 50	40	-	-	-	-	-	-	-	25	
Sagadahoc................	11 00	610 00	18 00	10 00	31 00	16 00	21 00	37 50	516 25	59 00	16 25	1 00	1 50	2 50	2 50	1 00	9 50	1 75	9 00	75
Somerset, East	6 00	525 00	-	10 75	21 75	10 75	24 00	-	172 25	32 50	7 50	3 00	-	-	1 00	-	-	-	5 00	
Somerset, Central.........	9 00	550 00	42 50	20 00	56 50	8 00	27 00	20 50	309 50	119 50	2 00	-	-	-	1 25	-	1 25	1 25	3 00	75
Somerset, West																				
Waldo County	5 00	400 00	15 00	10 50	30 00	-	5 00	-	105 00	56 50	10 00									
Waldo and Penobscot......	19 00	489 00	36 00	7 00	60 00	12 00	9 00	21 00	215 00	103 00	8 00	3 50	-	-	1 50	-	1 50	1 50	5 25	1 50
Waldo, North.............	9 00	-	19 50	6 00	21 75	-	11 50	3 35	105 25	27 25	6 00	5 00	1 50	2 00	2 25	-	3 50	-	3 50	1 25
Washington County	12 00	325 00	13 00	24 00	45 00	15 00	13 00	22 50	229 00	82 00	5 25	2 25	1 00	3 25	2 50	2 25	9 00	2 50	25 75	2 50
Washington Central	-	435 00	28 00	13 00	31 00	22 00	19 00	21 50	194 00	72 00	1 50	11 00	-	1 50	1 50	-	8 75	1 50	7 25	50
Washington, West	-	208 00	25 00	7 00	28 00	16 00	18 00	21 00	181 00	35 00	5 25	5 00	-	5 00	5 00	-	5 00	5 00	12 25	3 75
York County	6 00	650 00	7 00	6 00	36 00	5 00	6 00	29 00	178 50	49 00	2 50	-	-	-	50	-	-	-	50	
York, Buxton and Hollis ..	2 00	166 00	8 00	3 00	16 00	-	1 00	2 50	70 00	20 00	3 00	-	-	-	-	-	1 50	50	50	
York, Shapleigh and Acton,	6 00	136 00	3 00	3 50	25 50	10 00	8 75	5 75	105 00	29 50	5 00	2 50	2 50	2 50	2 50	-	10 00	2 50	1 50	1 50
York Ossipee Valley Ass'n,	6 00	365 00	8 00	7 00	32 00	5 00	11 00	3 00	209 00	47 00	-	3 00	-	-	2 00	-	-	-	3 00	

Financial Statement of Agricultural Societies for the Year 1886—*Concluded.*

	For Beets.	For Onions.	For Turnips.	For Cabbage.	Total am't awarded for Grain and Root Crops.	For any Other Cultivated Crops.	For Fruits and Flowers.	For Honey, Sugar and Syrup.	For Bread, Butter and Cheese.	Agricultural Implements	Household Manufactures and Needle-Work.	Manufactures of Wood, Iron and Leather.	Other Mechanical Products.	All Objects not Enumerated Above.	Number of Bulls and Bull Calves.	Number of Cows	Number of Heifers.	Number Heifer Calves.	Number Working Oxen (pairs)	Number Pairs Steers.	Number Fat Cattle	Total Number of Cattle.	Number Horses, Colts.	Number Sheep.	Number Swine.	Number Poultry.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$												
Maine State Pomological	-	-	-	-	-	-	613 75																			
Androscoggin..........	-	-	-	-	75 00	-	-	-	28 00	-	-	-	-	35 00	8	14	3	-	6	10	-	40	15	22	42	
Aroostook............	50	40	75	40	8 30	1 05	7 75	2 00	8 00	1 00	12 35	-	-	3 79	10	22	13	8	2	4	-	58	107	44	24	65
Aroostook, North..	1 50	75	1 00	-	15 25	3 50	22 50	8 40	10 75	-	13 20	-	-	35 00	19	36	29	13	4	25	-	165	84	33	1	25
Aroostook, Madawaska..	1 20	2 40	1 20	1 20	16 80	2 40	-	1 20	1 20	-	21 15	2 80	-	1 20	10	6	8	4	7	6	-	41	28	14	3	
Cumberland County	-	-	3 00	-	-	-	16 25	6 25	5 75	-	14 50	9 50	-	2 25	16	44	30	17	35	12	7	176	25	10	20	95
Franklin County.......	35	35	35	35	1 40	-	22 90	3 40	9 00	30 50	25 05	12 25	-	20 45	22	19	29	15	-	24	14	350	57	92	4	52
Franklin, North........	40	40	40	40	11 25	7 50	-	1 55	4 00	75	29 15	2 20	-	-	13	31	25	10	60	36	12	283	85	51	27	60
Franklin Central	50	-	25	25	2 20	-	6 00	1 50	2 25	-	4 00	-	-	-	5	22	2	2	10	6	4	50	24	42		
Kennebec County	3 00	1 50	3 00	-	70 75	6 75	53 00	5 00	38 00	3 00	57 35	-	-	-	18	58	53	9	75	40	40	263	117	57	72	69
Kennebec, North	-	-	-	-	10 00	-	22 00	-	12 00	-	5 00	-	-	21 50	9	9	13	6	6	4	2	49	65	33	14	30
Knox County	1 50	4 50	3 50	3 50	42 00	30 25	41 75	10 25	15 00	-	33 50	10 00	-	18 00	5	20	8	7	8	7	4	72	55	48	35	165
Knox, North	1 50	75	75	1 25	24 10	-	24 00	2 35	15 15	-	39 70	2 00	-	103 15	11	10	16	12	24	25	25	173	41	31	7	73
Lincoln County	2 75	50	1 00	1 25	42 75	4 50	34 00	1 50	3 75	2 75	32 40	25	7 00	57 43	5	9	11	-	21	13	6	98	35	23	26	39
Oxford County.........	75	75	75	75	93 50	6 25	32 75	9 70	29 00	18 00	36 20	29 00	10 95	139 00	31	37	44	16	41	57	11	289	45	70	57	96
Oxford, West..........	1 00	50	2 75	50	27 25	6 75	22 00	21 28	16 50	9 00	60 00	-	-	35 00	7	25	13	6	35	16	7	103	46	20	16	50
Penobscot County......	-	-	-	-	27 25	-	7 50	-	7 25	-	15 50	-	-	5 00												
Penobscot and Aroostook	50	-	50	50	4 50	-	7 00	1 50	1 75	-	16 50	1 00														
Penobscot, West	1 00	-	91	-	24 24	5 00	18 75	9 25	32 25	2 00	78 90	2 00	-	1 00	13	27	40	7	16	25	4	173	51	61	30	62
Penobscot, North	25	25	50	25	8 25	1 25	4 25	25	6 50	-	17 80	-	-	1 00	3	4	2	3	7	12	1	50	33	8	21	71
Penobscot Central																										

Piscataquis, East.......	75	-	75	50	3 50	1 25	75	-	4 25	-	-	-	-	-	6	7	4	6	3	4	-	39	32	14		
Piscataquis Central	25	-	25	-	2 50	-	13 25	1 25	1 25	1 00	10 50	3 00	-	-	15	20	10	10	11	9	-	68	70	9	33	40
Piscataquis, West.																										
Sagadahoc............	1 50	2 75	4 25	1 75	56 00	12 50	57 00	6 50	22 00	5 00	51 85	16 00	-	172 39	12	29	28	11	75	41	10	300	77	50	50	120
Somerset, East.........	-	-	-	-	34 50	-	7 50	-	17 00	-	41 50	-	-	-	9	22	30	10	12	32	6	121	66	74	44	
Somerset Central	75	1 75	75	1 75	14 50	9 00	23 60	5 25	13 50	-	15 00	5 00	14 00	15 25	17	28	39	10	46	21	8	236	86	58	10	100
Somerset, West																										
Waldo County	-	-	-	-	55 00	-	20 00	-	15 00	-	20 00	-	-	25 00	15	23	25	10	9	13	5	100	55	10		
Waldo and Penobscot...	3 00	1 50	1 75	1 50	30 50	5 50	22 75	1 50	3 00	-	79 75	-	-	57 45	18	17	13	8	10	14	8	115	96	20	18	200
Waldo, North	1 25	75	1 25	1 25	31 50	2 50	8 75	3 25	6 00	-	39 25	1 00	-	-	9	2	10	1	23	6	10	55	25	25	-	18
Washington County	3 50	4 75	3 25	2 25	101 50	-	31 50	3 25	14 00	1 75	65 52	9 00	-	25 65	20	33	18	9	3	16	7	125	49	20	25	81
Washington Central ...	2 00	1 75	75	1 50	44 75	-	17 95	1 75	6 50	-	64 95	16 75	11 00	13 75	15	30	16	6	2	14	-	99	45	18	10	176
Washington, West	5 50	3 75	3 75	1 50	60 75	2 75	13 75	3 00	10 00	1 00	64 75	8 50	3 00	125 15	14	19	14	9	6	23	-	114	36	15	25	97
York County	50	1 90	1 00	1 50	8 40	11 00	15 75	1 00	6 00	-	143 12	-	-	73 00	7	22	5	2	40	15	4	150	18	14	12	66
York, Buxton & Hollis.	-	50	-	25	3 25	-	-	1 00	1 50	-	47 00	-	-	-	5	34	14	3	54	8	2	170	8	1	-	25
York, Shapleigh & Acton	1 50	1 50	2 25	1 50	34 75	25 50	19 25	3 00	7 50	8 25	37 50	1 75	-	27 50	4	10	4	-	41	11	6	134	29	34	10	40
York Ossipee Valley Ass.	50	50	-	1 00	-	-	12 00	8 00	5 00	-	83 00	-	-	30 00	24	16	16	3	78	83	6	226	53	21	11	23

LECTURES AND PAPERS.

MUNICIPAL TAXATION—WHY AND HOW.

By T. W. Vose, Esq., Bangor.

Given at Institutes at Houlton and Bridgewater.

Mr. President: We are all citizens of a State whose fundamental law is embodied in a written constitution, in which is a "Declaration of Rights," which rights the State, in terms, guarantees to us. The Constitution of the State reads as follows:

Section 1. All men are born equally free and independent, and have certain natural, inherent and unalienable rights, among which are those of enjoying and defending life and liberty, acquiring, possessing, and protecting property, and of pursuing and obtaining safety and happiness.

Sec. 2. All power is inherent in the people; all free governments are founded in their authority and instituted for their benefit; they have therefore an unalienable and indefeasible right to institute government, and to alter, reform, or totally change the same, when their safety and happiness require it.

Sec. 3. All men have a natural and unalienable right to worship Almighty God according to the dictates of their own consciences, and no one shall be hurt, molested, or restrained in his person, liberty, or estate, for worshipping God in the manner and season most agreeable to the dictates of his own conscience, nor for his religious professions or sentiments, provided he does not disturb the public peace, nor obstruct others in their religious worship;—and all persons demeaning themselves peaceably as good members of the State, shall be equally under the protection of the laws, and no subordination nor preference of any one sect or denomination to another shall ever be established by law, nor shall any religious test be required as a qualification for any office or trust, under this State; and all religious societies in this State, whether incorporate or unincorporate, shall at all times have the exclusive right of electing their public teachers, and contracting with them for their support and maintenance.

Sec. 4. Every citizen may freely speak, write, and publish his sentiments on any subject, being responsib'e for the abuse of this liberty; no laws shall be passed regulating or restraining the freedom of the press; and in prosecutions for any publication respecting the official conduct of men in public capacity, or the qualifications of those who are candidates for the suffrages of the people, or where the matter published is proper for public information, the truth thereof may be given in evidence, and in all indictments for libels, the Jury, after having received the direction of the Court, shall have a right to determine, at their discretion, the law and the fact.

SEC. 5. The people shall be secure in their persons, houses, papers, and possessions, from all unreasonable searches and seizures; and no warrant to search any place, or seize any person or thing, shall issue without a special designation of the place to be searched, and the person or thing to be seized, nor without probable cause—supported by oath or affirmation.

These declarations would be mere idle words unless they emanated from some source or power able to enforce them. They are the authoritative utterances of the State, to every man, woman and child within its limits. The State is the collection of persons occupying certain territory and having a legislative and executive organization, and in the ordinary and proper sense of the word is described as an independent or sovereign State; and this is true of the States of the American Union with this qualification, "that in order to form a more perfect union, establish justice, insure domestic tranquility, provide for the common defence, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity" each one of the United States delegated to the Congress of the United States or was admitted into the sisterhood of States invested with all other powers than the following. The Constitution of the United States reads as follows:

SECT. 8. The congress shall have power,—To lay and collect taxes, duties, imports, and excises, to pay the debts, and provide for the common defense and general welfare of the United States; but all duties, imposts, and excises shall be uniform throughout the United States;—To borrow money on the credit of the United States;—To regulate commerce with foreign nations, and among the several States, and with the Indian tribes;—To establish a uniform rule of naturalization, and uniform laws on the subject of bankruptcies, throughout the United States;—To coin money, regulate the value thereof and of foreign coin, and fix the standard of weights and measures;—To provide for the punishment of counterfeiting the securities and current coin of the United States;—To establish post-offices and post-roads;—To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries;—To constitute tribunals inferior to the supreme court;—To define and punish piracies and felonies committed on the high seas, and offenses against the law of nations;—To declare war, grant letters of marque and reprisal, and make rules concerning captures on land and water;—To raise and support armies; but no appropriation of money for that use shall be for a longer term than two years;—To provide and maintain a navy;—To make rules for the government and regulation of the land and naval forces;—To provide for calling forth the militia to execute the laws of the Union, suppress insurrections and repel invasions;—To provide for organizing, arming, and disciplining the militia, and for governing such part of them as may be employed in the service of the United States, reserving to the States respectively the appointment of the officers, and the authority of training the militia according to the discipline prescribed by congress;—To exercise exclusive legislation in all cases whatsoever over such district (not exceeding ten miles square) as may, by cession of particular States, and the acceptance of congress, become the seat of the government of the United States; and to exercise like authority over all places purchased by the consent of the legislature of the State in which the same shall be, for the erection of forts, magazines, arsenals, dock-yards, and other needful buildings;—And to make all laws which shall be necessary and proper for carrying into execution the foregoing powers, and all other powers vested by this Constitution in the government of the United States, or in any department or officer thereof.

The power to enforce those declarations, therefore, is in the State, to wit: in the people of the State, and as the State has no property, or means of acquiring property but through or from its people, it follows that the expenses of the State in supporting and enforcing its guaranty of protection to its citizens must be borne by the persons and property to be protected; and hence taxes—which are defined "to be the enforced proportional contribution of person and property, levied by the authority of the State for the support of the Government and for all public needs." "It is the property of the citizen, demanded and received by the State to be disposed of to enable it to carry into effect its mandates and to discharge its manifold functions." "It is the portion which each subject gives of his property in order to secure and enjoy the remainder." "Revenues collected of the people for things useful and conducive to their welfare."

The justification of the demand is to be found in the reciprocal duties of protection and support between the State and its citizens and the exclusive sovereignty and jurisdiction of the State over the persons and property within its territory.

The citizens and the property owner owes to the Government the duty to pay taxes, that the Government may be enabled to perform its functions, and he is supposed to receive his proper and full compensation in the protection which the Government affords to his life, liberty and property, and in the increase to the value of his possessions by the use to which the money contributed is applied.

Taxation, therefore, must be an incident of sovereignty and coextensive with that of which it is an incident.

All subjects over which the sovereign power of the State extends are, in its discretion, legitimate subjects of taxation; and this may be carried to any extent to which a government may choose to carry it.

Section twenty-two of our bill of rights provides that "no tax or duty shall be imposed without the consent of the people, or of their representatives in the Legislature." There seems to be no limit to the power to tax, and the only security against abuse must be found in the responsibility of the Legislature, which imposes the tax to the constituency who are to pay it.

The judiciary can afford no redress against oppressive taxation so long as the Legislature, in imposing it, shall keep within the limits of legislative authority. The declaration in our bill of rights, section twenty-one, "that private property shall not be taken for public uses without just compensation, nor unless the public exigency requires it," concedes no new right to the State, but only regulates its exercise. By all the well-settled and acknowledged principles relating to the power of sovereign States, they have the power to tax all persons or property within their jurisdiction, except the means or agencies provided, or selected, by the Federal Government as necessary to the exercise of its functions. This power may be exercised oppressively upon persons and corporations, but the responsibility of the Legislature is not to the courts, but to the people by whom its members are elected.

The maxim is familiar with us, as in English law, that "taxation and representation go together," and became established as the result of a long, and at times bloody, controversy between the representatives of the people on one side and the crown on the other. What the maxim really meant was that the local Legislature must make local laws, not that *no person* could be taxed unless in the body which voted the tax he was represented by some one in whose selection he had a voice. But it never had such a meaning, and never could have without excluding from taxation a very large proportion of all the property in the State. If the privilege of voting for representatives in the Government were the only or even the principal benefit received from Government, there might be the highest reason in exempting the non-voting infant or alien from taxation; but this privilege to any particular individual, as compared with the protection of life, liberty and property, is really insignifican; and so long as all persons cannot participate in Government, the limits of exclusion and admission must always be determined on considerations of general public policy.

It is not doubted that, so far as can be prudently and safely permitted, all who are to pay taxes should be allowed a voice in raising them; if for no other reason, because those they vote for they will more willingly and cheerfully pay; as Locke expresses it in his Treatise on Civil Government, when comparing a burden imposed with one voluntarily assumed, "it may be all one to the purse, but worketh diversely to the courage."

But the maxim that taxation and representation go together is only true when understood in a territorial sense, which embraces the State at large; every person in the State being represented in its Legislature, and that body determining the taxation not only for the State at large, but also, within certain limits, for each division and municipality of the State.

All definitions of taxation imply that it is to be imposed only for public purposes. This is as true under one form of government as under another. But it is the right and duty, in the first instance, of the legislative department to determine what are, and what are not, public purposes. It falls there of necessity, because the taxing power is a branch of the legislative, and the Legislature cannot lie under the necessity of requiring the opinion or the consent of another department of the Government before it will be at liberty to exercise one of its acknowledged powers.

The Legislature must, consequently, determine for itself in every instance, whether a particular purpose is or is not one which so far concerns the public as to render taxation admissible.

But it is also true that the legislative determination on this subject is not absolutely conclusive. It may be sufficiently so to put the administrative machinery of the State in motion, but when the exaction is made of an individual, and the power of the State is made use of to compel submission, he has always the right to invoke the protection of the law; and the courts cannot refuse to pass judgment, otherwise an unlimited power in the Legislature to make any and everything lawful which it might see fit to call taxation would, when plainly stated, be an unlimited power to plunder the citizen. When, therefore, the question of the validity of taxation becomes judicial, if it shall appear that the exaction is made for a purpose not public, the right of the individual to protection is clear.

Of all the powers conferred upon Government, that of taxation is the most liable to abuse. Given a purpose, or object, for which taxation may be lawfully used, and the extent of its exercise is in its very nature unlimited.

It is true that express limitation on the amount of tax to be levied or the things to be taxed may be imposed by the Constitution or statute, but in most instances for which taxes are levied, as the support of Government, the prosecution of war, the national defense—any limitation is unsafe. The entire resources of the people should, in some instances, be at the disposal of the Government.

The power to tax is, therefore, the strongest, the most pervading of all the powers of Government, reaching directly or indirectly to all classes of the people. This power can as readily be employed against one class of individuals and in favor of another, so as to ruin the one class and give unlimited wealth and prosperity to the other, if there is no implied limitation of the uses for which the power may be exercised.

To lay with one hand the power of the Government on the property of the citizen, and with the other to bestow it on favored individuals to aid private fortunes, is none the less robbery because it is done under the forms of law and is called taxation. This is not legislation. It is a decree under legislative forms. Our court has been more than once invoked to prevent such abuse of legislative power. [Allen v. Jay, 60 Me., 124.]

However important it may be to the community that individual citizens should prosper in their industrial enterprises, it is not the business of the Government to aid them with its means. Enlightened States leave every man to depend on his success and prosperity in business on his own exertions, in the belief that by so doing his own industry will be more certainly enlisted, and his prosperity and happiness more likely to be secured.

It is well settled, therefore, that taxation for the purpose of raising money from the public to be given or even loaned to private parties, in order that they may use it in their individual enterprises, is not recognized as for a public use. In contemplation of law it would be taking the common property of the whole community and handing it over to private parties for their private gain, and consequently unlawful. The benefits, if any, that might flow from it to the public could not support it as legitimate taxation. The rule for such taxation, viz: to aid in establishing manufactures, would apply equally to any other business or pursuit which employs capital or labor.

The objects for which municipal taxes may be assessed, are enumerated in our statute as follows:

SEC. 46. The voters at a legal town meeting may raise the necessary sums for the support of schools and the poor; making and repairing highways, town ways and bridges; purchasing and fencing burying grounds; purchasing or building and repairing a hearse and hearse house for the exclusive use of its citizens; and for other necessary town charges.

Article VIII of the Constitution of the State still further defines the objects for which taxes may be assessed.

ART. VIII. A general diffusion of the advantages of education being essential to the preservation of the rights and liberties of the people; to promote this important object, the Legislature are authorized, and it shall be their duty to require, the several towns to make suitable provision at their own expense, for the support and maintenance of public schools; and it shall further be their duty to encourage and suitably endow, from time to time, as the circumstances of the people may authorize, all academies, colleges, and seminaries of learning within the State; provided, that no donation, grant or endowment shall at any time be made by the Legislature to any literary institution now established, or which may hereafter be established, unless, at the time of making such endowment, the Legislature of the State shall have the right to grant any further powers to alter, limit, or restrain any of the powers vested in, any such literary institution, as shall be judged necessary to promote the best interests thereof.

It may be safely stated that to bring a sound education within the reach of all the inhabitants, has been the prime object of American government from the very first. It was declared by colonial legislation, and has been reiterated in constitutional provisions to the present day. It has been regarded as an imperative duty of the Government; and when question has been made concerning it, the question has related not to the existence of the duty, but to its extent. But the question of extent is one of public policy and addresses itself to the Legislature and the people.

And the tendency on the part of the people has been steadily in the direction of taking upon themselves larger burdens in order to provide more spacious, elegant and convenient houses of instruction, and to place within the reach of all a more generous and useful education. Under this generous system, whether the tax-payer receives his remuneration in instruction given to his own children or not, he yet receives it in the improvement of the intellectual and social character of his neighbors, by which his property is rendered more secure, the labor for which he pays is better performed, and the demand for whatever he produces is more universal and more constant, the moral and social character of the community is elevated, the taste of the nation refined, and an impulse given to efforts for the benefit of man. With this view, no one could oppose the expense incurred in bestowing upon public edifices elegance, or even, in some cases, magnificence of structure, in the public celebration of remarkable eras and in the rewards bestowed upon those who have, by their discoveries, enlarged the boundaries of human knowledge, or by their inventions signally improved the useful arts.

PAUPERS.

The support of paupers and the giving of assistance to those who by reason of age, infirmity or disability are likely to become such, is by the practice and the common consent of civilized countries, a public purpose. Hospitals for the sick, houses and food for the poor, asylums where the deaf and dumb may be supported and taught, and where the insane can be safely kept and have such careful and scientific treatment, with a view to their restoration, as they would not be likely to receive elsewhere.

The poor we have with us always, and he would be a bold man who, in these days, should question the public right to make provision for their support and comfort.

To build and support for the use of the people highways, town ways and bridges, are among the most important functions of Government. The competency of the Legislature to levy taxes for the construction of the common highway, the improved turnpike and macadamised road, the planked or paved street, the canal, the tramway, or railway, is unquestioned.

The differences of opinion which have been entertained and exhaustively discussed by the courts, have principally arisen in those cases in which the Legislature has permitted or required the municipal corporations to become stockholders in private corporations for the building of railroads, canals, &c., conducted and managed in part, perhaps mainly, by individuals for their own benefit.

The public, it has been claimed, could not be taxed to aid such private corporations, because the benefits anticipated from them would be purely incidental, not differing in their nature from those which might flow from the building of a mill for the manufacture of bread stuffs, lumber, &c.

On the other hand, the argument has been that such corporations had a duplicate nature and were both private and public; that they are *quasi* public highways on which the public at large were entitled to equal and impartial accommodations, and that for all these reasons there was a public interest in their construction, which constituted them public purposes within the meaning of the law of taxation, and thus rendered the question of public assistance to them a question purely of policy and not at all one of power. It is conceded that municipal bodies have no such power unless it is specially conferred by the Legislature, the general authority to construct highways, town ways and bridges not comprehending such a case.

CEMETERIES.

As all the citizens of every municipality must die, and their bodies be disposed of in a manner becoming to our civilization, as well as to a regard for the health of the community, the purchasing and fencing burying grounds, and the purchasing and repairing a hearse and hearse house for the exclusive use of the citizens, has been declared by our Legislature to be a public use. While no person is compelled by law to bury his dead in a public cemetery, still the common, almost universal sentiment and inclination of the people tends to a common spot, in a convenient and appropriate place, where the bodies of those who have moved on just before us to join the vast majority may mingle together in the common dust, and the living mourners may together mingle their sorrows and their tears as they mournfully visit the silent cities.

AND FOR OTHER NECESSARY TOWN CHARGES.

Our court has said that these words do not constitute a new and distinct grant of indefinite and unlimited power, to raise money at the will and pleasure of the majority. They embrace all incidental expenses arising, directly or indirectly, in the due and legitimate exercise of the powers conferred upon towns, and accordingly have ever received a liberal construction. Without attempting to enumerate them *all*, I will name a few of the items which the courts have recognized as coming within the meaning of the words, "other necessary town charges."

Protection of property and persons, such as fire engines, and reservoirs to supply water for the same; police duty; public health; town clock; town house; for the employment of a reasonable number of agents or attorneys to advance or protect the rights of the inhabitants before any legally constituted tribunal, but not to send lobbyists to the Legislature, &c., &c.

Having briefly considered the reasons *why* municipal taxation is necessary, we proceed to consider upon what and *how* it is assessed.

This is defined in chapter 6 of the Revised Statutes.

SEC. 92. Before making an assessment, the assessors shall give seasonable notice in writing to the inhabitants, by posting notifications in some public place in the town, or shall notify them, in such other way as the town at its annual meeting directs, to make and to bring in to them true and perfect lists of their polls and all their estates real and personal, not by law exempt from taxation, of which they were possessed on the first day of April of the same year.

SEC. 93. If any person after such notice does not bring in such list, the assessors shall ascertain otherwise as near as may be, the nature, amount and value of the estate, real and personal, for which in their judgment he is liable to be taxed, and he is thereby barred of his right to make application to the assessors or the county commissioners for any abatement of his taxes, unless he offers such list with his application and satisfies them that he was unable to offer it at the time appointed.

SEC. 94. The assessors, or either of them, may require the person presenting such list to make oath to its truth, which oath either of them may administer, and either of them may require him to answer all proper inquiries in writing as to the nature, situation and value of his property liable to be taxed in the State, and a refusal or neglect to answer such inquiries and subscribe the same, bars an appeal to the county commissioners, but such lists and answers shall not be conclusive upon the assessors.

SEC. 97. The assessors shall assess on the polls and estates in their town all town taxes and their due proportion of any State or county tax, according to the rules in the latest act for raising a State tax, and in this chapter; make perfect lists thereof under their hands; and commit the same to the constable or collector of their town, if any, otherwise, to the sheriff of the county or his deputy, with a warrant under their hands, in the form hereinafter prescribed.

SEC. 98. They may add their proportion of the State and county tax to any of their other taxes, and make one warrant and their certificates accordingly.

SEC. 99. They may assess on the polls and estates such sum above the sum committed to them to assess, not exceeding five per cent thereof, as a fractional division renders convenient, and certify that fact to their town treasurer.

SEC. 100. They shall make a record of their assessment and of the invoice and valuation from which it is made; and before the taxes are committed to the officer for collection, they shall deposit it, or a copy of it, in the assessors' office, if any, otherwise, with the town clerk, there to remain; and any place where the assessors usually meet to transact their business and keep their papers and books shall be considered their office.

POLL OR CAPITATION TAX.

As I have before said, Government is instituted for the protection of person as well as property, and it follows that every person should contribute something towards the support of that Government under whose ægis he lives; and our statute has fixed the age at which his responsibility commences, to wit: twenty-one years.

Not a few of the male citizens of our State have enjoyed all the benefits which our municipalities can bestow upon either rich or poor; educated large families of children in our public schools, even, and contributed in consideration therefor only a poll tax, a mere pittance. Except the few aliens in our State, every man above the age of twenty-one years is the peer of every other man in every thing that pertains to the administration of the Government, and all share equally in the benefits derived therefrom.

Each person is alike protected, and *all* property in whosesoever hands it may be found is under the same protection. And therefore it matters not whether the man be rich or poor, his rights, privileges and immunities are co-equal with every other man's; and in addition to the poll tax assessed on all, each man is assessed in proportion to the property he may have accumulated.

The poll tax is small—not to exceed three dollars—for the very reason that it is assessed upon *every* male above twenty-one years of age. And the man who grudgingly pays that sum in consideration for the great benefits conferred cannot appreciate the great disparity between the price paid and boon received. A poll tax is, in its nature, an admission fee and annual due of every man when he, by reason of his age, is taken in or enters upon the duties of citizenship.

ALL REAL PROPERTY WITHIN THE STATE, ETC.

At first view the taxation or assessment of taxes on the value of all the real and personal property of the inhabitants seems to be just, and in that belief it has been steadfastly adhered to, notwithstanding the many and very serious difficulties attending it.

These difficulties pertain more particularly to the taxation of personal property, for the following reasons, among others:

I. Taxes cannot be assessed on goods, chattels, money and effects, wheresoever they are or on all obligations for money or other personal property, money at interest and debts due to the persons to be taxed more than they are owing, public stocks and securities, &c., without inquisitorial process of some kind, instituted for the purpose of ascertaining that which is not open to public inspection, and which the tax-payer, except under compulsion of such process, would not consent to disclose.

Few persons will voluntarily make a complete exhibit of their affairs to the public, and still fewer, perhaps, have their affairs in such shape that public officers can make an inventory of their personal possessions without the assistance of the owners in preparing it.

Our statute has recognized this difficulty, and provided for a list to be presented by the tax-payer, subject to an exhaustive examination, in writing, under oath, or has allowed the assessors to tax every person according to their own judgment, leaving the person taxed to reduce the amount by his own oath, if he shall see fit, and be able so to do.

This is objectionable not only as taking away a desirable privacy in business and family concerns, but also in holding out a strong temptation to false swearing in matters where a false oath would be difficult if not impossible of detection.

II. The assessment of personalty holds out constant and very powerful temptations to defraud, by concealing the knowledge of everything which the tax-payer believes cannot easily be discovered.

This is so well understood that it is scarcely expected that citizens will voluntarily state what they possess, or that officers will make much of an effort to discover it. Indeed, it is estimated that at least three-fifths of the personal property in this State never gets to the knowledge of the assessors.

III. Such taxes are, and must be, unjust in their discrimination between residents and non-residents who enjoy the same protection of the laws.

For example, a ten per cent loan, by a non-resident and resident, to an inhabitant in the State—one gets his interest, net; the other, less the tax.

This difference would not only be a serious discrimination against the citizen but would, and does, encourage further evasions and frauds, and particularly the loaning of money, in the names of non-residents, to escape taxation. It also presents an inducement to citizens whose investments do not require personal attention to reside abroad; any saving of the tax being equivalent to an addition to their income.

Again, to the tax-payer whose capital is invested in trade it works perhaps the greatest inequality. His stock is open to the inspection of the assessors, who may, and who by law are bound to assess it at its value; while his neighbor, who has his surplus in securities, avoids in whole, or in part, any assessment upon it.

In fact, the natural and inevitable result of such discrimination, or inequality, has led assessors—and I am pursuaded it is a rule very generally adopted for assessment purposes, to place a value upon all property which cannot be hidden from taxation, far below its real value, to offset in some measure, the unjust discriminations just referred to.

These are objections which every one feels and appreciates; others which are more obscure need not be mentioned. A tax on land is not open to these objections. Whenever the law seeks to tax land and personalty, with equality, the general result is that land pays much the greater proportion of the tax. No inquisitorial proceedings are required to discover it, and no frauds or evasions can conceal it from view.

These, and other reasons, have led some political economists to advocate the omission of personalty from the customary taxation by value, and the raising of the ordinary State and municipal tax by a tax laid exclusively on land and a few other subjects which, like land, are open to constant public observation and inspection, and in respect to which neither would harsh sifting processes be required, nor evasions be practicable, nor frauds invited.

Such a tax, it is claimed, while nominally falling upon a few, would in fact be diffused through the whole community, and collected from all, in the nature of results, and added to the price of what is produced and distributed by the classes taxed, just as any tax upon any common article of consumption is paid in the end by the consumer, and is no more burdensome to the dealer, who nominally pays it, than it is to any other member of the community of consumers. Such a practice could not be practical, however, unless adopted by all the States of the Union.

The author of the Wealth of Nations declared that "no tax can ever reduce, for any considerable time, the rate of profit in any particular trade which must always keep its level with other trades in its neighborhood." And indeed, in this country, during and after the great civil war, it was generally found that a heavy tax upon any particular article of consumption gave the business that produced it a new and vigorous impulse of prosperity.

SUBURBAN RESIDENTS.

At first thought, it strikes the suburban tax-payer, that to be assessed for the support of sewers, sidewalks, street lights and apparatus for the extinguishment of fires in the city or village within his municipality, is unequal taxation, for which he does not receive his proportionate benefit.

He rarely travels upon the sidewalks, scarcely if ever is in the village after dark, has no use for the sewers, and his entire farm buildings might be consumed before even the alarm could reach the fire department, much less come to his relief—and if on the spot would not find water sufficient to be of much, if any, use in quenching the flames. And, therefore, it is a burden which he ought not to bear.

But will reflection justify such a conclusion? What would farms be worth without a near and ready market for their products? The value of farm products is in a direct ratio to their distance from a ready market, and the market value of farms is based upon the value of its products at the farm. How far to a market, is always the first question.

And what is a market but a collection of consumers or ready purchasers for shipments? And what draws and centres consumers and commission men but advantages and conveniences for business, with reasonable expectations of favorable results from investments?

With one store in this village, there would be no competition in trade. The farmer would pay the merchant his price for his goods, for he must *buy* to live; and the merchant would pay *his* price for the farmer's products, because such farmer must *sell* to live.

The highways must be constructed and kept in repair for your own convenience and to accommodate the mail. Your suburbs would be less thickly populated, having nothing to invite capital, and the burden of taxation would fall wholly on the sparse population, with only such privileges and enjoyments as are familiar to the pioneers in a new country.

But let competition in trade arise and the village begins to form, the suburbs feel the agitation; both grow together. Capital crawls out of its concealment and invests in trade, and the capitalist, to increase his trade, invests in manufactures—the saw-mill, the grist-mill, carriage and starch factory, &c., therein employing more and more consumers year after year until the village is formed, the suburbs extended, products increased in quantity and value, until storehouses become overstocked for lack of means of shipment; and then the railroad extends its ever helping hand, at once transforming the country village into a metropolis, with capacious hotels full of boarders and travelers, consuming and trading; taking away, almost against your will, at good prices, the best colt, cow, pig and lamb; first-class public buildings, and stores filled with goods at lowest prices, the centre of trade and traffic for miles and miles around.

As population increases and centres, general information extends, the tone of society rises and with it, as a concomitant, comes the demand for those improvements which will preserve health and property, advance education, business, trade, industry and sobriety, and make the life of that remotest farmer who visits its busy streets and mingles with its intelligent people, worth living, a better farmer, better parent, better neighbor and a better citizen. Cultivated society exhales its influence and culture as flowers their perfume. No man can be among them and not inhale it. And so this village has grown to contain one-half of the population of the town and three-fourths of its wealth, and paying three-fourths of its entire tax.

Suppose the territory of one mile in diameter, including this village, be set off and organized into a city or town by itself, what would be the effect upon the suburban tax-payers? You would be left with your roads and bridges, your schools, your paupers and but one-fourth of your present valuation. Or, for want of sufficient fire apparatus, the fire fiend should sweep out of existence the whole or a considerable portion of your beautiful and thriving village; or the agents of that destroying angel, death, should enter, invited by your neglect to provide pure water or proper sewerage, creating consternation and depopulation. The depressing effect will be felt, and that severely, on the surrounding country.

To test its effect upon each one, let it be told you and believed, that the village had been destroyed and would not be rebuilt. The farm and its improvements would not be worth in the market fifty per cent of its value to-day; your pride, courage and ambition would fall like the barometer before the coming storm. You would feel desolate even in your own home.

Will you be willing to cut loose from this centre of trade, traffic and wealth, and assume its municipal duties without its aid? If so, my belief is your offer might not be rejected.

Perfect equality in the assessment of taxes is unattainable. Approximation to it is all that can be had. Under any system of taxation, however wisely and carefully framed, a disproportionate share of the public burdens will be thrown on certain kinds of property, because they are visible and tangible, while others are of a nature to elude vigilance.

Perfectly equal taxation will remain an unattainable good as long as laws and government and man are imperfect. Sound policy requires that it should be so far as possible. But there is no provision in the Constitution that it should be equal. If there were, the operations of Government must come to a stop from the absolute impossibility of fulfilling it.

I have read from our statute that all real and personal property of the inhabitants of the State is subject to taxation. To this statute there are several exceptions. The property of the United States is not taxable—nor the means and agencies provided or selected by the Federal Government as necessary or convenient to the exercise of its functions. The State cannot tax a bank chartered by Congress as the fiscal agent of the Government. Congress has provided that all shares of national banking associations located within the State may be taxed, subject only to two restrictions—that the taxation shall not be at a greater rate than is assessed upon other moneyed capital in the hands of individual citizens of the State, and that the shares owned by non-residents shall be taxed in the city or town where the bank is located, and not elsewhere.

The loans of the Government, contracted under the power conferred upon it to borrow money, the revenue stamps—the salaries or emoluments of federal offices—are not subject to taxation.

If the State possessed the right to tax these, the Legislature might pass an act discriminating so strongly against the bonds and other agencies of the Government as to amount to a prohibition of their sale in the State—a tax might be levied equal, or greater, than the interest, and if all the States should so discriminate against them, the power of the Government to raise money for its support or defence would cease.

The Federal Government is also without power to tax the corresponding means and agencies of the State officers, for the same reason.

An importer of foreign goods, in his capacity as such, is not the subject of State taxation, and his sales are exempt, because he purchases, by the payment of a duty, a right to dispose of the merchandise as well as to bring it into the country, and the tax, if it were admissible, would intercept the import, as an import, in the way to become incorporated with the general mass of property. But when the importer has sold the imported packages, or has otherwise mixed the goods with the general property of the State by breaking up the packages, it then becomes the subject of taxation.

Thus, we perceive that a very large amount of personal property, the wealth of the State, may, and does, both legitimately and evasively, escape taxation, in the municipalities of the State.

Having given the reasons, as fully as the limited time taken from my business would permit, *why* taxes are assessed in our municipalities, and upon what property such assessments are made, I will, in conclusion, very briefly state how they are assessed, and

I. There must be legislative authority for every tax levied, with the rules under which they must be levied.

Each municipal tax will contain, besides the sum voted by the inhabitants of the town at their annual meeting for municipal purposes, its proportion of the State and county tax.

The amount of the State tax is fixed biennially by the Legislature and apportioned to the different municipalities in the State by the State Treasurer, upon the valuation of the towns, as fixed by the Legislature at the decade next preceding the assessment, and that sum so to be assessed is, before the month of April, each year, sent to the assessors of each town in the State.

The Legislature also determines the amount to be raised by each county, each year, for county purposes, and the county commissioners each year apportion that sum to the several towns in the county and forward the amount to the assessors of each town.

At the annual town meeting in March the voters determine how much money shall be raised for schools—which shall be not less than eighty cents for each inhabitant according to the last preceding census,—how much for highways and bridges and other necessary town charges, &c. Sec. 91, chap. 6.

[The speaker here illustrated the method of making assessments.]

The assessment when made is committed to the collector for collection, and when collected by him turned over to the town treasurer, who pays it out upon town orders drawn upon him by the selectmen, and no money ought to be disbursed in any other way, except the State and county tax, which may be paid by the collector. Pardon me for one or two practical suggestions.

I. Every collector ought to be required to complete his collections within a year from the date of the commitment, excepting, of course, where he is obliged to seek his remedy by sale of the real estate. And as a penalty for not so collecting he should be allowed no commissions on taxes collected after the expiration of the year.

It is no kindness or favor to any tax-payer to extend his payment beyond the year. If he does not pay within that time, he will be less likely to pay the taxes of succeeding years, when two or three are pressing at once, and the result is an abatement of all.

II. TOWN REPORTS.

A report of the financial officers of a town ought to be so clear and simple that every man of ordinary understanding can analyze and rectify it, otherwise the expense of printing it for circulation among the voters is a useless expenditure. The Legislature so intended—Sect. 38, chap. 6, R. S., and sect. 1, chap. 359, Laws of 1885. It is surprising how few of the accounts in town reports can be made to balance, even by experts. It became necessary for me professionally, within a year, to examine the printed reports of twelve towns, and I found the accounts of one, in them all, that would balance. May I be pardoned for stating an annual account, or the form of one, for your consideration to be made by the municipal officers. The statute requires that they shall state in detail the indebtedness and resources of the town. Assuming that the report of the preceding year gave that correctly, we will make the report for the next annual meeting—charging the selectmen with the *entire* assets and crediting them with *all* disbursements.

Selectmen in account with the Town of Houlton.

DR.

To resources turned over from last year	$4,859 55
" indebtedness carried forward to next year	3,011 81
" taxes assessed and committed for collection	10,400 00
" State school fund, railroad and telegraph tax received,	1,500 00
" moneys received from all other sources	500 00
	$20,271 36

CR.

By resources carried over to next year	$4,537 12
" indebtedness turned over from last year	3,610 26
" paid State tax	2,000 00
" " county tax	1,200 00
" " school districts	4,500 00
" " town charges, including paupers, highways and bridges, etc	4,423 19
	$20,271 36

This makes a trial balance, and the items which make up the several amounts should be found under their appropriate heads in other parts of the report.

STRAWBERRY CULTURE.

By A. J. TOLMAN, Member of the Board, Knox County.

Read at Farmers' Institute at West Bath.

Within the last decade probably no branch of horticulture has received more attention, and there is none in which more experiments have been tried, or in which greater improvements have been made, than in the culture of the strawberry. The introduction of new varieties combining many good qualities—size, flavor, and productiveness, the latter especially a necessary requirement in a market berry—has been carried on to such an extent that it would seem we had reached the acme of perfection in this delicious fruit. Take the varieties as we find them on the list, from the fine aromatic flavor of the Boston Pine to the large-sized Sharpless, and there seems to be but little more to be desired.

The strawberry is the best of all small fruits, though small and unimportant they are, perhaps, compared with their larger relatives, the apples, pears, plums and peaches. But what home in country or town can do without a few jars of preserved strawberries, currant jelly or raspberry jam, stored carefully away to enjoy in the family or with our friends, during the winter days of our cold northern climate. Not only are they pleasant to the taste, but they bring thoughts of the warmer summer or autumn days, when they were where Nature had placed them, hanging in rich luxuriance and in bright colors, beautiful to the sight and a substantial contribution to man's comfort and happiness. The strawberry is the only fruit, I believe, that succeeds well in all parts of the globe. Where other small fruits fail, on account of short or dry seasons, or severe winters, here you will find it. Where fruit of any kind can be grown, large or small, strawberries are found growing wild or in cultivation.

Some of our most eminent horticulturists have devoted the best portion of their lives to the propagation and culture of small fruits, and to them we are indebted in part, at least, to the excellent varieties we are growing to-day. The world has made great improvements in machinery of all kinds—in the manufacture of carriages, farm implements and in tools and utensils of all kinds; also in the introduction of thoroughbred stock of all kinds. So with small fruits; the varieties we are growing to-day are as much superior to those grown fifty years ago as the cattle and machinery of to-day are better than those of one hundred years ago. While the farmers of that period were turning their attention to and using their spare lands for an apple orchard, and a few choice pear and plum trees, they were supplied in part with the smaller fruits.

The wild strawberry grew abundantly in the old pastures, raspberries on the new choppings, and blueberries in plenty on the burned lands. I will not attempt to give you any dates at which the different varieties of strawberries were introduced, for it is of no particular consequence, and the subject has been treated by well-known writers who made this business a study. For me then to repeat their figures would be of but little interest to you, and really of no practical value. Neither will I attempt to give you a botanical description of the leaves of the various sorts. It matters not whether they are serrate or dentate, although it is very important to know whether the blossoms are pistillate or staminate; the former being imperfect and not bearing well alone and requiring some plants of the latter set amongst them for fertilizing the blossoms.

The climate of Maine is not suitable for the cultivation of all of the smaller fruits, our season being too short for the best varieties of grapes to ripen, and our winters too severe to secure a crop of the finest blackberries oftener than one year in three. But with strawberries, although they winter kill sometimes, we can be fairly successful: and such is its popularity as a table dessert that it has become almost indispensable, and the culture and sale of the strawberry in this country has become an immense business. Thousands of acres are devoted to their production. Factories are erected for the purpose of making crates and baskets in which to transport them, and during the berry season they form an important part of the freight on our railroad and steamboat lines all over the country. We cannot all of us attend to the cultivation of strawberries, for although the demand has exceeded the supply and will, I think in the future, some of us must attend to the other branches of agriculture—dairying, stock husbandry, fruit growing, &c. If we are not within the reach of a good market the business would hardly pay, for it is a crop that will not keep. If not disposed of within two or three days after ripe, it becomes a total loss. But we can supply our home markets at least. Our cities and large towns are bound to have the berries, and we might as well supply them as to have our fruit dealers purchase them from out of the State.

One reason why the inhabitants of some of our smaller towns do not eat more strawberries is because they cannot get them. Many people have a small plot for their own use, but the public in general have no means of getting a supply. It used to be considered a remarkable piece of skill, management and good luck to grow a good bed of strawberries; but now that idea is done away with. Any person of common intelligence, having a good piece of land, who will set the plants properly and wield the hoe quite frequently through the growing season, will have no trouble in growing a crop. A half acre of land, well taken care of, will yield fifty bushels—1600 quarts. These, at ten cents per quart, would be one hundred and sixty dollars; this is not a large yield, or a large price for the berries, but how much more land and what a pile of vegetables it would take to realize that amount of money! The fancy prices for the bulk of the crop have gone by. People find it is not difficult to grow them, and there is more competition. And is it not so with all other farm crops? We cannot now get one dollar per bushel for potatoes, or forty dollars per ton for our cabbages and squashes, but have to sell at one-half those prices.

If you are located near a good railroad or steamboat line, there is no difficulty in finding a market for all of the strawberries you can raise. I would advise one to start in with a small piece at first, setting one or two standard varieties, and after having one crop he will learn how to take care of them. If the outlook is then encouraging, he can branch out to meet the demand.

SOIL AND SITUATION.

Any land that is clear from stones is suitable for growing strawberries. Rocky land will produce them as well as any soil, but where the ground has to be hoed and cultivated many times during the season the cultivator ploughs up the stones and throwing them over and on the plants very often breaks off the fruit stems, which, of course, is very injurious, and the stones constantly coming in contact with the hoe keep it dull, making progress slow and the work harder. If possible, good land should be secured, on which some crop has been grown the year before. A sandy or clay-loam soil well drained, or inclined so that no surface water will stand upon it, and you are ready for operations. Land on which grain was sown the season before will do very well, but it will not work as well as a piece on which a hoed crop has been grown. It is not advisable to set plants on land on which a crop of potatoes has just been taken off. The potato exhausts the potash in the soil more than any other farm crop, perhaps; and this forms a large per cent of the composition of the strawberry. True, it would be replaced largely when the land is manured for the berries. But it would be better to take a piece on which a crop of cabbages or corn had been raised the year before.

IMPLEMENTS.

No special tools or implements are required for this, any more than for any farm crop. The common square hoe will do for taking care of the plants a large portion of the first year, and a cultivator made with the teeth straight, like the old-fashioned harrow, is good enough for the first season where the land is soft and works easy. We use both this style and the Planet, Jr., cultivator, with an iron frame, which is one of the best in use. The second season we use pronged hoes made especially for the business, about the same width as the common flat hoe and consisting of four flat teeth or prongs. This hoe is the only one employed after the first season. They save a large amount of hand work and stir the ground more thoroughly than any other kind. The Warren hoe, having three sharp corners shaped like the letter V, somewhat, is a very good one but not as strong as the other, although it answers very well for the same purpose.

MODE OF CULTURE.

There are many ways of growing strawberries, and many opinions and theories as to which is the best mode of proceeding. If you are growing them for the family and wish to set only a few plants in the garden for your own use, the mode of culture would be essentially different from what it should be when grown for market in the field; and you would want a choicer collection and one where a fine flavor is more desirable than productiveness, for we do not find both qualities in one variety. In the garden you have a small plot of ground cultivated by hand with no room to work a horse cultivator or anything of the kind, and the spaces between the plants which have to be kept clear from weeds with a hoe should not be too wide. I should advise hill culture for the garden. Some grow them in narrow rows, but you get larger and better berries and can take care of them easier if grown in hills about twenty inches apart, each way. Keep the runners cut close. By so doing very large plants are formed, which will bear more than a dozen ordinary plants will if occupying the same space. I have heard the statement made, that for every runner cut off a new fruit stem was formed. It can't be true of all varieties, as some sorts send out double the runners that others do, where their productive qualities are about the same. Take the Crescents and Wilson's, for instance; the bearing qualities are about equal in each, while the former sends out a great many more runners than the latter. These sorts are *very* productive and grow more runners than varieties do that have a larger berry. It would seem by this that a plant which sends out many runners had great productive qualities, but it is not so, as the Kentucky and the Lenning's White are very strong and vigorous sorts, propagating rapidly, yet almost worthless as market varieties. Such has been my experience at least.

The runners need not be cut until they are six inches long or more, just before they commence to root. If allowed to root, the strength of the main plant is exhausted in feeding the runners. The finest and best berries are grown in this way, always in hills, for exhibition purposes. I have seen the Sharpless strawberry grown in this way by one of our Rockland merchants, who takes great pride in his garden, specimens of which girted seven inches, and thirteen berries filled a quart basket more than level full. A number of baskets were sold by him at fifty cents per quart, when other varieties were only worth twelve cents; and usually this variety, when properly grown, will sell for nearly double the price received for common sorts. It is too much work to grow them in the field in this way. When grown for market by the acre, there must be a chance to employ the horse cultivator and the plants must be set farther apart. Consequently there will be a smaller yield per acre. In field culture we usually manure at the rate of ten cords per acre of good barnyard or stable manure, spread evenly as possible and harrowed in before setting the plants, going over the ground three times at least. One or two loads of wood ashes, leached or unleached, would be very beneficial, but it is not always easy to procure them. The plants are set three and one-half feet apart by one foot or fifteen inches in the row, as the plants are to remain on the ground two years or more. The rows should be straight as possible. A line is stretched lengthwise the piece to be set, and a shallow furrow made with a horse and small plow. The horse is driven as close to the line as possible. Three or four furrows are struck out and then the line is placed directly over and in the furrow, being high enough to be out of the way in setting the plants, and all are set by the line, so that the rows are straight and uniform. The plants are set a little below the level so that they catch the water from rain storms or showers and hold it. In hoeing, the plants should not be hilled up. The surface of the ground should be kept as level as possible. The crown of the plant keeps forming on the top of the ground. The runners form on top and if care is not taken the plants will be above the space between the rows and more liable to winter kill. This is a great trouble to beginners, and the cause of many failures. The ground heaves badly where the surface is uneven, plants are thrown up, the earth is washed away from the roots, and they are ruined. Runners are allowed to grow in field culture, and take root until the ground is covered between the plants and the rows are one foot wide. This is called the matted row system. It will take nearly all the season for them to fill up. When the rows are perfect, the runners should then be cut and no more allowed to grow until a crop is taken off. The cultivator will cut or break off most of the surplus runners, and a proper use of the hoe will keep the plants uniform. A circular piece of steel fastened to the side of a cultivator is an excellent thing

5

for cutting runners, being sharp on the edge and fastened with a bolt so it can revolve. An old circular saw with the teeth broken off would answer the purpose. Runners will take root much faster if covered with a little dirt or a small stone to hold them down. This can be done when hoeing the plants, and when they are hoed again these plants will be strongly rooted and sending out runners themselves. Plants should be hoed and the ground cultivated every ten days during the months of June and July, after which they need not be hoed as often. After the month of August, scarcely any weeds will grow if this has been done. After the ground freezes so that it will bear a team the plants should be covered with brush or meadow hay. Straw can be used but it usually contains a great many foul seeds, which make their appearance the following spring, in the form of Roman wormwood, barn-grass, clover and sorrel, making so much extra work that you will wish they had not been covered at all. Our plants are usually covered with meadow hay, which is as good as anything except spruce boughs. I have used corn stalks, tomato vines and oat straw, when I had nothing else. If ground is sheltered in any way, so that the snow drifts in and remains on the most of the winter, the plants will have covering enough. In some seasons when we have had a large amount of snow they have been winter killed badly when covered. A neighbor of mine covered his ground, a half acre or more of fine plants, very carefully one season with spruce boughs. We had a large amount of snow, which remained on the ground until late in the spring, and two-thirds of his plants were winter killed. He thought he had mismanaged in covering them, and re-setting the ground he had by fall a nice bed of strong, new, healthy plants. This time he thought he would make no mistake, and left them uncovered. We had but little snow *that* season, an open winter, and he lost them all. This last fall he covered his plants again. It is always safer to cover them, but care should be taken to cover lightly, the object being to prevent freezing and thawing during spring months, which does more damage than severe zero weather. Brush is, without doubt, the best covering, as it does not not lie close to the ground, the limbs holding the snow and ice up from the plants.

PICKING AND MARKETING.

Now then, supposing that we have an acre of plants in good condition, having come through the winter and one year old We are expecting a crop of berries and make preparations to market them.

In the first days of strawberry growing in large quantities for market growers were not as well provided for as we are to-day. The berries were carried in bulk with the hulls taken off. Finding that they would not keep long in this condition, the hulls were left on. Finally they were put up in round quart boxes with a cover on them and packed on top of each other in large square boxes, and although this arrangement was an improvement on the old method, still it failed to give satisfaction. The boxes were too tight and the berries moulded badly. Then holes were cut in the sides, which preserved the fruit a little better. Finally, the square, open baskets and crates were introduced, the American among the first, which is still in use. When these baskets were first put upon the market they were quite expensive. Manufacturers who had a monopoly of the business sold them easily at thirty-five to forty dollars per thousand, and they were not very plenty at those figures. To-day, good baskets can be bought for eight dollars per thousand, and still lower for cheaper grades. These baskets are used for all kinds of berries, except the blueberry, which, on account of its small size, is still put up and carried to market in the old style, round box with cover. Crates can be purchased of any reliable market man in any of the large cities for one dollar each, all fitted, each crate having three slats and thirty-two quart baskets. This is the most convenient size. Seven-eighths of the crates in use are of this size, and when a person orders a crate of berries, it is understood to be a bushel or 32-quart crate. They are made in various sizes and shapes—40, 48 and 60 quarts—but these are too large for one man to handle easily, beside they are of bad shape to stow into a common express or grocery wagon.

We have made it a practice since the first days of our strawberry growing, as soon as the plants were done blossoming or nearly through, when the fruit begins to set, to mulch the vines thoroughly. We go all over the piece and place straw or meadow hay between the rows. This is done mostly to keep the berries clean, but it not only does this, but keeps the ground moist and the berries grow larger and better, and the plants remain in bearing for a longer time. Pickers have to go over the ground every day or two and, where it is treated in this way, they not only work faster, but keep their clothes much cleaner than they could if the straw was not there. I never found any trouble in marketing a crop of strawberries. If you are in a small town, beside supplying the village store-keeper, you will probably have regular customers who will want a basket or two each day. Many of your neighbors will want a few quarts to put up for winter. The church is going to have a strawberry festival and will have a crate or two. The demand for them will surprise you, for the season is short, not longer than three weeks, and they have to be eaten while they are here. If you have a surplus, send them to some reliable commission house, that will sell them for you for a small sum, usually ten per cent. This makes it an object for him to sell at good figures. The higher the price the more he receives and the better satisfaction it gives to the party who ships them. We have usually sent our surplus berries to Boston. During the summer season we have a boat daily each way. The berries are picked in the afternoon, put aboard the boat at five o'clock, and if the weather is not foggy or rainy, they arrive in Boston the next morning by daylight in good shape. If the weather is damp they are apt to grow mouldy, and in this damaged condition sell lower. But we have to take the risk, and do not get many such days during the berry season. They should never be allowed to get over-ripe. In fact, those to be shipped or sent a long distance should be picked as soon as they have turned and before they are fairly ripe.

They should never be picked directly after a rain storm or in wet, foggy weather. While the fruit and foliage are damp the berries are soft and should not be handled until the sun comes out or the foliage is dried by winds. Picked in this way not only is their beauty destroyed, but their keeping qualities also.

YIELD PER ACRE.

Different results are given in different localities. Much depends on the nature of the soil, the condition of the ground and the care that has been given them during the growing season. If there was a good set of plants, the rows perfect and no portion of the ground winter killed, a fair yield would be from seventy-five to one hundred bushels per acre. Where extra care has been given plants, the runners cut close and no weeds allowed to grow, the yield has been very large, something like three hundred bushels. It is claimed by the parties who introduced the Crescent Seedling that this variety, under very favorable circumstances, made the enormous yield of fifteen thousand quarts or over four hundred and sixty-six bushels per acre. But in ordinary field culture I should say that one hundred bushels was a very good yield. Generally there is some portion of the ground where the water stands or it is naturally damp and cold and plants will winter kill. I have always noticed this, no matter how well the ground was underdrained.

PRICES.

The prices have not been very satisfactory to growers within the last two years. This season they were sold as low as eight cents per quart in our home markets, and in Boston the best Maine berries brought but fourteen cents, while some were sold as low as six cents. This left the grower but little after taking out the freight, commission, cartage and the expense of picking; and when we add to this the wear of crates and loss of baskets, there is not much money in the business. But the two past seasons I believe to be exceptions, and do not think prices will remain where they have been. The principal cause of these low prices was the receipt of large quantities of fine berries from Western New York, which came to market with the Maine berries. The market was overstocked—an over production we might say—and they retailed about the streets three boxes for a quarter. Those received during damp weather were almost unsalable and closed out at two or three cents a box to the canning factories, berries of better quality than they had paid twelve cents for earlier in the season. Our berries, the bulk of the crop, do not reach the market until the middle of July, and the people are not so anxious to buy after they have had a constant supply for nearly three months. The large markets commence to receive them in refrigerator cars from Florida in the early spring, some of the first berries selling from one to three dollars per quart. They are not sent in large quantities at these figures. Not many people care to buy them and they are only used at wedding parties, swell dinners and other grand events among the aristocracy. When very scarce they bring fancy prices, five dollars per quart or more.

In regard to fancy prices paid for berries and the amount used by the Boston market (which is the market for Maine berries) for the season, I wrote a letter to a friend of mine, a dealer, and received the following answer, which explains itself:

BOSTON, Oct. 27, 1886.

A. J. Tolman, DEAR SIR: Yours received this morning, and it came very opportune as there was a meeting of the largest strawberry receivers to-day, and I laid your questions before them. The first question: What is the largest price of hot-house berries; a man gave a dinner at Wellesley, Mass., and gave four dollars a quart for sixteen quarts of berries. This is the highest price that I can ascertain was ever actually paid in Boston.

Second, the first berries arrive from Florida about the middle of February, and sell for two dollars and a half per quart, but one dollar would be a more even quotation. They very soon drop to fifty cents, and sell for that price for some time. Third, we have received in Boston eight thousand thirty-two quart crates in one day, as near as we can ascertain. Fourth, the amount of berries received in Boston during the season would be one hundred and fifty thousand thirty-two quart crates. In two months the estimate is ninety to one hundred thousand thirty-two quart crates, leaving about sixty thousand for the other four months. This estimate is as correct as could be given by the largest dealers in Boston. Trusting this information will be of service to you, I remain,

Yours truly, W. F. BURROWS.

56 Clinton Street, Boston.

The best prices are obtained in the northern cities, even after paying the expense of sending them there. As the season advances they get them from the Carolinas and Virginia, the prices going down with each new shipment until people of moderate means can afford to use them. Norfolk is a great shipping point. Those sent from beyond Norfolk are rather poor, being picked green in order to arrive in decent shape. But from there, berries are of fair quality and continue to improve as we get farther north. Those from Jersey are very good berries. Then we get them nearer home. This makes the season very long, especially in the New York and Boston markets, after receiving them from Maine.

The Provinces are beginning to ship a few, going into market a little later than ours. Most of the berries received from Norfolk and New Jersey are covered with sand, smaller and of poor quality compared with those we get nearer home. But after people have been eating them three months or so, we must offer them a good berry in order to sell to them at all It is conceded by the market men, generally, that the Maine berries are of as good quality, both as regards size and flavor, as any that go to market, and they usually bring as good prices as any sold at that time. A few crates of ours three years ago sold at twenty cents per quart, while the best prices paid in Boston for their natives was but seventeen cents that season. A great many southern berries are sold here in our Maine markets. They do very well in the place of something better. But people will not buy them when they can get natives, although they sell for half the price of the latter.

In starting out to raise berries by the acre I would not advise one to purchase a large quantity of crates and baskets. He must have some, of course, for use in his home market. If any are shipped, the house to whom he consigns them will furnish all the crates and baskets needed, free of cost, and be glad to do this in order to secure his custom. Baskets should be well filled, as by transportation they settle badly and if heaped up will be no more than level full when they reach market. See that no green, half-ripe or over-ripe berries are put into the boxes, as you not only lose the growth on these berries but it injures your reputation, for in order to secure a steady sale for them you want them put up a little better if possible than your neighbor's. One or two green berries in a basket will spoil its sale and sometimes the sale of a crate, or will reduce its price two or three cents on a quart. The party buying them will argue that every box is in the same condition and your commission man can't say for certain that it is *not so*. If pickers are so careless as to put in green berries, especially after being reprimanded, discharge them at once. It is the only way by which your fruit can be properly put up. After an example of this kind, the rest of the hands will be more particular. The berries should be handled as carefully as possible. Do not turn them from one basket into another or pick them over. Have them put up just right and let them remain in the basket just as the picker has placed them. In taking them to the boat or station always carry them in a spring wagon if possible, and take plenty of time so as to drive very carefully. I have sometimes waited in order to finish filling a crate and then been obliged to drive fast in order to reach the boat in season, and the berries were much injured by being badly shaken up.

All crates should be stencilled plainly or marked in some way so that they will not get mixed up with those of other parties. Do not have your crates stand in the open field while being filled. Place them under the shade of a tree if there is one near by, if not, build a small shed or put up a tent large enough for the purpose, to keep them as cool as possible. After being picked do not allow the filled baskets to stand in the hot sun. The top berries are very likely to be spoiled by scalding. Partially cooked, they will turn white or pale and should be thrown out and used for some other purpose. Every picker should be provided with a stand which will hold four or six baskets, and when these are full they should be brought in. It is much easier to keep the account where the same amount is brought in each time. The prices paid for picking are usually one and one-half cents per quart for the first berries, and as they grow smaller two cents, and finally the last berries three cents per quart. The last berries are small, but there is a good demand for them, and the last end of the crop brings better prices.

After the berries have been picked, the ground should be cultivated immediately. It will become quite hard between the rows during the picking season by walking over it constantly to gather the fruit, and should be pulverized. The cultivator should be widened so as to plow up some of the old plants on each side, and when the runners start they will fill these places with new plants, and ensure a crop for the next season. The rows should be plowed down narrow, so that they will be not more than six inches wide. Give the land a good top dressing of commercial fertilizer and wood ashes, and by September there will be a lot of new plants. I prefer fertilizers for a top dressing, as they contain no foul seeds, act quicker and can be applied without driving a heavy team on the bed. After two crops have been taken off, the plants should be plowed under and the ground re-set. If the plants are in a good healthy condition, however, it might pay to cultivate them the third year. I have seen a paying crop from a bed four years old, but nothing like the first one taken off, of course. Some of our largest growers raise but one crop, and say there is more money in it than to take care of an old bed. The berries are larger, bring better prices, give better satisfaction, and the loss of the use of the land is more than made up in the higher price received. Those who raise berries for market year after year set a new piece every spring and plow one under every fall; about one-third of the land being in runners every season.

VARIETIES.

In buying plants to set, go to some reliable parties that are engaged in the business—well-known nurserymen or parties that are growing fruit for market. Do not depend on the talkative tree agent who, with his bright-colored plates, will try to make you believe that he has just the sort you want—a decided acquisition; a new sort just introduced; the largest, best flavor and most productive ever grown, and will sell them to you at two dollars per dozen, a large discount from the regular price. Do not listen to him. Do not trade with him at all, but buy your plants of reliable parties that have a reputation for honesty and square dealing. Neither purchase of irresponsible parties who offer to sell below the market price. In such cases they are about sure to be badly mixed. Do not set old plants if you can get them for nothing. They are not worth the labor of putting out. Use strong, healthy runners if possible. Do not experiment with new varieties, only on a small scale, until you are convinced that they are worth growing, or unless you are growing plants for sale. If you are growing fruit for market you cannot afford it. Take old standard sorts that have been grown for years. Some varieties do not succeed on all soils. Others do well wherever planted. If I were confined to one variety I would take the Wilson's Albany. This may be a little bit old-fashioned, but for a shipping and keeping berry it has no equal. After experimenting with other sorts and growing them alongside the Wilson, I think more of it than ever. For a home market, however, the Crescent Seedling I think more profitable. It is more productive if the runners are cut close. The flavor is better, and it remains in bearing a longer time. It is one of the first to ripen and remains in bearing after other sorts are all through. But it is soft and will not compare with the Wilson as a berry to ship or keep over a day or two. There are many valuable varieties; one of the best is the Miner's Great Prolific. This is large, fine-flavored and productive, but has a white tip or end which does not ripen with the rest of the berry. This is a bad fault and hurts its sale. The Manchester, Windsor Chief and Capt. Jack are all excellent, and should be in every collection. If you want to grow large berries, nothing will compare with the Sharpless, although the Cumberland Triumph and Jucunda are large enough and rather more productive.

Now, as to the time for setting plants, I prefer the early spring, just as soon as the frost is out of the ground and before the crown of the young plants have started at all. In doing this the land should be prepared in the fall to save time, as everything has to be done at once. Some growers argue in favor of fall setting, and if you haven't the time to spare in the spring it will do very well. Quite a crop is realized the first year if the plants do not winter kill, but it is somewhat risky and they need the whole season to form a strong, healthy plant, and fill up the space if they are grown in matted rows. It is a great advantage in growing strawberries to have a chance to irrigate the plants during the month of June, while they are in blossom and the fruit is being formed. They need a great deal of water, and the cause of many failures to produce a crop has been the lack of it during a dry season. If the land is naturally dry it would almost pay to haul the water and put it on by hand rather than do without it. If a stream of water is within a convenient distance an hydraulic ram might be used at no very great expense. The strawberry plant is hardy and will grow if it is given any chance at all. The weeds are its worst enemies and should be taken out when small; for, if a strong root of witch grass or sorrel gets its grip on them it will about ruin the plant to remove it.

Strawberry growing is rather a pleasant and a light work compared with the growing of other farm crops. The beds need your constant attention from the time the plants are set until the fruit is sold. In closing, I will say that though my methods may be different from others, and my judgment at variance with the opinions of others in the selection of varieties, yet the recommendations given and the conclusions drawn correspond with my experience.

GOOD HUSBANDRY.

By R. W. Murch, Hampden.

Read at Farmers' Institutes at Portland and Kennebunk.

When the world was created and sent circling around the heavens, the Creator had other purposes in view besides adding another member to the solar family. We may not be able to understand all these purposes, but that it was to be the abode of beings not yet created was evidently one of them.

At the creation God said, "Let the dry land appear, and it was so." And "He called the dry land earth," that is, the soil. This soil had in it all the constituents necessary to produce vegetation, the grass, herbs, trees, fruit, etc., which contained in themselves the power of reproduction and perpetuation, and was to produce food for the subsistence of man and beast throughout all time.

As yet, the soil had produced nothing, for God had created "every plant of the field before it was in the earth, and every herb of the field before it grew." Up to this time it had not rained, and "there was not a man to till the ground." Then "there went up a mist and watered the whole face of the ground," and man was created from the dust of the ground.

Everything had been provided, and the ground was now ready for tilling. An atmosphere surrounded the earth, necessary alike for the life of man and plants; the soil had been created, means for watering it had been provided, the sun had been called into being and fixed in the heavens to shine down upon the earth, warm up its soil and start vegetation into life, and now man has been created to "till the ground."

"The Lord God planted a garden eastward in Eden," and He put the man into the garden to "*dress* it and keep it." Do we ever consider what this means, to *dress* it? Many of our farmers of the present day go about and continue their business in utter disregard of this first requirement. Had Adam taken off crop after crop, year after year, without returning as much as he removed, it could not be said he was *dressing* the garden; in fact, he would have been doing just what many of our Maine farmers are doing to-day, he would have been *undressing* it, to use a homely but expressive term.

Dressing a piece of land to "keep it," means to keep it up to its normal standard of production; that is, as much vegetable nutrition must be returned as the cropping has removed. When you obligate yourself to feed and clothe an individual for a term of years, we all know what that means. When you have given him a few meals, and fitted him out with a suit of new clothes, he has been fed and clothed to be sure, but not according to the meaning of the obligation, and nobody would so understand it or accept it. The person requires food every day, and feeding him means *keeping* him fed; clothes wear out, and clothing him means *keeping* him clothed. So with the requirement made of Adam; dressing the garden means keeping it dressed, and the same injunction is as binding on us to-day as it was on Adam six thousand years ago.

When nothing is taken off, all soils are naturally self-sustaining; in other words, when everything the ground produces falls back and decays where it grew, it returns to the soil every element removed therefrom during the process of its growth, and so long as this continues, the soil will hold its own; no fertility is or can be lost.

But when the land is brought under cultivation, the farmer is constantly removing some of these elements in the several crops he is taking off; and unless these materials, in some form or other, are returned, the soil is just as surely losing its productive power as it is that the sun shines, and as long as the exhaustive process of continued cropping goes on without adequate returns no soil can retain its full productive power.

The rich, mellow soil of Aroostook County is now producing remarkably heavy crops, and may continue to do so for some years without any perceptible diminution; but the time will come when her crops will fall off as they do in the older portions of the State, unless

Aroostook farmers are wiser than their fathers. A new soil may be made to yield heavy crops for a few years, by simply disturbing and changing its physical condition, which is easily accomplished by plowing and cultivating. By this easy mechanical process, the soil is disintegrated and improved, and made to yield satisfactory crops for a number of years without any sensible diminution. Notwithstanding, they are heavily drawing on the resources of the soil all the time; and year by year its fertility is being exhausted more rapidly than would appear.

We have been considering the soil, the manner in which its fertility is exhausted, and how it may be restored; and as barnyard manure is the most active and efficient agent in its restoration, we will give our attention to the further consideration of its importance, and also the different methods of application.

Farmyard manure is undoubtedly by far the best fertilizer that can be applied to our soils; and at present, it is the only reliable dressing containing all the properties the soil needs, upon which the farmer can depend. From the care bestowed upon it we conclude the value of the manure pile is greatly underrated by a large majority of our farmers. Notwithstanding a large percentage is running to waste through various channels, it is still the bank that never suspends payment, and upon which the farmer is constantly drawing, though with a lessening percentage of profit.

The voidings of cattle contain all the material that has been taken from the soil, less in amount by what has been assimilated in the formation of flesh, bones, blood, dairy products, etc., and what escapes through the process of decomposition; and, as this is the only complete fertilizer we have, no man can fail to see the necessity of its preservation from loss.

In view of the great importance of the manure pile, every possible available means should be used not only to prevent waste, but to increase its bulk and value; and we may rest assured that every deposit made in this bank will pay a better interest than Government bonds.

All coarse fodder which is not eaten by cattle, such as large cornstalks, straw and other litter, may be converted into good soil dressing by removing it to the yard and hog-pen, for the animals to work over and mix with their excrements. The process of fermentation and decomposition is constantly going on in warm weather, and if the mass is forked over a few times during the summer, the process is quickened, and by fall completed, when there will he a black, friable and rich dressing, ready for the soil and plant nourishment. For corn, with perhaps the exception of that from the hog-pen, there is no better fertilizer.

In regard to the time when manure should be applied. This depends somewhat upon its condition in connection with the crops we propose to raise, and whether necessity compels us to use it to the best advantage in order to supply present needs. It is well understood that fresh droppings do not readily decompose and assimilate with the soil; but, in my opinion, there is no time when stable manure can be used to so good advantage, on the whole, as when it is dropped from the animal, and before anything is lost by decomposition and evaporation. When it can be done, it should be immediately hauled to the field and incorporated with the soil by plowing or cultivating, or both. This, of course, cannot be done in winter, and it is fortunate that manure sustains but little loss at this season—I should say rather, it is a wise and most beneficent provision in Nature's laws, that the process of fermentation and decomposition is stayed, or, at most, goes on very slowly during the cold season, so that it may be moved to the field at the farmer's convenience and applied in the spring with little or no practical loss. While it is true that the elements of green manure are not all immediately available as plant food, yet its constituents are all in the soil, and held there without loss as a "reserve force" to be drawn upon by future crops.

Heretofore most of our farmers have applied their dressing mostly in the spring, in connection with sowing and planting; but the practice is changing, and the manure accumulated during the summer is now largely used in the fall, and either cultivated into the soil or spread broadcast over the rough surface of plowed land. This method has a number of advantages over the former, the greatest of which is the saving of time and labor in the busy time of spring work. In this latitude, a great deal of labor, the preparation of the ground for crops, the carting and spreading of manure, sowing, planting and a large amount of incidental work that always has to be attended to, all this spring labor is unavoidably crowded into a very short time; and some of our work must of necessity be delayed till late in the season, thus lessening the chances of successful crops. Other conditions being equal, any method by which spring work can be forwarded should be regarded with general favor. Another advantage

—if it be an advantage—is that the ground is in better condition for the next succeeding crop.

All manures for garden crops should be well rotted and pulverized before being used. In the absence of old manure, green may be composted and fined, and made to answer a very good purpose for garden dressing. It is better to apply in the fall, and thoroughly mix with the soil. Plow deep and let the ground remain in the rough.

In regard to *how* manure should be applied for most profit, I must differ from many practical farmers and writers. It will be recollected that some twenty years ago, there was much written and presented to the farmers through the agricultural press in favor of top dressing. The theory, based upon scientific principles, is still advocated and practiced by some, but the results of experiments have greatly lessened the number of its former adherents. That this is a cheap method of dressing the land is true; but that it is the most profitable method is not true, in my opinion, an opinion formed upon the results of numerous and varied experiments. To keep our grass fields continually in hay by this method, frequent and bountiful applications of farm-yard manure are necessary. A good quantity of hay may be produced and kept up for awhile, but the quality will be inferior. The bottom will be fine and thick, and frequently have a strong taste which cattle do not relish. If I had plenty of manure, and was able to lose fifty per cent of it, I might adopt the cheap and easy method of surface dressing. But I have no confidence in it as the best or even a good method for the common farmer to pursue.

I have had considerable experience in raising hay. This is my leading crop. It is raised for market, and it is for my interest to follow the cheapest and most remunerative plan. When I began to make hay a specialty, in order to satisfy myself more fully upon this point, I carried on experiments through a number of years and under various conditions. I have top-dressed grass land at different seasons of the year—in the early spring, immediately after haying, and in autumn. Manure has been applied in large quantities, in medium quantities, and in small quantities; it has been applied in a green, coarse, unfermented state, in a partially rotted state, and in a condition as perfect as could be made by the means at my command; and in my candid judgment, taken as a whole, fully fifty per cent of its fertilizing value was lost in the above experiments.

The poorest results were from cow manure made the previous winter, and applied, as I remember, about the middle of May. There was no straw or other coarse material in this dung. It had been kept under cover, and had never been frozen or leached, and was extra of its kind. It was moderately fine, but of course from its nature somewhat lumpy, and was spread over the ground to the depth of about two inches. The strip was still in good bearing condition, and the sod perfect. In this experiment if the increase of crop had been represented by a cipher, it would not have been far out of the way. I had a similar experience once before, and shall not repeat the experiment.

The best result was from stable manure one year old, completely rotted, black and fine. The plot for this experiment, like the other, had a perfect sod, and was in fair bearing condition. The manure was spread on liberally, more than I had been in the habit of applying to plowed land. The result was a good increase running through two seasons, when the increase fell nearly off. Without knowing certainly about it, my opinion was, comparing it with an adjoining plot under cultivation at the same time, that had the piece been plowed and the same amount and quality of manure been worked into the soil, the benefit would have been double, or nearly double, what it was.

From what was learned from my various experiments in surface-dressing land in grass, I do not hesitate to say that the practice is attended with too much loss for the average farmer to sustain, and ought to be discouraged. From other experiments, my conclusions are, that to receive the greatest benefit from farm-yard manure, it should be worked into, and incorporated with the soil, not very deep, say from two to four, not over five, inches, and as soon after it is dropped as may be.

In favor of surface dressing, chemistry tell us that none of the fertilizing properties of exposed manure escape, nothing but water is evaporated. Without considering this point in this paper, I will venture the assertion that, whether a wise choice or not, nine farmers out of every ten would choose green manure just as it is ejected from the animal, in preference to the same with the original moisture all dried out.

Another reason advanced in favor of top dressing is that the land may be kept continually in grass. True, but it may be kept continually in better grass, and more of it, by turning under the sod after the hay crop has been taken off, putting on the same amount of manure you would use for surface dressing, mixing it thoroughly with the soil, and seeding down to grass. Should the autumn be favorable, the young grass will get a good start, and you may count on a good crop the following season. I am acquainted with some farmers who follow this plan, and it succeeds well. My own practice, however, in this direction has been to turn under the sod in the autumn, and seed to grass in the spring in connection with a crop of grain. I lose one crop of hay, but I gain a crop of grain. I am not sure it is the better way. If my soil had less clay, the former method might be preferable.

You understand by this time that I am no advocate of top dressing. A large lump of dry manure, be it ever so rich in fertilizing matter, is of no more value to plant growth than a block of wood; therefore it should be as fine as possible and covered in the ground, where it will absorb moisture and distribute vegetable nourishment all through the soil where the little rootlets are seeking for it.

We come now to the matter of waste. On a large majority of farms there is more or less needless waste, generally more, by liquid drainage from the barnyard and dung piles. This colored liquid, rich in fertilizing material, is flowing almost unchecked down through the fields into the brooks or into the gutters by the roadside, and is thus a constant drain upon the best source the farmer has for maintaining the productiveness of his fields. I once heard a farmer remark that his fields were greatly benefitted by liquid flowing from his neighbor's barnyard above and across the way. In this case but little actual loss resulted, for what would have been an absolute loss was just so much gain to another party. But we can hardly afford to dress our neighbor's fields even in this way. In nine cases out of ten the loss is absolute and irreparable, the drainage being carried off into brooks.

In one sense, this very liquid is carrying off our hay, grain and vegetables. Now, if we actually saw these productions of our labor, piles of hay, bushels of grain and vegetables by the cart-load, floating off on the water, and could look on this destruction of our property with habitual indifference, and as little concern as we do on the drainage from our barnyards, we should be called simpletons and not competent to take care of property, and ought to be placed under the protection of a guardian. And yet, the cases are very similar.

How long shall this indifference—it is not too much to call it unqualified, inexcusable slackness—continue? Has this matter of waste been going on so long that our farmers have come to habitually look upon it as a matter of too small importance to require attention? Because we have not given the matter the thought it demands, and eyes have been closed to its importance, as they have been to other important things connected with farming. Is there no way to prevent in part, at least, this loss which a large percentage of our farmers are sustaining? It is true, we are not able to construct expensive barn cellars to receive the solids, and tanks for the liquids of farm stock; we are not able to adopt all the modern methods and improvements to prevent losses in manures, which are observable about the barns of the wealthy farmer; but we are not left entirely "out in the cold," at least, we are not without a partial remedy.

Now, I can imagine I hear someone say, this all sounds very well on paper, Mr. Murch, but where is the remedy for a poor farmer like me, who, with the best he can do, can scarcely get money enough together to pay his tax, and buy shoes for the children. My buildings are on descending ground. I cannot control the operations of nature; the rain will come down, I can't help it; and it will run down hill, too; it is not only stubborn against running up hill, but it won't remain where it falls. It is bound to go down hill to the brook, and if it carries along the soakings of the barnyard, how can I help it?

Well, sir, I am very glad you asked this question, and though I may not be able to answer you so fully and satisfactorily as might be wished, yet I will give you the partial remedy I was about to speak of before.

At a small outlay in labor, with no cash expense at all, a reservoir may be sunk at the lower extremity of the barnyard, or better perhaps, just outside the yard, or in any convenient place in close proximity to the yard and dung-piles, where it will receive the drainage. The sides may be lined with plank; or what is better, sided timber may be used instead, and made as nearly water-tight as possible. The size may vary to meet requirements. In most cases, if so constructed as to be eight feet in length inside, with a width of six feet, and a depth of four, it will be found to be of good and convenient size. This tank, which contains one cord and a half, may be filled with muck, sods and loam; or, in the absence of any thing better, sawdust will be found to answer a very good purpose.

The dark, rich liquid from the dung-piles flows into the tank, and percolates the entire mass, and imparts to it so much fertilizing material that in a short time, the contents, bulk for bulk, are almost if not quite as valuable as the manure pile itself. If the reservoir be cleaned out twice a year, spring and fall, there will be ten or twelve additional loads of good field dressing at a comparatively small cost. Instead of paying forty dollars a ton for superphosphate, would it not be good policy to spend a part of the money in trying to save what is wasted?

Again, there is a great waste of dressing, unavoidable and cannot be wholly prevented, which comes through the excrements of animals dropped on the highway. Perhaps it has not occurred to many of us that this amounts to much; and while it cannot be prevented, is not worth consideration. But the annual loss the State of Maine sustains through this one avenue is no small sum. In round numbers, there are 90,000 horses in the State. A large percentage of these, livery stable horses, truck horses, country team horses and gentlemen's driving horses, are on the road or in the street a large portion of the time; and their voidings, solid and liquid, are dropped on the public way. Taking all the horses in the State together, perhaps it would not be overstating it to say that one-fifth of all the voidings of Maine's horses is dropped on the highway. Reckoning the dressing from each animal worth five dollars per year, we have in the aggregate, $450,000, one-fifth of which, $90,000, is distributed along the public way.

I do not claim that these figures are correct; they are simply my estimate, founded upon observations in my own vicinity. The estimate is low, purposely so, because I dislike exaggerating either losses or profits.

But even this loss need not be total. In rains and showers, and more largely in freshets, these voidings are washed into the gutters, whence they are carried away to the brooks and streams, and so become a total loss; but in many cases, the water may be so controlled by tapping the gutters in different places, as to let the water flow over our fields, and thus they may receive the benefit of this fertilizing material that would otherwise be lost.

Here, then, we have a fund in perpetuity, kept replenished by the public, upon which our fields may draw without expense; and though there be a continual run upon this fund, it can by no possibility fail; though, by our own indifference and neglect, our fields may fail to receive the benefit so freely given.

There is another source of waste which is almost universal, and apparently so insignificant that not the slightest attention is given to it. I refer to the run from the sink-spout. This is the outlet of slops, dish-water, soap-suds, scraps of meat and fish, crumbs of bread, etc. All these materials are constantly running to waste through this avenue; I said to waste, but it should be added, to worse than waste; for it creates a pool of filth full of the germs of disease, almost under the window, and as offensive as it is unhealthy. This may not only be, as it ought to be, avoided, but turned to good account as a field or garden dressing. A simple and cheap method of utilizing the deposits from the sink-spout is to construct a pit as described before, which will hold about a cord. Fill with any good absorbent, or waste material, as rotten chips, turf from the roadside, etc., which will absorb the fertilizing matter, and connect with the sink by a long pipe or spout, and the thing is complete, except, of course, the covering, which must not be neglected. Here, then, we have another source of revenue to the farm, not large, but constant and unfailing.

This subject is not exhausted, and cannot be in one paper without making it too long. The contents of the hennery, the privy, chamber slops, etc., are sources which yield the richest material for fertilizing the soil, and which, like other sources of loss, are almost universally neglected.

I wish now to call your attention for a few minutes to the necessity of plowing the ground.

In order to realize the best results from cropping, the physical condition of the soil must be changed occasionally. I have thought sometimes that plowing the ground is quite as necessary to keeping it in a healthy condition as manuring. At any rate, judging from my limited experience and observation, manuring without plowing (top-dressing) will produce no better results for a few years than plowing and re-seeding to grass without manuring.

It is patent to every farmer, upon a little reflection, that the soil needs stirring occasionally. The simple process of plowing does not add anything directly to its fertility, but it renders more of that already in the soil available. The air cannot circulate freely through a solid mass; the rains, instead of being absorbed, would run off; the frost would not operate on a solid mass so beneficially, so the more compact the soil is the less benefit it would receive from these important agents. Without the air and rain the soil would produce nothing, however highly it may be manured; but so long as it is kept open, porous, it is in the best condition to receive the greatest benefit from the atmosphere and rain.

These natural agents, indispensable to everything that grows from the soil, we have no power to control; but, by a judicious preparation of the ground, we can so far control their results, that our crops may receive the benefits they were intended to bestow. So, instead of adopting and recommending the method of surface dressing, as many do, in my opinion, an opinion, as before stated, founded upon many experiments carried on under variable conditions, as well as upon conclusions from reasoning, plowing in connection with manuring is better by far.

The soil of itself naturally settles together without any agency. But there are many other effective agents at work more or less of the time in all of our cultivated fields, which operate to make the soil more compact. In removing one single crop of hay, the mowing, raking and carting off necessitates a great deal of teaming over the field; and so does the harvesting of other crops.

Furthermore, farmers have not yet generally abandoned the practice of turning their whole stock of cattle into the tilled fields in autumn. The injury sustained by these fields from the tramping of cattle, especially over the lower portions, does not seem to be at all considered. Again, there is manure to haul, rocks to remove, plots to cultivate, which cannot be reached without going over the mowing fields; and then there are various other matters that necessitate a great deal of teaming to and fro over the land in grass; so that in a few years, there is scarcely an inch of land in the whole field which has not felt the pressure of the wheel and the tread of horses and cattle, and some of it many times. What would you naturally expect would result from all these causes? Just exactly what does result, the soil would become more compact.

No farmer has failed to notice that a temporary road across his field always produces less grass than the adjacent portions. Why? The reason is obvious; the soil has become so solid that the little roots work their way through it very slowly and find but little nourishment; not because the nutriment is not there, not because the soil is not furnishing all the nourishment in its power, but simply and only because the plant food has become so imprisoned and cramped in the hard soil, that it is quite impossible to exercise their proper functions.

Nobody, except an absolute simpleton, would think of sowing grain or planting corn on the highway. Why? Not because the soil is not rich enough; not because it does not contain as much fertilizing material as the field a few rods away; not because the timely rains and showers do not come down upon it as they do upon the cultivated field ; not because the sunshine and heat do not come down upon it ; no, these factors are all present, and not one of them which the field possesses is wanting ; but solely because, by constant travel over it, it has become a solid mass of earth, through which no root of plant can force its way. The food is there, but it is quite beyond the power of vegetation to reach it.

When men and animals are hungry, they start out seeking for food, and if they cannot obtain it they must starve. Food may be right at hand, but if unavailable, it might as well be a thousand miles away. So with the roots of vegetation ; they cannot go through the solid earth after nourishment, though it may be there in abundance as it is in the road-bed. This plant food might as well be in the Chincha Islands as in the road-bed close at hand for all the benefit it will be to vegetation, and so it must starve to death right in the midst of all the elements necessary for its life and growth.

This, of course, is an extreme illustration, and its parallel would not occur on our farms ; but I chose it because I wanted to make a strong point in favor of plowing, the direct effect of which is to keep the ground open and porous, so that the air and rain and heat may circulate freely through it.

There are other reasons why plowing is necessary. Every few years the soil needs disintegrating and readjusting, so to speak. Some of its fertilizing material has disappeared in the several crops which have been taken from it, thus breaking up and disturbing its relationship. These crops have drawn more heavily upon some portions than others, so that an equilibrium of elements no longer exists. The readjustment is readily accomplished and the equilibrium restored by plowing and cultivating. In this manner the physical condition of the soil is changed ; the particles change places, are thoroughly mixed up and brought into harmonious relationship, where each is in condition to contribute to the necessities of growing vegetation. Thus it is seen that plowing not only lightens the soil, but thoroughly mixes it, and, in the absence of manure, which is, of course, indispensable, leaves it in the best possible condition for the production of any crop that will grow upon it.

Now in conclusion, I want to say just a few words for the encouragement of farmers ; for I find there are a few chronic declaimers against farming, men who are constantly finding fault with it because they *think* it is not so profitable as some other kinds of business. They complain that farmers have a hard time of it, and receive but small pay. I am not here to discuss these points to-day, but I feel warranted in saying the complaint cannot be fully sustained.

Farming is a safe and sure business, one in which God is a partner, if I may so speak. He says to us, I have made the soil, I have arranged the seasons, and given you seed-time and harvest. You are required to till the ground, sow and plant the seed, and take care of the crops. I will send down the rain and the sunshine to moisten and warm the ground, so as to insure the growth and maturity of the promised harvest. Is there another so safe a partner? is there another so safe a business?

We hear people of all classes talking of hard times. This kind of talk seems to be contagious, and even farmers who hardly know when hard times come or go are complaining; but still they live, hold their own, and enjoy all the necessaries of life without diminution. There is no class of men so well fortified against hard times, let them come from any cause or quarter, as the farmer. Let a financial panic prevail, and prostrate all kinds of business in the trade and manufacturing centres, and the farmer will feel it least of all. The "bears" and "bulls" of Wall street may growl and roar till other business is tottering to its foundation, but the farmer heeds it not; he just moves along the "even tenor of his way," and would not know there was the least business disturbance, did he not learn it through the papers.

There are certain solid, substantial, underlying facts connected with farming, which no business panic can touch. No sudden or unexpected change in business can, in the least, affect the source from which the farmer derives all his living and income, the soil. The soil just as readily, just as freely, just as bountifully pours its blessings into the hands of the farmer, and if this contagious, hard-times fever reaches a few, it is not because they are suffering, but because they *think* they are not making money so fast as some men in other kinds of business.

We may not accumulate a fortune by farming; the period allotted to human existence is too short to acquire wealth through the ordinary profits arising from tilling the soil. Riches ought not to be the primary object of life. We should aim higher, for that which flows from contentment, happiness and the highest enjoyments to be found in a life of activity and usefulness. It is obviously our duty to secure a competence that will place us above want, a competence that will supply us with every thing that will contribute to the highest happiness of our families and ourselves, a competence from which, without suffering, we can contribute to the necessities of others. And this, I believe, is the condition of a great majority of our farmers to-day.

The farmers of Maine are not poor, nor are they rich; but they are in just that condition when all the necessities and comforts and, it may be added, many of the luxuries of an easy living are within their reach. And you may go this wide world over, and you will find no class of men so industrious, so independent, so honest and so happy as New England farmers.

PRACTICAL CO-OPERATION.

By J. W. LANG, Bowdoinham.

Read at Institute at Chesterville.

That nation grows where every class unites
For common interests and common rights;
Where no caste barrier stays the poor man's son,
Till step by step the topmost height is won;
Where every hand subscribes to every rule,
And free as air are voice, and vote, and school.

—JOHN BOYLE O'REILLY.

On the 28th day of October, 1886, occurred the ceremonies of presentation, unveiling, and acceptance of Bartholdi's colossal statue of "Liberty Enlightening the World," on Bedloe's Island, New York harbor. The 28th of October will ever be memorable on this account. The statue is a monument to the tie that binds this nation to her sister republic across the water, and an expression of the deep and lasting feelings of love and friendship that lie behind the whole. On this international occasion, the chief executive of the United States in his speech of acceptance, among other things, said: "We are not here to-day to bow before the representation of a fierce and warlike god, filled with wrath and vengeance, but we joyously contemplate instead our own deity keeping watch and ward before the open gates of America, and greater than all that have been celebrated in ancient song. Instead of grasping in her hand thunderbolts of terror and of death, she holds aloft the light which illumines the way to man's enfranchisement." These are noble words and lofty truths. So we, too, are here to-day, not to raise the red flag of the Commune, or the black flag of the Nihilist, but to consider for a short time the beneficent principles of practical co-operation in some of its varied forms. So, too, we believe that liberty which illumines the way to man's enfranchisement will all the better accomplish the purpose when aided and accompanied by co-operation. Instead of the cold and indifferent selfishness, dead to another's welfare as Arctic climes, it brings the semi-tropic warmth of fraternity and of brotherly love and sympathy. It leads out upon the pleasant hills and valleys into the glad sunlight of prosperity.

The noblest words of Daniel Webster, to our mind, are: "Liberty and Union; one and inseparable." This is the American idea. It is the corner stone of our popular government—individual liberty and complete union, combined with high morality and general public intelligence. Monopoly is an usurpation of public welfare to private ends. One of the greatest issues, in fact the chief issue before this country, is the tariff with its two sides—protection and free trade. These sides are being argued by the press, the debating societies, the stump speakers, and by our national legislative body in Congress.

The abstract theory viewed in the light of existing facts presents grave matters demanding the candid, careful thoughts of the best intellects in the nation. But the trouble does not end with considering difficult questions upon their merits. The whole tariff business is so intertwined with selfish and party considerations that other difficulties are presented. Every one wants to buy as cheaply as possible and to sell at the highest possible price, so that pretty much every one is a free trader in what he has to buy and a protectionist in what he has to sell. Hence tariff legislation is too often selfish log rolling rather than a result of an honest study of economics. Motives of party or of personal popularity often take the precedence of the public good. This makes a revision of the tariff full of knotty perplexities. Three-quarters or more of the people in the nation are doubtless in favor of "tariff reform." But these words in some cases are a cloak for abstract free trade notions, and the words have been picked up as an opprobrious epithet to hurl by one party against the other. To add to the confusion, therefore, "tariff reform" is coming to have an arbitrary or technical significance. If a person with a free trade or a protective record argues for tariff reform, his record rather than his arguments are attacked.

We regard the subject of tariff reform, considered in the light of seeking to adjust the duties necessary for the proper protection of our industries and for payment of expenses of the national government, as of great importance to farmers and to the agricultural interests of the State of Maine. It is a matter for farmers to consider and inform themselves upon, and to act upon as their best knowledge dictates. It is a matter that requires the best practical coöperation in its intelligent and proper solution.

Singly and alone man accomplishes but little. The most independent are at the same time very much dependent. It is when efforts are joined that power is developed and results attained. It would take one man a long time to build even a small vessel alone, but hundreds coöperating together build a large ship in a few months. Thousands of laborers soon construct a railroad connecting widely separated points. By coöperative effort mountains are tunnelled and great rivers bridged. Man is so constituted that it is necessary for him to coöperate with his fellow man if he would prosper.

The greatest objects accomplished in past ages have been done by practical and persistent coöperation. Not that it went by that name or was recognized in the acceptance we now attach to the term, but it was that principle all the same. If the gathered force was dictated by priest, king, emperor, tyrant, dictator or general, its application worked out the desired results the same as though each individual volunteered to the task in hand. The pyramids were raised from the quarry, moved in huge blocks long distances, and completed into their present wonderful size and altitude by the combined strength of tens of thousands of men. So we may say of Babylon, of Nineveh, of Thebes and of the Chinese Wall. It was the combined force of human beings that gave the result.

This country was settled by practical coöperative methods. Every effort in our early settlements that was not practical failed. Jamestown and Plymouth survived, and this survival was the pure outcome of that which was practically fit for the demands of the occasion. Never before in written history had men greater need of acting together than had our ancestors — the ocean on the one hand with its storms and perils cutting off alike retreat and succor; the wilderness on the other with its uncleared soil, its savage beasts and savage men. In the face of these difficulties alone the wonder is that these little bands of settlers, here and there, were enabled even by heroism, hardship and endurance, amid that which was so new and strange and unknown, to maintain a foothold and plant the seeds whose mature harvest is a great nation.

Our ancestors were practical coöperators, they had their chopping-bees, their piling-bees, their house and barn raisings, they coöperated in making their clearings, in building the block-houses and forts. in defence and offence toward Indian enemies, in their hunting, their fishing, their seeding and their harvestings and later in their huskings and apple-bees. Necessity made them coöperators. Some of the practices of these "good old times" have come down to our day; what we need is to revive their practice of working together, modernized and adapted to our times and our surroundings.

As time passed on, the country became settled, the early dangers and hardships passed away and people began to feel and act and live and operate more independently. Bye and bye it came to be a game of life and the smartest player won the game. Selfishness grew like a thrifty weed. Then came meanness and dishonesty here and there, and distrust of our fellow-man. These are all opposite to and the death of coöperation. As a rule now, it is everyone for himself and the sharper, the speculator, the middleman for us all. Is there not a better way?

If there is any class that needs to work together it is the farmers. It needs no array of facts, or of figures, or of arguments to prove this. Every one of us has had painful practical experience that has taught us this fact and burned it in upon heart and brain as with a hot iron. If we know anything we have come to know this, and no man taketh away that knowledge.

The first thing necessary toward coöperation, then, we have—that is the belief. Next, we want faith; and this both in ourselves and in our brother farmers. Then we want action. we want security, and we want perseverance. All these will be made plain and practical with careful consideration and judicious efforts.

A Kemp's manure spreader would do all the work required in its line on a half dozen farms. Perhaps not one of these half-dozen farmers feels able, or is actually able to prudently incur the expense of buying a spreader alone. Divided among the six the expense to each would be $20, instead of $120 for one. A threshing machine and wood sawing machine would cost about $300. Ten farmers that raise two hundred bushels each of grain, pay out to the travelling threshing machine, at 6 cents per bushel, an aggregate of $120 annually. Three years' service of the machine would save them its cost and $60 over, to say nothing of the amount saved in sawing wood, cutting ensilage or hay and straw, and possibly in grinding feed. An improved stock animal too costly for one farmer can profitably be purchased by several.

There are some kinds of coöperation that are not mutually profitable. Coöperation cannot tolerate meanness or dishonesty. To illustrate, we quote the poem, "The Bevelled Grindstone," by our Burns of America, David Barker:

Some thirty years ago, or so,
  When I lived with my mother,
I knew a man whose name was Joe,
  And Simon, his half brother.

Now Simon was a whole-souled man,
  Though often getting mellow;
But Joe was made on a different plan—
  A most penurious fellow.

This Joe—for so the neighbors say—
  Told Simon, his half brother,
He thought it might be made to pay
  To run a grindstone together.

They bought the stone, when Joe, you know
  Just ground it to a bevel,
For, as I said before, this Joe
  Was meaner than the devil.

He gave the left side of the stone
  To Simon his half brother,
And run the right hand side alone
  While Simon run the other.

When neighbors came to grind—now mind—
  And Joe, the mean one, finding
They had no coin to pay—they say—
He gave them Simon's side to grind
  Who charged no fee for grinding.

As time rolled on, they say, one day,
  That Joe came in a frothing
For grinding on the other side
Old Simon's bevel side grew *wide*,
  While Joe's ran off to *nothing*.

MORAL.

I sing to each earth child around,
To each whose "head is level,"
When piled beneath that six-foot mound,
If not before, you'll surely find
'Tis just as well to let folks grind
Upon *your* side the bevel.

What is wanted now more than anything else, perhaps, is practical coöperative selling. The Grange inaugurated practical coöperative buying and it has done, and is doing, a great deal of good. But it has been worked for all it is worth under present circumstances and has had all the general effect it will have under the present condition of things. In coöperation, when the Grange started as an order, it was the best it could do, or seemed the best it could do, to begin with practical coöperative buying of groceries and farm supplies and implements. It brought exorbitant margins and prices down with a crash. It benefitted the whole farming community whether in or out of the Grange. This coöperative buying should be continued, for it will not do to let up on the grip we have. But above this, with this and beyond this, we want practical coöperative selling. This will give us both ends of the trade, so to express it. "Speed the plow" is well enough, but of what avail to speed the plow when the increased product only helps by competition to crowd down prices. We say speed the plow, and also speed the market cart.

The best prices for farm products are always obtained when sold direct to consumers. In some sections of our State many farmers, and especially those near our cities, have regular market days in the week when they go to market and carry their produce. They sell at the stores if they can to advantage, if not, they sell at the houses. Some have regular customers and have established regular routes, especially for the sale of milk, of butter, and of vegetables. They get better prices and are surer of quick sales. They prefer this to selling at shops and stores. But this sort of selling must ever be limited to the few. It has drawbacks. Competition comes in here and tends to crowd down prices. Farmers, individually selling, come into competition with each other, and from inexperience, market fluctuations, and want of business tact and ability cut prices so to sell quick and get home; and the result is a general loss to all producers.

It seems to us that coöperation tends to build up and strengthen, and that competition tends to pull down and weaken. Would it not, then, be wisdom to abandon competition and adopt coöperation? We have it in the cheese factory, we have it in the creamery, we have it in the school system, we have it in the support of the poor, we have it in our public road system, we have it in the town, the county and in the unit of the nation. Manufacturers, physicians, lawyers, doctors and teachers coöperate together in class interests.

Railroads and corporations coöperate together; operatives and laborers are coöperating together in their unions and organizations and though the majority are yet outside of these coöperative bodies the pressure is felt by every branch of business. The only way to meet and resist organization is by counter organization. Why not the farmers? Why not the cultivators of the soil, who alone and singly are a prey to more scheming than any other class or calling? This is because they are the more numerous, are least sophisticated, as a rule are made to compete with each other in both buying and selling; and because they have very little to do in making prices of what they sell or of what they buy.

Again, the time occupied in individual marketing is quite an item. One of our neighbors reckons his time at two dollars per day whether on or off his farm and makes his labor count him that. Another is obliged to work at something else a part of the time to pay his bills. These may be considered extremes, but suppose we call the farmer's time one dollar per day—and this is too low—his single horse team and expense one dollar and twenty-five cents per day. This makes two dollars and twenty-five cents for every day spent marketing. We will suppose fifty days are spent during the year in buying and selling and in travel, an item of some account, or $112.50 per annum. In the same neighborhood there may be six, eight or ten farmers of which our example is an average, each doing their own marketing and each competing against the other. If there are ten on this basis there will be an aggregate expense to the ten of $1125.00 per year. Now, one man with a good two-horse team would do the marketing for these ten farmers at less than half the cost, reducing the competition from ten to one, and very likely that one would be the better salesman of the whole. This is not all. One man running a market team daily would soon become known and depended upon. He would soon be able to secure orders ahead, and from the state and temper of the market would know just when to sell and what to load with. He would be able to take advantage of the demands of the market and this advantage would soon go some ways toward paying his expenses. This sort of practical co-operation would largely reduce the cost of selling our farm products. It is laid down as an axiom that to make farming pay we must produce the largest and best crops at smallest expense. We must cheapen the cost of production. Now is it not equally correct to place side by side of this—the crops must be marketed at the largest price with the least expense?

In addition to this suggestion for practical coöperation in carrying products to market, we will venture another suggestion in regard to sale. In every city or large village, and perhaps at every or nearly every seaport town and railroad station, we believe it would be a practical thing to establish a coöperative store for sale of farm products and purchase of farm supplies and farm implements—a store and storehouse of good capacity that should receive the products of the farmers and distribute them to consumers, or ship them to the best markets elsewhere, and conduct business generally on the best business principles.

These ideas are given to set us thinking. An hour's hard thinking sometimes is more profitable than a day's work. We have presented these few plans for you to consider. Some of them may seem wild and chimerical. Some of them may not be new to you. We believe them capable of being carried out to profit. The world's ways are changing. Old things pass away or become new. Old matter takes new forms. The farmer's old rubber boots of this year may come back next in the shape of ju-jube paste, or "goody, goody gum drops, ten cents a pound." And you will find them on sale at the fairs everywhere.

We believe it to be a plain and indisputable fact that the greatest need among farmers to-day is the need of more practical coöperation. It would be of great use to any section of our State. This subject calls for thought and study. It calls for investigation. It opens up the most promising field for saving and for profit. We must learn the value of the fact that a dollar saved is just as good as a dollar earned. The old axiom puts it stronger than this even—"A penny saved is as good as two pence earned." We are not always sure of getting what we earn. Sometimes it costs considerable to collect after earning. Economy is the best adaptation of means to ends. Good management lies at the bottom of success. Farmers should study to learn the purchasing power of money, and that a dollar in their hands has just the same value, just the same power, just the same trade value, as it has in anybody's hands when handled with the same ability, care and understanding.

One hundred dollars in the hands of a farmer has just the same purchasing power that it has in the hands of the shrewdest trader. The secret lies in the handling. Take the best ammunition in the world and the best fire-arms made, place them in the hands of the ignorant and unskilled marksman and very poor shots will be made.

In the hands of the skilled marksman wonderful execution will be had. Too much good powder and shot is wasted by farmers with our old flint-lock blunderbusses.

How long do you think it would have taken to put down the late rebellion, had each soldier been sent poorly equipped to the front to act on his own hook independently and as he pleased? Why, it took the best military discipline and coöperation of the nation's immense forces four long years to overcome it.

Let us consider the purchase of commercial fertilizers. Only a few years ago the standard makes cost the farmers $45 per ton. Now they are from $36 to $38 per ton. What think you has been the greatest cause in cheapening their cost? While it is true that the materials of which they are compounded have in common with the prices of most everything else been lowered, at the same time demand has correspondingly increased. While competition has had something to do with it, the vast increase in amount used by the farmers each succeeding year, has greatly off-set the effect of competition. The greatest factor in the reduction of prices has been buying in quantity and buying direct of the manufacturers. In other words, coöperative buying. Buying by the ton, ten tons, and buying for cash. Many granges buy by car-loads; here and there an individual farmer the same.

We have done just enough of this to see the great saving there is in it. We believe that this year superphosphates of standard brands are going to be bought by the car-load for $30 to $35 per ton and no better are made anywhere than those made in our own State. By coöperating in the purchase of commercial fertilizers the farmer gets his profit in the outset. Buying at retail he pays $38 to $45 per ton. At wholesale from $32 to $38 per ton. These six or seven dollars per ton is from eighteen to twenty per cent saved at the start. Isn't that worth saving? The superphosphate is going to give us just the same crops and the same results as though we had not saved six or seven dollars per ton in its purchase.

It is just the same in the purchase of all other farm supplies. The profit between wholesale price and retail price can be saved. It is these savings that will help swell the net profits. We must learn to coöperate, to work together as we have learned to work apart. When we learn to mass our orders, to purchase in quantity, we have the same power against corporations that corporations have now against us. Our motto should be "coöperation," our standard should bear the legend "one composed of many," our aim and object should be "we will work together for our class and our mutual interests."

In the purchase of farm implements go direct to the manufacturer and if with an order for two or more you can always get reduced prices. If you enquire the price of enough to make it an object to the manufacturer he will add a sort of postscript saying we will give you so many per cent off *for cash*—enough to make it an object beyond offsetting the freight. Manufacturers much rather sell direct to farmers for cash than to others, for the farmer puts the implements at work on arrival and this advertises them practically. It is not every farmer that feels able to buy a disk or wheel harrow, a spring-tooth harrow, a seed drill or seed sower alone. All these tools are great labor savers, and of great value in their season of use. Each one is capable of doing the work required of it on several farms. Here there is a chance to save by coöperating in buying and in use. Let us substitute coöperation for borrowing.

One grasshopper don't amount to much. One caterpillar is an insignificant thing. One potato bug ought not to frighten any one, but these fellows have learned coöperation and when they choose to give us a grand exhibition of the power of numbers, we find we are almost at their mercy. Why are we so slow, so backward, so averse to learning these vital lessons, and so negligent in putting them in practice?

The moral and religious forces of the enlightened world must work, and do work, in harmony and union in order to do their best work. The churches though differing somewhat in forms of worship and on minor doctrinal points are still coöperators in the great field of Christianizing the people. They are practical coöperators working toward and for great and glorious objects. More and more, year by year, sectarianism is growing beautifully less, and year by year the broader and higher principles are brought more to the front. In the great work of temperance reform all branches are coöperating, and the grand temperance army grows larger and stronger by practical coöperation. Wherever we turn our eyes we behold examples and learn lessons of the value and the effectiveness of combining together for desired objects Why not use this potent force for the good of farmers, and who will use it for the farmers' good if the farmers neglect to do it for themselves?

As an illustration of what the agricultural class can do if they will toward helping themselves, and by the means of practical working together for their rights and their welfare, we will call attention to the accomplished fact of our experiment station. The Legislature of 1885 did not dare to refuse the tremendous pressure of demand. The previous Legislature put the farmers off with an old played-out law of Masachusetts. It gave them a stone where they asked for bread. From every grange, subordinate county and State, from every farmers' club, from every agricultural society, from every farmers' institute and from every post-office almost, came long petitions.

This fact teaches also another lesson: farmers must respect themselves and demand their rights, and if necessary, ask long, loud and persistently for what is of vital importance to their interests. Farmers must ring their own bells, and blow their own horns! As a class, farmers have too long furnished wind to blow everybody's horn but their own.

Again, another noted illustration of what the farmers can accomplish when they make up their minds and put on their war paint: On the statute books of the Nation stands to-day the bogus butter law, the outcome of a long and fierce battle with fraud and with capital. Somebody might say, "O, that is only a little two-cent concern." But there is millions in it for all that, and better than all else is, that it is a victory for the farmers. It shows they are terrible in their might when aroused in defence of assailed rights. It shows they are as puissant as when at old Lexington and Concord

> "The embattled farmers stood
> And fired the shot heard round the world."

We must bear in mind, also, that when the railroad men, the lumbermen, the fishermen, or the sportsmen want a law, or a measure made a law that they deem of benefit or necessity to them, that class interest combines and persistently push their interest. It only remains for farmers to learn the lesson, and having learned, remember and practice. Effort will accomplish what fault-finding never will.

Now I wish to say a few words in regard to the grange. It is a school of benefit to both old and young. It is the best and most practical coöperative organization we have among us. It is based upon farming and designed especially for farmers. It is the only order that goes with us in our every-day life on the farm. Its ritualistic work, tinged all through with Christian principles, is drawn from every-day actualities on the farm; the lessons of the degrees are sublime. In its fraternal bands it binds together in one great family the tillers of the soil. It enlists self-interest with the general interest and general good. It gives mutual help for self help.

In this State we have two hundred granges and fourteen thousand members. Here is a factor in the case of practical coöperation among farmers that is little understood. Here are two hundred organized bodies of farmers meeting regularly, most of them once a week; then there are fourteen county granges electing monthly; then the head of all, the State Grange, meeting annually in December, so it will be seen the State is well organized under the grange. It will readily be seen what a factor for good these town, county and State organizations may be. If some law for general welfare of farming is wanted, if some special branch needs particular encouragement and fostering, here is a means, and an organization covering the State everywhere to help it along. It is an organization of, for and by the farmers. It is theirs. But when looking over the field, seeing a town here and there without a grange, seeing also so many farmers that are yet outside of the grange gates, I am reminded of the words of one of the best and wisest among men: "He came unto his own and his own received him not." But the grange is growing, its principles and its capabilities are being better understood, and there is every reason to be encouraged. The grange is thoroughly organized and is doing a great social, educational and coöperative work. It has its trade arm with the Patrons' Coöperative Store at the head in Portland. It has its mutual aid society in which life insurance is furnished at cost. It has two strong mutual fire insurance companies where protection from loss by fire is offered at cost. It has its reading circles and its newspapers and its literature. In its ranks are many of our best farmers all over the State and nation and most of the prominent agricultural men. The Patrons of Michigan have seen their State Master made Governor of the State at the recent election, a parallel to what happened to the State Master of Maine four years ago. A good patron will make a good Governor anywhere.

It is a great mistake not to have a grange in each town of the State, and when they do get one started, it is a terrible blow to their best interests not to give it a little time and attention in a patriotic manner, and then not only themselves but all farmers will reap benefits from it they do not now appreciate, because the effect of our subordinate grange work all over the State and nation is of such a silent and unassuming nature, you can hardly realize the great revolution it is making in public opinion for the benefit of agriculture and the farmers. Too many think because they are not made county officers instantly or sent to our Legislature, the grange is a failure; or they may not receive a cash benefit paid to them—many times as large as would be fair pay for all their service rendered, and because they cannot see or feel these benefits are coming to them in some such manner, they fail to realize that the general prosperity of farm interests does bring them large reward, and they do not give the proper source from whence it came full credit.

It is becoming clear to the American people, says Professor Olin, "that strikes, boycotts and mobs are not remedial agencies. The old-fashioned conviction is forcing itself upon the political and social world that if you sow corruption, there will spring up crime; if you plant sedition, you will gather rebellion; if you scatter mob law, you will harvest mobs; if you sow to the winds of socialism and anarchy, you will reap the whirlwind of destruction and death."

It is also becoming equally clear that arbitration and coöperation are the best ways to settle all questions of disagreement, and to reach and to accomplish all needed reforms.

Under present environments and especially under future prospects, we can see no bright hope for the farmers and the farming community, unless coöperation shall be made more and more of practical use. Our own interests, our own future, and the future of our boys and girls demand it. We see no reason why farmers should not "pool their interests" and control the "out-put" of food crops the same as the coal, the oil, and the iron men do.

A keen observer of men and things, in a recent public print, says:

"In those localities where patrons buy and sell together, and by a system of lecturing keep up an interest in the order, a higher standard of excellence prevails among the farmers and their families; more independence of character is displayed; more interest is taken in the education of their children; fewer mortgages encumber their property; a purer morality exists; and more time and attention is given to public matters and public duties."

There is no calling on earth more honorable and more to be respected than that of cultivating the earth. It has the claim of being first and was given to man by his Creator. It should be handed down by father to son improved, beautified, and fully up to the exigencies of the times.

No State has superior inducements for a home, or greater facilities for enjoyment of life than the good old State of Maine. Her sons and daughters may be found in every State and territory, and all over the world. While many go out beyond her borders for better or for worse, many remain. While those who go are upholding the honor of their native State abroad, it remains for us to uphold it at home. It remains for us to make practical coöperation such a success here that in it we shall lead. Practical coöperation will enable us to become broad, and deep, and strong. It will teach us how to be truly the best of farmers, the best of citizens, the best of patriots.

"No north, no south, no east, no west,
The whole broad land is ours,
We'll hide those dreadful battlefields
And plant them o'er with flowers.

We'll sow the seed, in faith and hope,
Our work shall never cease,
'Till every hill and mountain slope,
Shall send us words of peace.

We'll start the cheer at the eastern sea
And send it to the West,
'Till the glad shout comes back to us,
From mountain crest to crest.

Then gather all your hosts again,
Wide out your banners fling,
And rouse ye, nature's noblemen,
To crown the farmer king."

A HILL OF POTATOES.

Discussion of the subject at Hampden Farmers' Institute.

Opening of the Discussion by the SECRETARY of the Board.

To-day we have presented for consideration as the leading topic of the day a subject which has not received much attention from the Board up to the present time. I hardly know the reason why this is so, yet it is a fact nevertheless. I am aware as well as you that the subject of the potato and its cultivation is not one which is especially applicable to this town, or even to your county, and indeed I hardly know where it would be specially applicable to any one county more than another, with the exception of Aroostook; and there potatoes grow well enough without the Board of Agriculture or any of its labors. But consider a moment, if you please, if you think that this subject is not well chosen, that it really is a subject of universal importance.

A brother farmer has said to me this morning that the subject was not of special interest here, for the time had gone by when you in this section were making this a leading feature of your farming or a leading product on your farms.

The Board of Agriculture was aware of that, and yet the farmer is not sitting here before us who does not raise potatoes, or try to, and the self same farmer who said that the subject was not of special importance here made the statement that his crop of potatoes this year did not amount to much—an argument at once, you see, of the necessity right here of as much knowledge as we may be able to gain of this subject.

Although the individual interests here in this particular direction may not be large, yet when you consider the fact that it is of universal application, that every farmer in the county is growing, or attempting to grow, and would grow, more or less potatoes, you see that in the aggregate it is a matter of considerable importance, even here in Penobscot County.

In what I may say this morning I merely want to call the attention of the audience to the widespread importance of the subject. I was brought up to look upon the potato as one of the low-grade crops of the farm. This was educated into me by my father. He was one of those farmers who was always careful of the condition of his soil, that it be kept productive, that it be carried from its present condition to something better right along year after year; and I was educated to believe that the potato was an exhaustive crop, that if it was continued on a large scale on the farm for any length of time it necessarily reduced the productive condition of that soil and in the end was a detriment to the highest interests of agriculture, and on that account was not a profitable crop. I have held an opinion all along without really knowing the reason why or studying into it to find whether it was actually sound or not, that this was a crop to be set aside as much as possible. Recently I had my attention called to it from a different standpoint; and I must say that I have got some light upon it which has led me to look very differently upon the crop from what I did before giving it this more recent attention. Senator Frye, at a dinner given to the sons of Maine in New York, made a very happy speech. In it he alluded, as is usual for speakers on such occasions, to the importance of the ice crop and the granite and the summer visitors, and also, with a judgment which politicians are not always credited with using, referred to the agriculture of the State as worthy of credit, and boastfully denominated our unrivalled potato crop "the peach crop of Maine." The idea was original. It had never occurred to me that the potato crop of the State was anything to boast of in after-dinner speeches. But why not? Delaware and New Jersey are glad to exchange their peaches for our potatoes, and when they get them it is at a cost even above, bushel against bushel, what they get for their world-renowned crop. Then let us join with Senator Frye and proudly boast of our potato crop. Let Delaware grow her peaches—when she can; Maine can do better with potatoes. No spring frosts destroy the crop, no cold winter can ruin the labor of years. The people of this country want potatoes, while they can do without peaches. Every well-spread table three times a day is supplied with this vegetable. It is growing to be more and more necessary to be used as a part of the food of the people of this country. It then becomes one of the staple products of the country.

Then, if it is of so wide importance and we have the facilities—the special qualities of soil and conditions of climate for growing it, it is our business to feel proud of the crop, and go on and provide means and measures to secure knowledge adequate to the crop itself and to its importance. It is with a view of doing this that the subject has been introduced to the attention of the Board at this time and not because it is particularly applicable to Penobscot County, although the interest is by no means insignificant here.

The last census gives the crop of the State of 1879 to be 7,999,625 bushels, or to put it in even numbers, say eight million bushels of potatoes. Since that time the crop has somewhat increased, especially in certain sections. Of that crop of 1879 the county of Aroostook alone produced two and one-quarter millions. Since that time the crop has increased. The year 1883 was especially favorable throughout the State for the crop. The conditions of the season were such that far the largest crop was grown that had ever been produced in the State of Maine in one year. The Secretary of the Board of Agriculture (you will find it recorded in the report of that year) estimated, taking the census as a basis for calculation and reckoning the increase of the crop from that time, that twelve million bushels for the State was a fair estimate for the year 1883. Certainly this was a crop of sufficient value for us to feel proud of.

Whether the crop has since reached the amount of the crop of 1883 is doubtful. Probably it has not quite come up to that, yet the area of potatoes, especially in Aroostook County, has been from year to year on the increase, while the acreable yield has been just about kept up, varying from year to year only according to whether the season is favorable or not. In the older parts of the State probably the acreage continues without great change either way, though it is fully kept up, yet on the whole our better care in cultivation and closer attention to the demands of the crop have given us, under the same conditions of season, an increase in the acreable yield in the State at large. Probably the Member of the Board of Agriculture will claim that the aggregate crop in Aroostook County, last year, 1886, was larger than in any previous year. Then it is safe calculation, on the basis of the census figures, to say that in the State at large the crop of 1886 approximated ten million bushels.

Potatoes are found on the farm and in the hands of every owner of land in the State of Maine. Not only large farmers grow them, not only the small farmers grow them, but every garden that is large enough has its plot of potatoes. A crop of universal growth in the State and measuring in the aggregate at least ten millions of bushels, I submit whether it is not of sufficient importance for us to give investigation to, and for us to inquire into the methods and practices of culture, and reach out for something which shall promote its increase. No attempt has yet been made to even measure our knowledge pertaining to its production; in fact, it is a question whether we have definite knowledge in the matter to admit of measurement. I, for one, am ready to admit that I know but very little definitely about the methods and practices which should be adopted in the production of the potato. In fact, this knowledge has not been very definitely fixed anywhere. It is true we sometimes find a man who knows all about it; he has fathomed its mysteries and *knows* that this method of manuring will avoid the scab, and that this method of culture is certain to produce the best results. But unfortunately for that well-defined position, his next neighbor knows just as certainly that that man is all wrong. That is where our knowledge of potato culture is to-day, without compass or chart, and yet we have this great interest on our hands and it is destined to increase rather than diminish. President Chadbourne, formerly of the Massachusetts Agricultural College, and a gentleman whom many of you have met and others have known by reputation for many years, once stated that he had grown potatoes for forty years and yet, said he, "I have no fixed knowledge of how to grow a hill of potatoes. And so long as that is the case," continued he, "is there not a chance for our young men to study agriculture, and is there not really a call for the study, even in so small a matter as a hill of potatoes."

We are here to-day, perhaps it is better to say, not to learn how much we know about growing potatoes, but rather to find how little we know in regard to it. We hope to call such attention to the matter as to give it increased importance in our minds and to do whatever we may be able to secure a more definite knowledge in regard to the best practices in the cultivation of this crop. By all means let us first cast aside the idea that it is a crop beneath the attention of our good farmers. Let us feel proud that the State of Maine is well adapted to the production of this crop; and while we let Delaware grow her peaches, Florida her oranges, and California her grapes, let us hold our attention to our specialty, and I have no doubt that we can make this crop as profitable to us here in the State of Maine, as the crops referred to are in those other States. We have here the special facilities for carrying on the work and let us see if we can make something out of the potato crop as they are making something out of their special lines of work.

THE POTATO IN AROOSTOOK.

By Francis Barnes.

Aroostook County is, for the most part, still an unbroken wilderness. Excepting the French settlements, the population could all be contained in the three first ranges west of the east line of the State. There are probably as many wild towns in those ranges as there are settled towns in the ranges farther west.

The wilderness region of our county, like that of Penobscot, Piscataquis and Somerset, is to remain such for indefinite years. The lands are all private property and the owners desire to keep them as they are. Hence they are averse to settlers, and the rapid growth of this section of the State may be reckoned as having reached its culmination. The settled towns, if considered as I have classed them, in three ranges, comprise a territory one hundred miles by eighteen, or eighteen hundred square miles of farming lands. These lands lie on the water sheds of three distinct river systems. The St. John, by far the larger of the three, the Penobscot, and the St.

Croix. This latter is confined to the extreme southeastern corner of the county, in the towns of Amity, Orient and Weston. Still the systems so interlock, and so closely, that in Amity the waters flow with the whole three channels, and in Orient and Weston the Schoodic and Penobscot fountains are almost side by side. While teaching school in the town of Amity I boarded at a farm house which was about two miles due west of the initial post of the treaty line of 1842, while between that point and the house was a copious spring, whose waters coursed off to the north to the St. John, and the rain which fell on the western part of the same farm flowed off and down by Bangor and the town where we now are.

The peculiarly fertile lands of the county are only found in the valley of the St. John River, and then only from south line of the town of Hodgdon east to the main river and north to the Grand Falls. An examination of the Geological Map of Northern Maine, by Prof. C. H. Hitchcock, in Mr. Goodale's Report of 1861, reveals one cause, at least, of this fertility and its necessary limitations. The geological formation from the St. John River westward across the boundary line through the 2d Range of Townships, that known as calcareous slates. This formation extends northward, covering the two ranges, till we get into the upper part of Caribou, where the rock changes to what is known as clay slate, and this, with the talcose schist, is the characteristic formation of all the headwaters of the great river.

In the first range the calcareous formation continues on to the town of Van Buren, where the clay slate shows itself, while in the Province the limestone continues to the Grand Falls and some few miles above. The botanist of the surveying corps of 1862 found this distinction of rock carried out in the distinction of the flora of this higher valley, and the lower portion which we are to consider in particular.

In the second annual report upon the natural history and geology of the State of Maine for 1862, on page 125, we find these words: "The country lying along the river St. John, from Boundary Branch to Grand Falls, is marked by the very frequent occurrence of certain northwestern plants.

And the district comprised by the curved northern limit of Maine and a line drawn from Grand Falls to a point between Baker Lake and Boundary Branch will be found to be nearly the range of these plants in our State. This district is so entirely distinct, botanically, from any other portion of Maine, that its limits can be said with confidence to be clearly defined.

These peculiar plants occur on the shores of many tributaries of the upper St. John and in the neighboring woods. The whole region through which they are distributed is covered by a thick growth of coniferous trees, most of which are of good size and valuable for tun timber and deal.

Move directly south and east of the lower limit of this district, we come into a different vegetation. The St. John plants have entirely disappeared, except along the river banks, to which they have been floated by the spring freshets. * * * * * * This second region, which we can distinguish by the appellation of *Aroostook District*, is characterized by the occurrence of a different flora. Instead of conifers we find a prevalence of hardwood trees. * * * * * Of course the lower limit of the Aroostook section must, for the present, be considered entirely provisional, because we have not been able to devote sufficient study to this portion of the subject. It is my opinion, however, that it will be found that the "wheat-growing lands," as the farmers call them, are much better north of Weston, on the eastern boundary, than south of the same town."

This much by way of introduction, in order clearly to show what we are to talk about in discussing potato cropping in our county.

The boundary line of the Webster-Ashburton Treaty, in its pure artificialness, and so artificial that its northernmost point, which had been declared to be in the highlands between the St. John and St. Lawrence, was located in the bed of the St. John River, just about bisects the calcareous formation of the middle portion of the watershed, and on that limestone are the towns which have the wealth, population and potatoes of Aroostook County. The settlements on the clay and other formations are scattered and feeble, while all the rest is the wilderness of forest.

It is a difficult task to make safe estimates of the yield, in bushels, of a crop like potatoes, in so large a section of country as Aroostook County. It can only be approximated, at the best, and in the figures no reckoning is made for the Madawaska District.

A beginning was made by note of the shipment by rail of marketable potatoes. From the books of the railway company we have in bushels, between August 1st, 1886, and January 1st, 1887: From Houlton, 147,300; Fort Fairfield, 125,880; Caribou, 32,320; Presque Isle, 51,653; total, 357,153. What proportion is that of the whole amount to come to market? Our most experienced buyers stated, in their judgment, from all they could learn in all directions, this is one-half. Double the amount is 714,306 bushels. Our next point of inquiry is as to the consumption for starch.

The amount of starch made in the county south of Presque Isle was 1,240 tons. As to the product above, the only means at command was to take the return made up for the Secretary of State, and work from that. The person who made it up told me it was obviously inaccurate, and therefore I have revised it. The return for the south part of the county was found to be 50 per cent short of the actual production. By revision, therefore, we have the product of North Aroostook as 2,424 tons. These tons reduced into bushels, at nine pounds of starch to a bushel, gives 814,223 ; adding potatoes marketed, 1,528,629 ; an estimate of one-eighth is conceded for the amount reserved for seed and feed, 218,376 ; total, 1,747,005. A method of proof was adopted, in this wise. A careful summary of the towns of Mars Hill, Blaine, Bridgewater and Monticello showed an average of 53,250 bushels. Reckoning that as the product of thirty-five towns, we have 1,873,750. Hence we are not far out of the way. A bin to hold the crop would need a dimension of 130 feet each way, or of cars 3,407 in a train nearly two and one-half miles long.

That I may most forcibly impress upon your minds the rapid growth of the county, and the magnitude of the work that has been done in bringing that wilderness of 1.800 square miles to its present condition of productiveness, I can state that the time from the first carrying in of the first seed potato by the Anglo Saxon race, to our section of the State, till to-day, does not yet fill out the limit of one lifetime.

In the person of Mrs. Christiana W. Putnam of Houlton, a venerable matron of 83 years, the mother of seventeen children, eleven boys and six girls, all of whom but one lived to grow up, we have one who was born before the foot of a Saxon settler had trod these wilds, and who, with her parents, came at the age of nine years to live in what is now the town of Houlton. From her life we gathered interesting details of the early time.

Her mother, her sister Sally, twelve years old, and herself came overland in the company of Judy Samuel Cook from Alfred, York County. They rested at the old Elm Tavern at Portland, on that eventful day next after "the sea fight far away ;" That "thundered o'er the tide ;" and standing on the steps, with childish eagerness and curiosity, she saw the solemn march of the soldiers as, with muffled drums and arms reversed, they bore the bodies of the dead captains, to lay them "In their graves, over-looking the tranquil bay." The party reached the import settlement October 10, 1813. Judge Oak had a log house on the east slope of what we call the Garrison Hill, Mr. Joshua Putnam one across the road; a small clearing was around each of them. Above, at the top of the hill, Mr. Joseph Houlton had built his log cabin; his son James had a camp near the present depot, and Mr. Aaron Putnam a log house and barn down across the stream, near the present bridge. Such was Houlton and the Saxon settlement of our county when she first looked upon it. Mr. Joseph Houlton was one pioneer who felled the first tree in the spring of 1807. His family were in Woodstock that season. Several grandchildren of Mr. Houlton still live with us. From Mrs. Louisa S. Powers, one of those descendants, the fact was learned that her mother, afterwards Mrs. Isaac Smith, was fourteen years old that summer. She had told her daughter that in August her mother got tired of staying alone at Woodstock and they two came over on horseback to the place where Mr. Houlton was at work, in a bit of a clearing at the foot of the east slope of the Garrison Hill; and as the women came in sight Mr. Houlton was busy cutting his first crop of wheat. Neither Mrs. Powers nor Mrs. Putnam can say just when the first potato was brought in and planted; but putting together all facts attainable, and merely drawing a fair inference, it is reasonable to believe that in June, 1807, Mr. Houlton planted the first potato, and it was, undoubtedly, that variety known as Early Blue or Blue Nose. When Mrs. Putnam came, six years later, and the settlement comprised the four log cabins and a camp, the settlers had a supply of this kind of potatoes. Immediately after this season came what is known, and remembered by these aged persons with a shudder, as the cold years of 1814, 1815, 1816. Crops could not grow and ripen and the seasons rather grew worse, till in 1816, on the 9th of June, nine inches of snow fell in Madawaska, and the ground was completely covered in Houlton. Mrs. Putnam's father was a house carpenter and had moved his family to Woodstock before the worst of this distress came around. She remembered the harrowing tales of crops cut off, of rye flour $17.00 a barrel at Fredericton, of families going from six to eight weeks at a time without a mouthful of bread to eat.

People in what had been called good circumstances about Woodstock had to have aid from the Provincial Government to save their families from starvation. How the potato fared in that period of frost and gloom we cannot now ascertain. There may have been a scanty seed saved in each season, or a draft may have been made on Provincial aid to start again with. Eighteen hundred seventeen saw a good year again for crops and from that day to this the potato has grown continuously. The method of planting, of course, was in the new land among the stumps and logs. The custom was to begin the chopping in the winter, burn it over in May or June, and then plant the seed wherever a bit of ground could be seen and enough ashes, earth, and refuse could be hoed together to make a suitable hill. No hoeing or after-care whatever, but in the fall dig at convenience.

The Black Christie variety was always grown as a later keeping potato than the Early Blue, and to this day it has many advocates and lovers, who claim it as the best table potato. Its color is the main objection brought against it. A variety called the "Saco" was early introduced to the settlement and used for cattle. It had a very large, round, two-fisted sort of shape, and was white. Late in the following spring it could be eaten at the table. This potato had altogether disappeared before the advent of present varieties. Mrs. Putnam states that one spring day, she pared one of these mammouth Sacos as we would an apple, cutting quite deeply, and after the paring was done she took the skin out to the barn, scratched a slight trench between the black logs, and planted the skin there, laying it along its full length. In the fall she dug up thirty-six potatoes as the yield of the skin, some few were good size, the rest small. In 1819 occurred the marriage of Mrs. Putnam. Her husband was Amos, oldest son of Aaron Putnam. The young couple kept house for two years on a place across the stream, and then moved onto the farm where she now lives, south of the village.

The present farm had but three acres cleared and a camp built on it when they moved there. From that date onward they never failed to raise their own bread and potatoes.

The settlement grew slowly till the war times arose and the troops were quartered in the hamlet. Then came the first market for potatoes in 1832. The regiment of soldiers, with their families and attendants, were all cash buyers, and paid in gold. During the thirteen years of the garrison the settlement throve and made a good start.

Not till the advent of the railroad, and through connections with Boston were made, did the business of raising for market begin. In 1872 Kimball & Co., of Boston, established themselves as buyers at Houlton, and modern potato growing began.

The Early Blues, Black Christies, Californias, and Jacksons were the kinds grown to that date. The Jacksons sold well for a time, but gave way to the Rose, as that is now fading before the Hebron.

The New Brunswick Railroad Company and its predecessors have been of immense benefit to our farmers. Without these lines of rail the magnificent figure of this year's crop would have been impossible. "The far-seeing railway manager is the best friend of the farmer." Such is the statement I read in a circular put out by the New York State Dairymen's Association, and the truth is unquestioned. In spite of declamation and rant, the railroads are a help to the farmers everywhere, and a direct aid to comfortable living. In the present manager of our road we have a farmer's friend, and his aim is constantly to do all possible and expedient to facilitate the movement of passengers and freight. For the past two years the owners of the road have expended large sums over and above the income of the road to increase its capacity and efficiency.

The importance of the potato crop to the residents of the county is such as to put it foremost in the list of products. The enormous expansion of the potato business the past fourteen years is due wholly to the railroad facilities which have been given to us.

Before the cultivation of the potato began on its present scale, the ways were few by which a farmer could realize the indispensable ready money with which to meet the taxes and other cash items.

I am familiar with more than one instance where the man was paying interest on money and had been for years, who could not extricate himself from the burden; but the same man after a few years of potato raising raised the mortgage and has been a free man since.

Statistics of comparison with the other crops would only be bewildering, and while the tons of hay and bushels of oats are large enough to clearly show a great source of income, yet the greater part of these crops are consumed in the year's work; but the potato is almost wholly turned into money.

The broad scale upon which preparations are made to take care of the season's crop, and the amount of capital invested in starch factories, as well as in the many frost-proof potato houses at the principal railway stations, show the magnitude of the interest. I have no means of knowing the sum of money which is required, between the month of August in one year to July of the next, to handle this crop.

A few statements of the present situation in Houlton will illustrate the point. There are eight large frost-proof receiving houses at the railway. These are open the first of September, and continue so till well into June following. In all of them one man is kept constantly employed, sometimes two. Thus it has come about that every man in a circuit of forty miles, in all directions, knows that any day, and any hour in the day, he can sell his potatoes in an open market, where buyers are competing with each other, for a check on the bank. The importance of this condition of things, locally, to the town of Houlton, is above estimation.

Potato raising is well adapted to our locality for three reasons in the main :—the comparative newness of the soil overlying our calcareous ledges ; the general absence of surface stone in these towns, thus allowing large, smooth fields where all machinery can be worked to advantage ; and the present fashion in the trade which calls for Aroostook potatoes, and pays more money for them than any others.

We do not undertake to say why a new soil, so called, is better for the potato than another, nor whether this limestone slate has a large part in helping to make up the quality of the tuber, but the fact seems to be that, in averages of successive years, the new land and calcareous slate potatoes are ranked above others. So long as they steadily bring the most money, argument pro or con is superfluous.

The smooth fields are undoubtedly an incentive to extensive culture. The growth of the starch interest illustrates this. We do not have the permanent pasture, so called. All our land is fit for the plow, but up to 1872 there had been no inducements to call for great fields under the plow.

Farm after farm could be found where the woods had been felled and burned. The clearing up was but partially completed, for the land had been seeded down and turned out to pasture. These pastures were full of the old mortgages and log piles, and the bushes were sprouting up all around them. The land itself was just as good as the rest that had come under the plow, but they had plowed all they cared to and the rest was waste.

With the market opened at the starch factory, the men one and all invaded these waste tracts, and, behold, in a year or two, the whole surface was transformed into as smooth and comely fields as the rest of the farm.

When we strike out our potato lands, the only questions are, what spot to begin at, and how much can I handle this season? Horse power is wonderfully efficient in the planting and cultivating of such spots. After the mere new land period is passed potatoes are grown on every part of the cleared land.

The fashion in use of potatoes has set strongly in our favor, and underlying the outward appearance there may be a real reason for this drift. We are for the most part above the 46° of latitude, and our summer may be better adapted to the best development of the potato than even the southerly part of the State. It may do for our potato what latitude does for the Baldwin apple, making it most perfect at or near its most northern limit. The demand for our seed for points south and west of Boston is very large. Our summer heat is always tempered with cool nights, and these have a tendency to restrict the ravages of rust and its attendant evils. Be the reason what it may, or be it that there is no reason for the quoting of our potatoes above others, so long as the current is in our favor we will do all we can to keep it running, and make money out of it. Our farmers make money. Of that there is no doubt.

This year's crop was remarkably good in all respects. One of our best men stated to me that on ten acres of his land he harvested as good a crop as he ever had, and he took to the depot, at digging time, fifty barrels to the acre, right through. The culls for the factory were just about the same in number of barrels; 100 barrels to the acre, $2\frac{3}{4}$ bushels to the barrel; 275 bushels a good yield.

The question which always comes up, like Banquo's ghost, is, "How soon will you exhaust the soil, and lose the possibility of raising these nice potatoes?" I cannot answer that question for I do not know enough about such matters. The use of fertilizers has set in on so large a scale, with so much of stable manure as we are now getting to have, that if the present theories about fertilizers are in accord with the truth in the matter, we are not going to exhaust the soil.

Our potatoes are grown on three kinds of land, as the term goes. The land just burned over, the pasture land, and the tillage land in rotation with grain and hay. Sufficient allusion has already been made to the new land method, for as the forest is the same in kind, and ashes and smut are unchanged in quality, the processes with the griming up and smooching of the operator are the same now as in the days of your father. In the statements of the methods on the other lands, I must limit myself again, for the county is so large that personally I cannot say that I know just the practice in vogue everywhere, nor does what I say, I presume, apply, in the least degree, to the French settlements, for they are "of their own kind" in a peculiar sense. A careful study of farm methods among so diverse a people as we are would be very interesting, if the expense were warranted by the means at command.

On the pasture lands it is not the practice to put stable manure, as a general thing, but with the sod turned over in the fall, at the cropping time the fertilizer is used in the drills. Seed is cut two eyes to the piece, and dropped fourteen inches from piece to piece. Two or more persons drop, the horses follow immediately, and large breadths are soon planted. In regard to cultivating, the exact ways are as different almost as there are individuals.

If the breadth of land is very large the horse hoe begins as soon as the tops appear, and the work goes on continuously, returning to the point of start, as soon as the field is gone over, to complete the hilling up. With such complete dependence upon the horse hoe flat cultivation is unknown.

For the crop in the tillage land, or, more strictly, old mowing fields which must be taken up, two methods prevail. In the one case the stable manure is spread on the sod, and then turned under with the sod. In the other case, the manure is spread after the plowing and worked up with the harrow. Which of the two ways is the better is, perhaps, determined by the convenience of the farmer at the time of the work, more than by any balancing of actual merits. In the drills is put the fertilizer, as on the pasture land, according to the faith of the person as to the profit of such a step. The drills are hardly more than scratches on the surface, and the tubers are protected by the ridges thrown up about them. The use of plaster is very extensive in two ways. One to rub the cut seed in before planting, and later the plaster is put as a top dressing, and possibly mixed with ashes.

It is not considered judicious to begin planting before the second week of May. Then the planting is pushed with all possible dispatch. Cultivating and hoeing are finished from the 7th to the 15th of July, when the hay harvest begins. By the 20th of August, in the midst of the grain harvest, the tubers are fit to dig, and oft-times the care of the grain is given over for some days, and potatoes are hauled to the station.

DISCUSSION.

Question. I would like to inquire if any farmer who keeps an accurate account can tell the cost of a bushel of potatoes—cost per bushel through a series of years?

Mr. Barnes. I have to say that question is a good deal discussed in our granges. I cannot say to you how faithfully these accounts have been kept, but I think that generally the cost is reckoned at ten cents a bushel, or about that.

Question. About what proportion of the fertilizer do they estimate is taken out by the crop?

Mr. Barnes. I do not know anything about it; I can only give the practice of the shrewd, money-making men; they keep using commercial fertilizers year after year, and the gain in using them is such that they go right on.

Question. I would like to know something about whether the potato pests that are so much in our way here infest the region where you are. I speak of the Colorado beetle and the rot.

Mr. Barnes. I think it is safe to say that the beetle does not breed but once in our growing season. We use Paris green. We use Paris green when the bugs are small and developing at their most rapid rate—mostly mixed with plaster and sprinkled dry. Of course a good deal is put on in water, but I think our best men use it dry. About the rot, I presume our potatoes rot just as yours do.

Question. Is the application of Paris green universal there?

Mr. Barnes. Yes; there are a few people who have tried taking off the beetles with their fingers rather than use the Paris green, but in a little while they get tired of that kind of work and take Paris green. But I do not reckon that the potato beetle is any great injury so long as we know they are coming and make one vigorous onslaught upon them.

Question. Is there any attempt made by the farmers to prevent the destruction by rot?

Mr. Barnes. I do not know of any. Our farmers want to make money and are simply working with an eye to making the shortest cut to it and take the chances.

Question. I would like to ask if they have any scabby potatoes in Aroostook?

Mr. Barnes. I do not think there are any; of course you know Aroostook is a large county, and I give you the general impressions from what I have seen. I do not think the scab is ever found on the new land; it is a product of civilization. Some things we get with high civilization, and scab on potatoes is one of these.

Question. Have you made any observation as to comparing methods of hilling?

Mr. Barnes. Our men use horse power as much as possible, and my own practice is to hill up.

Question. I would inquire whether one application of this Paris green is enough for the season?

Mr. Barnes. Yes, that is all that we use. Plaster and Paris green used when the dew is on in the morning.

Question. Sometimes you do this work in the morning and in the afternoon comes a summer shower and washes it off: Do you apply it again?

Mr. Barnes. Of course a shower may come in the afternoon; but then here is a question. If we sprinkle in the morning, can they eat all day and not get it and drop over on the ground? My opinion is that they will soon eat it and then they will die. I should not care about the shower in the afternoon if I had sprinkled it on in the morning.

Question. Is the use of flour at all general in your county?

Mr. Barnes. I do not think it is; plaster is very plenty there, and very much cheaper; we mix one part of Paris green to one hundred of plaster.

Question. What is the cost?

Mr. Barnes. Five or six dollars a ton.

Question. I would ask whether the potatoes are dug by hand?

Mr. Barnes. Every machine that is manufactured for digging potatoes by horse power is brought to us up there, but the perfect digger has not come. Our machine for digging potatoes is the Madawaska Frenchman and his wife and children, and when they will dig, sort and put in potatoes at ten cents a barrel, we calculate that is cheap enough. We furnish horse power to get the potatoes out of the field. My potatoes were all dug by one man and three children, the oldest seven years old and the others coming along in order.

Question. In your planting and raising of the crop in Aroostook, in using fertilizers, how do the farmers in that new country buy fertilizers to raise potatoes, and does it pay?

Mr. Barnes. Our people use fertilizers for two reasons: The first is the agents want to sell them, and in the second place we find that our best money-making men buy them and use them, and are satisfied with them. I use them and would not do without them, but could not show with figures and arguments why I do, or whether I get enough to make up the cost or not.

Question. Do you apply in the drill, or broadcast?

Mr. Barnes. My boy was bossing my farm this year, and I told him to broadcast it, and he put it in the drill.

Question. I would ask whether or not our friends in Aroostook are not sending off the fertility of their soil with their potatoes? Would not some other method of farming keep up their fertile soil better than the production of potatoes?

Mr. Barnes. I stated, sir, that it was the money we were after; I calculate if we are using fertilizers freely that we are not exhausting the soil.

Question. Our fathers raised a great many potatoes and sent them off to market, and we are suffering the results. Would not some other crop have been better?

Mr. Barnes. I presume that the man who raises the largest crop of potatoes, raises the largest crops of hay and grain. The potato crop in Southern Aroostook is largely grown now as a rotation crop. For by growing in rotation, the manuring in connection with the potato crop affords the opportunity of obtaining the best grain crops.

RAISING EARLY POTATOES.

By A. I. Brown, Market Gardener, Belfast.

There are at least four good reasons why it is desirable to produce choice, well-grown potatoes early in the season.

First, that the family may have a supply. Second, that the remunerative prices of July may be obtained. Third, that the early crop will escape the ravages of the Colorado beetle, at least partially. Fourth, that chances of the crop being injured, and often cut off by severe drought is lessened and sometimes obviated.

To raise early potatoes successfully and with reasonable certainty it is necessary to attend to details; the first and most important of which is the provision of suitable seed. I cannot state what is the earliest of the many varieties of early potatoes. To settle this point would require years of extensive and careful experiments, while in the meantime, new varieties possessing decided superiority would have appeared. Even were it possible to state the earliest and best, beyond doubt and without question,—the annual selection of seed, the mode of cultivation, the winter storage, and many other matters differently managed by different farmers, would soon show that there was no longer any standard of super-excellence In the hands of one man there might be an improvement; in the hands of many men there certainly would be deterioration. Those who have been long engaged in raising early potatoes have doubtless observed that the seed "runs out," to use the common expression. Some of the reasons are very plain. In the first place, as a rule the tubers are dug before they are *fully* ripe. The large ones are sold and the small ones are kept for seed. Whatever may be established as to small versus large potatoes for seed in general field culture, I am certain in my own mind that in the matter of strictly early potatoes there is a preference in good size.

If we were to plant some of our early sorts late in the season *for seed* expressly I will waive the exception. This should be done. A tuber that ripens in July must remain in storage two months longer than one ripened in September. And these two summer months are the most trying to its vitality of any in the year. As to the important matter of keeping through the winter, reference may be had to Prof. Balentine's valuable paper on that subject.

The next thing to be considered is the soil and its preparation. What is termed old ground is best. The best results, cost considered, are to be achieved on land naturally well drained, strong and well pulverized. Well rotted stable manure should be plowed under in the fall. The field should be replowed in spring. If at the time of planting there should have been a superabundance of rain, after plowing, harrowing and furrowing it is well to put a small forkful of horse manure in each hill for warmth and drainage. Manure so used should always be covered with a little earth. If no manure be used a handful of phosphate should be applied to each hill, scattered over a circle a foot in diameter and mixed afterwards with the soil. Early potatoes can be raised upon undrained wet lands by preparing in the previous autumn as follows:

Plow old ground deeply and pulverize thoroughly. Furrow and put out manure as for drill culture. With a large plow turn two furrows over the manure, one on each side, so that what are to be the rows the next year will be well ridged up. If necessary, trench deeper between the rows by running the plow along again. In the spring remove all the teeth from a common cultivator like the "Planet," except the middle one. Attach a pair of horses or oxen, and open the top of the ridges. Put in some phosphate and plant the seed. If the ground is quite wet do not wait, because the team need go over it but once, and the ridges will dry out quickly so that the seed will not rot.

Much has been written about allowing sprouts to get a start in the spring before planting. The usual practice of putting a quantity of potatoes in a bag or a barrel behind the stove, where white and sickly sprouts grow out and wind among the interstices, has been very justly condemned. It is better to grow healthy sprouts or none. The true philosophy is to follow nature by placing the tuber at first where there is darkness, warmth and moisture, and later, while the tuber remains in the previous condition, give the growing shoot air and sunlight. A very good plan is as follows:

Make some shallow boxes about 2½ feet long, 15 inches wide and 2 inches deep, open at the top. Put into each of these one layer of potatoes, seed end up, closely packed. Sift over them some fine earth. Moisten the earth occasionally; set in a warm place one box above another, with a couple of pieces of lathing between. After the sprouts are well started and the weather is warmer, place the boxes out of doors side by side in the sun during the daytime. When planting time comes take these boxes to the field and leave them at intervals between the rows. Cut the potatoes and drop them at the same time. The same rules are to be followed in cutting potatoes for early planting as in other cases, and I need not repeat them. There are, however, some obvious points in favor of good-sized pieces from which a part of the eyes have been removed, particularly if we adopt the following plan for giving the plant an extra early start in spring. This method is in use by many of our market gardeners and potato specialists. After the appliances are once provided and the necessary experience gained, the operation is not so difficult nor slow as it appears to be.

The potatoes are first cut and are immediately rolled in land-plaster. The pieces are laid side by side a very short distance apart in a hot-bed, where the heat is very moderate. The hot-bed should be so placed as to receive the greatest possible amount of sun-light. Earth is sifted over the bed until the potatoes are covered. The bed should be sprinkled from time to time. More earth should be sifted on after the weeds start, either before or after the potatoes come up. The result will be, if the experiment is properly conducted, a growth of healthy potato plants having vigorous stalks, and roots as well.

When the season is sufficiently advanced, the frame of the hot-bed is removed and the plants are placed in sections and with care upon a drag, by means of a suitable fork, then taken to the field and set out.

It must be borne in mind however that to make a success of forcing any plant in a hot-bed requires experience. It is not within the scope of this article to pursue the subject except to show cautionary signals. When potato plants are in danger of frost they may be covered with soil until the danger is past. In regard to the after cultivation it is only necessary to emphasize what our candid Yankee farmers already know. *The best cultivation yields the best returns.* I cannot forbear to add a word in reference to selling. Potatoes that have been forced to early maturity, even if ripe, will usually scar and lose their fresh, inviting appearance if tumbled into bags or barrels in the field and out again at the market.

Our produce of every kind should be put before the public so that it will attract attention and favorable comment. In short, we should offer a good article, displayed to good advantage, but honestly, when we have a right to demand good prices. For open market and grocery retail trade I know of nothing better than "bushel boxes" for potatoes. A box 18x18x6½ inches inside measure will hold about a bushel. Such a box, made on the farm will cost but a few cents, and is of convenient form. When potatoes are gathered in the field and displayed in market in one of these boxes, they are always seen at their best.

POTATOES A SURE CROP.

By S. L. Holbrook, Member from Sagadahoc County.

It was but a few years ago that the idea was taught by our most advanced agricultural leaders and progressive farmers that the growing of potatoes, especially in large quantities, was detrimental to the best interests of the farm, and that the growing of that crop indicated a poor husbandry ; that the farmer who raised them for market was selling his farm by the bushel and at a very cheap rate. But the light which a more modern science has shed upon practical farming tells a very different story. Science teaches us, and practice corroborates the fact, that potatoes are not so exhausting to the soil as the cereal crops, especially when grown under a system of rotation.

It has always been the aim and study of mechanics and manufacturers to make and put upon the market something that somebody wanted to purchase, some article that would sell. This same spirit should always actuate the tillers of the soil—to produce something that is demanded in the market, some crop of a high selling value. As much as I am in love with farming, and as much as there is about it that is grand and ennobling, yet underneath it all farming is a question of dollars and cents. The question comes right home to every farmer: How can I raise the wind?

And in answer to that question I have the boldness to say, that for a field crop and with the present out-look there is no better crop for the farmers of Maine to grow than potatoes. Our potatoes have a wonderful reputation for quality, and all the way from Massachusetts to Florida, Maine-grown potatoes are in demand. And it is a very proper question for a convention of farmers like this to raise—How can we grow a good crop of potatoes and do it every time? It is my business here to-day to assist in answering that question.

The first requisite for growing a crop of potatoes is a suitable soil, for all soils are not adapted to potato growing. A stiff, heavy clay is not suitable, neither is a light, sandy soil, and the man that undertakes to make a business of raising potatoes on those soils will very likely make a failure of it. But fortunately most of our soils in this State are well adapted to the cultivation of this crop; so it only remains for us to know and practice the best methods of preparing the ground to receive the seed. According to my own practice and quite an extensive observation, I would not recommend the planting on sward land if you expect paying crops. Corn, beans or grain are good preparatory crops for potatoes.

When these crops have been taken off, plough the land; and here we shall always remember the old adage that tillage is manure. Apply seven cords of manure to the acre and harrow thoroughly. Take a large plow, put in two horses, and mark the rows. Be sure and go deep by going twice in a furrow. Drop five cords of good barn manure in the furrow thus made. Drop the seed, and cover with a horse hoe and when done the land will be about level and the seed will be covered from five to seven inches deep. The manure in the furrow will make a good warm bed for the seed to lie in and will give the young plant a start. Then, later in the season, the crop will feed on the manure that was spread broadcast, as it is characteristic of potatoes to feed from the surface the last part of the season.

By deep planting we get a more strong and healthy plant. Besides, potatoes like a cool place to lie in and are not so liable to rot, as it is very well known now that the rot first attacks the tops of the potato then is washed down by the warm rains of early autumn, and those potatoes which lie near the surface will suffer the most.

The question of seed is an important one and of vital importance to the potato raiser, for the law that is acknowledged to prevail in the animal kingdom also applies in the vegetable kingdom, that like begets like; and he who disregards this law will make a serious mistake.

Natural selection is undoubtedly the principle by which species are preserved, whether it accounts for their origin or not; and artificial selection of seed is the only method by which any variety can be improved or even maintained. Without it the variety always either runs out or degenerates so much that it soon becomes unprofitable to cultivate. There are many records of carefully conducted experiments made on many kinds of cultivated plants, showing differences in the seed itself in vigor and in crop-producing power.

Among those who have thus benefitted the world, we might mention the name of Frederick Hallett of Brighton, England, who was the originator of the famous Pedigree wheat. Dr. Gustave Marck of Germany has published a long account of experiments made by him which go to prove the superiority of well-selected seeds. Professor Lechman, in Bavaria, shows by his experiments very striking results in the same direction. Professor James Bakeman of the Royal Agricultural College, England, has experimented on the various root crops and gives us some valuable information in regard to their culture. Darwin cites his authorities, saying that in France since the cultivation of beets for sugar the plant has doubled its yield of sugar, and that it has been done by a careful selection of seed.

The selection of the best seed, or the rejection of the poorest, has always been the only method of improving crops. All experiments point the same way, and the law is universally recognized.

In this connection it is well to remember that it is easier to run out a crop by using bad seed or even by simply neglecting the selection of the good, than it is to improve on already good varieties. The down-hill road is the easiest travelled.

Using seed which has been grown in some other locality, or as farmers say, "a change of seed," has been practiced by farmers in all ages; and that this is very often attended with an increase of crop has been proved by the experience of centuries. Sometimes this change of seed means bringing in a variety new to the region or to the farm; at others it is merely a change of seed of a variety previously cultivated, thereby bringing it from some other place more or less distant. However, in the light of our present knowledge, we see several causes why there should often be an increase of crop along with such change.

To illustrate: potatoes grow well as far south as Louisiana and the Bermudas, if the seed is yearly brought from a cooler climate. In fact, they cannot grow them in any other way. The same is true of peas, and there are large importations of seed peas from Canada to the United States every year. In Connecticut onion seed is imported from Tripoli. The first crop grown from this is of such excellent quality that the trouble and expense of importation are justified. But if the cultivation is continued from seed produced by the American crop, in a few years the onions degenerate in size. Melon seeds from Thibet are taken every year to Cashmere, and produce fine fruit. But vines growing from the seed of melons produced thus in Cashmere yield the next year a very poor fruit.

The evidence is so strong in favor of this practice, that I feel justified in saying that in order to grow a good paying crop of potatoes every time, you must adopt the practice of changing seed. The constant sending of the seeds of squashes and other garden vines from the New England States and other places east of the Appalachians to the fertile prairie soils of the West is another illustration, and similar facts have been observed all over the world. On this fact the modern business of growing garden seeds is largely founded.

The amount of seed to use is an important matter to decide, or whether to plant whole potatoes or cut them once, twice or three times. Each of these different methods has its advocates, and perhaps in some seasons or under some circumstances or conditions you will see no great difference in the yield. But you must remember we are talking about *growing a crop every time*, so we do not hesitate to say, *use whole potatoes for seed.*

So, in recapitulation, we will say that the essential requisites for growing a good crop of potatoes are:

1st, A suitable soil on which some other cultivated crop was grown the previous year.

2d, Manure liberally.

3d, Use good seed.

4th, Plant deep.

5th, Give thorough cultivation and clean culture through the season.

DISCUSSION.

Question. I would like to ask the question, why, if this deep planting is so useful and beneficial, do I find potatoes on the top of the ground. Why don't I find them in the bottom of the furrow?

Mr. HOLBROOK. Have you ever tried deep planting? I always invariably find those potatoes that lie deep are not so liable to decompose as those on the surface.

Question. How would you plant on heavy soil?

Mr. HOLBROOK. I would not plant on heavy soil.

Question. I would ask if potatoes planted in this way are subject to mildew?

Mr. HOLBROOK. Yes, if you get a rank growth of potatoes and a certain state of weather with excessive moisture.

Question. What is the cause of potato rot?

Mr. HOLBROOK. That has been tried to be answered by a great many of our learned men; the best answer was made by Prof. Fernald of our college, and that you will find in the Report of 1884 if you will read it. It first attacks the tops of potatoes; it is more prevalent in wet weather than in dry.

Question. How far apart are your rows?

Mr. HOLBROOK. I always plant the rows far enough apart to use a horse hoe—say three and a half feet—and plant the hills near together so to get a large yield—say fourteen inches apart. It takes no longer to hoe them.

Question. Do you plant whole potatoes?

Mr. HOLBROOK. Yes, every time.

EXPERIMENTS IN POTATO CULTURE.

By Edmund Hersey, Hingham, Mass.

Read at Hampden Institute.

Familiar as we are with the potato, it is comparatively a new article of food. It was unknown in the old world until after the new was discovered by Columbus, and for a hundred years after the Pilgrims landed on Plymouth Rock the New England farmer planted his garden without the potato. It is said to have been first brought to New England by a party of protestant Irish, who settled in Londonderry, New Hampshire, in the year 1719, but its cultivation did not become general until many years after. The name Irish potato was no doubt derived from the fact that it was introduced by the Irish people.

In the year 1762, the scarcity of Indian corn in New England led to the enquiry whether some foreign vegetable could not be found that might be introduced, to in a measure take the place of corn bread. The subject was fully discussed, and resulted in the introduction of the potato. It gave such satisfaction that it soon found its way into many gardens, though it was grown only in small quantities for many years. I well remember that, when a small boy, neither of my grandfathers grew the potato to any great extent. Only a few bushels were grown each year. The turnip, parsnip and carrot were considered of quite as much, if not more consequence than the potato. But to-day the potato is considered by all classes to be an indispensable article of food, and it would be considered a great hardship to be obliged to do without it, for nothing has yet been discovered to take its place.

During the last fifty years the cultivation of the potato has become so general and extensive, and we have become so familiar with its qualities, and the various methods of culture, that most farmers have drawn very positive conclusions as to the best methods of seeding, planting and culture. If these conclusions had all been alike there would seem to be no necessity of spending any more time in investigation or argument; but as there are scarcely any two which agree on all points, it is evident that nearly the whole field of investigation and discovery is before us. We have failed in our investigations because of the want of well-matured plans to settle, by comparison, disputed points, and because of drawing conclusions from results obtained from crops grown in some particular manner, but not so as to compare with those grown in any other manner.

While an ordinary crop of potatoes can be grown by almost any one, and with but little effort, to grow a large crop to the best advantage requires greater skill than it does to grow almost any crop that is produced on a New England farm. The reason of this is because in propagating the potato we do not plant the true seed but a tuber. As there is a vast difference between a seed and a tuber, if we are to work to the best advantage in growing the potato we need to make ourselves familiar with this difference.

A true seed is derived from the unity of two incomplete germs of life, which are often derived from flowers of two different plants, but when derived from the flowers of the same plant, the product of the seed thus obtained differs from that of the plant from which it was derived, evidently partaking of the qualities of some previous generation. For example, a grape vine may be isolated so that the flowers must fertilize themselves; though the vine may produce the choicest fruit, the seeds may produce new vines that will produce very poor fruit, thus showing that the seeds are a new creation that draw qualities from remote previous generations.

A tuber is derived from a complete germ of life, and partakes of the qualities of the life from which it is derived; it is not a new creation by the unity of two lives, but simply the extension of one old one. A true seed contains one germ of life, and is surrounded with a limited amount of plant food to force a growth in the new plant, and in the different seeds from the same plant there is but a slight difference in this amount of stored-up plant food. A tuber contains many germs of life, and there is a great variation in the amount of stored-up plant food to supply the varied numbers of life germs; but unequal as is the amount naturally, man steps in and increases it by cutting out the single life germs and planting them to depend entirely on the plant food in the soil to force the young plant, or by the side of a germ thus planted he may plant a large tuber with all of the germs of life but one destroyed, thus providing for this a very large amount of stored-up plant food. Thus, while one plant is compelled from the start to depend on the soil for its food, the other has enough to feed on for weeks without depending at all on the soil for nourishment.

A true seed is enclosed in a covering which keeps out the air and water to a great extent until placed in the earth where warmth and moisture combined start the germ of life enough to burst the covering. But a tuber has no such covering. Both the air and moisture affect it so as to often greatly injure it before the season of planting comes around, unless the farmer makes an especial effort to keep it where the heat, light and moisture are just right to keep it in its natural condition.

At planting time the farmer, as a rule, plants what potatoes he chances to have, whatever may be their condition, and that he may use as few bushels of potatoes as possible, he cuts them in small pieces; and thus with the interior exposed to the action of the soil, and in a bleeding condition, they are committed to the earth without for a moment considering how much has been done to weaken the power of the potato to force a growth in the young plant.

If we are ever to make any progress in our investigations to ascertain the best methods of producing a crop of potatoes, we must never lose sight of the fact that there is a great difference between a true seed and a tuber. A seed being a complete renewal of life, there is no running out except by constitutional weakness; but a tuber, being but the continuation of the old life, it will eventually die out with old age, even with the best of care and the most intelligent selection. Thus varieties change with age. Some when first produced from the seed will be of a very excellent quality, but in a few years change so as to be of little value for table use. Other varieties will, at first, be of doubtful value for the table, and only grown because of their great productiveness, but after planting for a score of years they improve and become a very good table potato. The old Long Red was of this character.

In consequence of this difference between a true seed and a tuber, if the farmer would make progress in potato culture it is more important that he should understand the exact character and wants of the tuber than if it was a true seed.

Every farmer who has had much experience in growing the potato has learned that the variations in the amount of the crop, one year with another, are far more than with crops grown from the true seed; and different fields the same year will sometimes differ one-half, though to the careless observer or cultivator the two fields appear to be alike and to have received the same treatment. Having noticed these great variations early in life, I commenced nearly forty years ago to experiment with the potato, that I might be able to produce it to the very best advantage, and also that I might if possible settle some of the disputed points in potato culture. This work has been very slow and not always satisfactory, but there are some points which are settled so far as relates to my own practice.

In the preparation of the soil it is found best to thoroughly mix the manure with it and pulverize it so that it will be light, fine, and loose to the depth of four or five inches, but when not more than six cords of manure is applied to an acre, the crop is very much increased by applying a small quantity of some quick-acting fertilizer in the hill, always being careful not to have it strong enough to injure the roots of the young plants. If the fertilizer is to be purchased, superphosphate is as good as anything, but it had best be mixed with four times its bulk of thoroughly decomposed muck that has been dug out and exposed to the air two or three years; but in my experiments the crops have been varied quite as much by the condition of the potatoes planted, as by the condition of the soil, or the quality of the manure applied.

As the length of this paper will not permit me to give all of the experiments which I have tried, only some of the most important will be given. Twenty-five years ago there was quite a discussion as to the importance of planting potatoes grown in a higher northern latitude. It was claimed that much larger crops could be grown than by planting potatoes grown on the same farm. I was planting the Jackson White potato, and had continued to plant from my own growing for ten years in succession. I got even larger crops than did those who purchased their potatoes to plant. I contended that our own potatoes were best. At first the proof appeared to me to be so positive that no further trial seemed to be required. On reflection I thought it best to make such experiments as seemed necessary to make it as clear to my opponents that I was right, as it was to me. So I purchased some Jackson White potatoes grown in Nova Scotia. These were planted so that every other hill was seeded with the purchased potatoes, and every other hill with my own. You may judge how I felt when I dug the potatoes and got nine bushels of the Nova Scotia potatoes and only five bushels of my own. The experiment was repeated the next year, resulting in nine bushels of the Nova Scotia potatoes to six of my own. This experiment taught me to be more careful in expressing an opinion based upon the results of different farms.

There having been much said and written in regard to the planting of small potatoes, I commenced a series of experiments some years ago to ascertain if it be a fact, as is generally believed, that the potato will run out by a continued selection of small potatoes for planting. My first trial was by planting whole potatoes about an inch in diameter by the side of large potatoes cut to the same size. The result of this was largely in favor of the small potato. The opponents of the small potatoes declared the trial was unfair because the small potatoes had the most eyes. So seven years ago I commenced again, and destroyed all of the eyes in the whole small potatoes but two, and in the cut potato had two eyes, thus giving them both an equal chance, as the weight of the pieces were precisely the same as the whole ones. The land was all prepared alike, and while in every other hill were planted two small whole potatoes, the hills between them were planted with two pieces of the cut large potatoes. At harvesting time the product from the small potatoes was assorted, carefully weighed and recorded. And then the tubers were selected for planting another year, so that the small potatoes that were planted this year came from the small potatoes planted seven years ago. The product of the cut large potatoes was treated in the same way. The result for the seven years was as follows: Number of pounds of good eating potatoes from the small whole potatoes 205 1-8 and 62 pounds of small potatoes. The same number of hills of the large cut potatoes produced in the seven years, of good eating potatoes 192 5-8 pounds, and $71\frac{3}{4}$ pounds of small potatoes—the small whole seed producing 13 pounds more large and $9\frac{3}{4}$ pounds less of small potatoes than the large cut seed.

Thus it will be seen that the small potatoes have not only held their own but have surpassed the large potatoes, and what at first seems remarkable, the small potatoes produced the most large potatoes. But I do not suppose that this was because of the size of the potato, but rather because the small ones were planted whole. From many experiments I am convinced that to cut a potato weakens its power to force a vigorous growth in the young plant. When a whole potato is planted by the side of a cut one, the whole potato starts first, and usually keeps in advance of that which comes from a cut potato; the difference being from a week to ten days. Whatever difference there may be in the product from small whole and large cut potatoes is mainly, if not entirely, caused by the fact that the tubers of one are whole and the other cut.

To growers of early potatoes it is important to know the fact, that by planting whole potatoes they may gain in time from a week to ten days, which sometimes makes a difference in price of at least fifty cents a bushel.

The next experiment I will call your attention to is one tried to settle the disputed point as to which end of the potato is best for planting. The potatoes were cut in two parts so as to leave the eyes in what we call the seed end in one part, and the large or stem end in the other part; and before planting all but two eyes in each piece were destroyed. Ten hills of each were planted, every other hill being planted with the potatoes from the seed end, and every other hill with potatoes from the stem end, two pieces being planted in each hill and the hills placed about forty inches apart. At harvest time the product of the seed and the stem end were kept separate, assorted, and weighed, and a record made. Then potatoes for the next year were selected from each and kept separate, so that potatoes from the seed end of one year should furnish potatoes from the seed end the next year. This experiment has been under trial six years, with the following result:

The seed end produced of large potatoes $166\frac{1}{2}$ pounds, of small, $47\frac{1}{4}$, total, $213\frac{1}{2}$. The stem end produced $141\frac{5}{8}$ pounds of large potatoes, and $47\frac{1}{8}$ of small, the seed end producing 25 pounds more large potatoes than the stem end, and one-eighth of a pound more of small ones. It is very evident from this test the seed end is the best. The young plant from the seed end always starts first and keeps in advance until full grown. This indicates that there is more vital force in the seed end than in the stem end.

An experiment has been made to test the difference between potatoes with long sprouts on them, carefully planted so as not to injure them, by the side of those that have the long sprouts all taken off. This experiment, with one exception, has shown that the potatoes with the sprouts all rubbed off will not produce half as large a crop as if carefully planted with them left on, thus proving that the crop depends, in ordinary soil, largely on the condition of the potato at the time of planting.

To test the loss of vitality in a potato by cutting it and planting it with nothing to protect the interior portion of the potato from the action of the soil, two potatoes were taken and cut lengthwise, as nearly in the centre as possible. One-half of each potato was immediately covered with plaster, the other half of each potato was left uncovered, and in a few hours those covered with plaster were planted in one hill, and the uncovered ones in a bill by the side of them. The potatoes covered with plaster started first, kept in advance of the others, and when dug it was found that the covered pieces produced at the rate of 358⅔ bushels to the acre, while the uncovered seed produced but 316⅔ bushels.

To show the power of the potato to feed itself, and force a vigorous growth, a trial was made by selecting two potatoes weighing about one-half pound each. From each of these was cut one of the strongest eyes, with a very small piece of potato attached to it. The two eyes thus severed were planted in one hill, and the two large potatoes in the next. The plants from the large potatoes started off with great vigor, while those from the single eyes started much later, and made a much slower growth, and the plants never grew much more than half as large as those that came from the large potatoes. On harvesting the crop it was found that the single eyes produced two and one-fourth pounds large and ten ounces of small potatoes, while the large whole potatoes produced eight pounds six ounces of large, and one pound ten ounces of small potatoes, or more than three times the amount produced by the single eyes. The same experiment was tried with another variety with very nearly the same results, the proportion being more than three times the amount from the large potatoes to that obtained from the single eyes. Several hundreds of trials have been made by myself and others to test the difference between single eyes and whole potatoes, when planted in ordinary soil, and with two exceptions, the result has been largely in favor of whole potatoes. Of one hundred experiments, the result was on an average as ten is to thirty-two, which is a trifle over three times as many potatoes from the whole potatoes as from the single eyes.

Numerous experiments have been tried with scabby potatoes, but the results have been so various that no conclusions of any great value have been drawn. At first there seemed to be good evidence that the planting of scabby potatoes was more likely to produce a crop of scabby potatoes, but the last three years' trial has secured crops perfectly free from scab from potatoes that were very scabby —just as free as from potatoes that were carefully selected with no appearance of scab. But I am not yet satisfied that it is wise to plant scabby potatoes. In one of my experiments with scabby potatoes for planting, a small handful of salt was put in the hill and mixed with the soil. The potatoes at harvest time were perfectly smooth and free from scab, though the seed was scabby, but they were no more free from scab than those by the side of them that had no salt, but the yield in the salted hills was the largest, being at the rate of 366⅔ bushels to the acre, while the unsalted was but 225 bushels. As this is but a single trial, I do not attach much importance to it. The trial will be continued and conclusions will not be drawn until after five years. We often make great mistakes by drawing conclusions from one or two years' trial. It is only by years of careful trials, not of whole fields treated alike, but of different methods arranged side by side, so there shall be the least possible difference between the soil and treatment in the different methods, that we can ever expect to make progress and settle disputed points. While I am satisfied that in all my trials with the potato scab I have made but little progress in gathering information as to its character or its cause, I cannot help thinking that, for reasons I do not understand, fresh barn manure is more likely to cause it than well decomposed manure, and also that commercial fertilizers produce better potatoes than barn manure when put in the hill, whatever may be its condition. In my practice I have thus far secured potatoes free from scab by harrowing in the barn manure and putting a small quantity of commercial fertilizer in the hill, except when I have planted on low, wet land. Fresh manure placed in the hills, if it does not produce the scab, will on my land often draw the gray wire worm in such quantities as to very much injure the potatoes. My impression is that commercial fertilizers have a tendency to drive the worms away from the potato hills.

From the numerous experiments I have tried I am convinced that in ordinary soil a large piece of a potato is better to plant than a small piece, and that it is better because the young plant draws nourishment from the potato more readily than from the common soil. I am also convinced that a small whole potato is better than a piece of the same size cut from a large potato, not because the potatoes are small, but because, the skin being unbroken, the life of the potato is not weakened as it is when the potato is cut open and the interior is exposed to the air and the action of the soil.

The condition which a potato is in has much to do with the amount of product at harvest time. If the potato be healthy, with strong eyes, the young plant starts off with great vigor; but if it be diseased, with small, weak eyes, the plant starts feebly and never recovers sufficiently to produce a large crop unless the land is in the best possible condition. A very rich and well-prepared soil will do much to overcome a weakness in the seed or tuber. A single eye in a soil as rich in plant food as the potato itself will produce a good crop. It is this fact that has led many to believe that single eyes are the best. In planting new varieties, to economize seed we cut the potatoes very small, and to secure a large crop the soil is prepared in the best possible manner; and then because we get a larger crop than from heavy seeding on a soil not well prepared we jump at the conclusion that single eyes are the best. But if we had planted the single eyes and given them no better treatment than we did the large pieces, the crop would not have been half as large as that produced by the heavy seeding. In most of my experiments I have confined myself to land in the ordinary condition, such as is usually found in the farming districts. This has been done because I have believed that the result of my investigations would be of more value than if the experiments were made on rich garden soil.

As a rule we are too careless in our investigations, and do not consider with care all the conditions which surround us. Especially is this true in potato culture. There is no crop which we grow that is so easily affected by the condition of the seed, the soil, and the state of the weather. A potato to be in good condition for planting should be kept during the winter where the temperature is very even, and just cool enough not to chill it; and should always be kept in the dark where the atmosphere is moist enough to prevent the potato from drying. I have no doubt that in Massachusetts the potato crop is reduced one-third by planting potatoes that have been kept where it is too warm and dry. A potato that has sprouted at planting time so that the sprouts break off in planting will not, as a rule, produce much more than half as large a crop as potatoes that have been well kept, and have the eyes started only just enough to show that they are in good condition. The condition of a potato at the time of planting affects the crop quite as much as the size, providing it is large enough to give the young plant a vigorous start.

Cut potatoes should not be planted immediately after being cut, unless covered with plaster or some other material to shut the air out and prevent bleeding; they should be spread a few hours to stop the bleeding and dry them off.

There are certain periods in the growth of the potato when it is seriously injured by hot, dry weather. This is when the tubers are nearly half grown: sometimes a difference of a week in the earliness of two fields side by side will make a difference of one-half in the product. With us in Massachusetts, as a rule, the early potatoes escape the hot period, and produce a larger crop than those that come in one or two weeks later. But last year the hot, dry weather came just in time to seriously affect the early potatoes, and before the later ones had advanced enough to be seriously affected, rain came, and the weather was cooler, so the late potatoes produced a much larger crop than the early ones. The reason why there is sometimes such great difference in the yield of two fields with all of the conditions apparently alike, except a few days' difference in the time of planting, is because of an unfavorable state of the weather when one field has advanced to a condition to be the most seriously affected, while the other has passed beyond it, or has not arrived at it until the weather has changed. If at the time the tubers are making the most rapid growth there comes a state of weather that stops or checks the growth, the crop will be seriously affected, and will never recover, however favorable may be the state of the weather. If a new growth is forced it will be in the direction of new tubers and not, as a rule, the enlargement of the old, except in the shape of warts or prongs, both of which are undesirable. The most that the farmer can do to prevent loss by the variations in the weather is thorough cultivation and nearly level culture on dry land. You probably suffer by the drouth as much as we do and possibly, though not probably, you may, on some of your land, suffer by too much wet, which will check the growth quite as quickly as too dry weather. Of course you understand that the remedy for this is underdraining and hilling.

Every farmer who desires to grow potatoes to the best advantage must be intelligent enough to understand the conditions of the soil on his own farm, for his method of preparing the soil, of planting and cultivating his crop, as well as the particular fertilizer that is best to be used, depends mainly on the character and condition of the soil. If I should give you my practice, and you should adopt it, it might be fatal to the production of a crop on your soil. In fact, I am compelled to adopt different methods on different parts of my own farm. If I plant on a light soil, I plant deep, so as to make the hill entirely below the surface, keeping the land entirely level. If I should plant shallow and hill I should not get half a crop. If I plant on a wet soil, the seed is planted very near the surface, and the hilling commences at planting time. Methods of planting and cultivation must be governed by the character and condition of the particular soil that is to be planted. So no farmer should have a particular method unless his land is all alike. Nor must he copy the methods of his neighbors or of public speakers unless the surrounding conditions are the same. It should be our aim to gather all of the information possible and carry it home for thought and to assist us in our investigations. Whatever we think is reasonable and will apply to our own farms, let us carefully try and prove its value when applied to our particular farm. But whatever we try let it be done in a manner to leave no need for guess work. Let it be tried by the side of some method which we are familiar with. Thus by comparison we shall be able to draw conclusions of value. But final conclusions should not be drawn from single trials. This is entirely unsafe. The trials should be continued several years, and then if the results are nearly all alike it will be safe to conclude that so far as your farm is concerned the matter is settled. But because it is settled with you it may not be settled when applied to other farms. It is only general principles that can be settled to apply to all farms. For example: If it weakens a potato to cut it on my farm, it will be very likely to weaken it on all other farms; and so if it will strengthen it to cover it with plaster, it will on all other farms. So if under ordinary culture it is found that a whole potato on my farm is better than a single eye, then on all other farms, with ordinary culture, it will be better. But this does not prove that on some farms single eyes may not be made to produce as large a crop as I can produce with whole potatoes. If a man has a soil as rich as the potato, or has in it plant food that is just as available as it is in the potato, then he will find it for his interest to plant single eyes and thus save in the cost of seed.

What we now need is a systematic effort to settle disputed points in potato culture under ordinary conditions. Our experiment stations should be induced to take hold of this work, and to secure true and lasting records the crops at different stages of growth should be photographed. Then the results of different stations and different individuals could be brought together for comparison. Many of my experiments during the last two years have been photographed, and from some of these transparencies have been obtained. These I exhibit on the canvas to the audience by the aid of the stereopticon, which can only be done in the evening or by darkening the hall. That you may have some idea of these views I have brought for your inspection a few photographs.

In conclusion, I would say I do not ask you to adopt my methods of seeding or of culture, but I do ask you to carefully try some of my methods by the side of yours; see if what is true on my farm in Massachusetts may not be true on your farms in Maine.

KEY TO EXPERIMENTS.

First Experiment.

No. 1, small potatoes; No. 2, large cut.

	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
No. 1	5	14	2		7	14	525
No. 2	7		1	8	8	2	601⅔
							26⅔
No. 1 (7 years)	205⅛		62		267⅛		
No. 2 (7 years)	192⅝		71¾		264⅜		

The small seed producing 13 pounds more of large potatoes, and 9¾ less of small.

Second Experiment.

No. 3, seed end; No. 4, stem end.

	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
No. 3	4	8	1	10	6	2	408⅓
No. 4	4	4	1	2	5	6	358⅓
							50

The seed end for six years produced,—

	Large.		Small.		Total.		Acre
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush
No. 3	166½		47¼		213¾		
No. 4	141⅜		47⅛		182½		
	25⅛		⅛				

Third Experiment.

A 1, large cut potato; A 2, small cut.

	Large.		Small.		Total.		Acre.
	lbs.	oz.	lbs.	oz.	lbs.	oz.	bush.
A 1		14	1	6	2¼		150
A 2	1	2	2	4	3	6	225
							75

This experiment tried for one year only and may be misleading.

Fourth Experiment.

B 1, covered seed; B 2, uncovered.

	Large.		Small.		Total.	Acre.
	lbs.	oz.	lbs.	oz.	lbs. oz.	bush.
B 1	2	10	2	12	$5\frac{3}{8}$	$358\frac{1}{3}$
B 2	2	14	1	14	$4\frac{3}{4}$	$316\frac{2}{3}$
						$41\frac{2}{3}$

Fifth Experiment.

E 1, single eyes; E 2, large potatoes.

	Large.		Small.		Total.	Acre.
	lbs.	oz.	lbs.	oz.	lbs. oz.	bush.
E 1	2	4		10	$2\frac{7}{8}$	$191\frac{2}{3}$
E 2	8	6	1	10	10	$666\frac{2}{3}$
						475

E 2 being more than three times E 1.

Sixth Experiment.

F 1, single eyes; F 2, large potatoes.

	Large.		Small.		Total.	Acre.
	lbs.	oz.	lbs.	oz.	lbs. oz.	bush.
F 1	1	14		6	$2\frac{1}{4}$	150
F 2	4	10	2	4	$6\frac{7}{8}$	$458\frac{1}{3}$
						$308\frac{1}{3}$

F 2 producing a trifle over three times that of F 1.

FIRST EXPERIMENT.

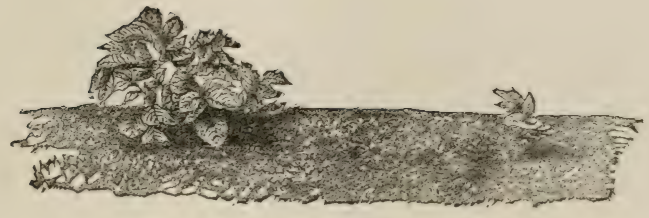
June 28th.

No. 1. No. 2. No. 1. No. 2.

No. 1. July 21st. No. 2.

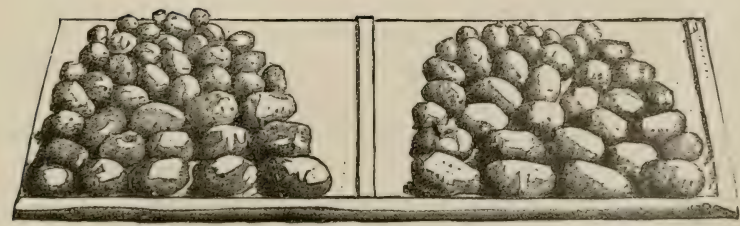
No. 1. Result. No. 2.

SECOND EXPERIMENT.



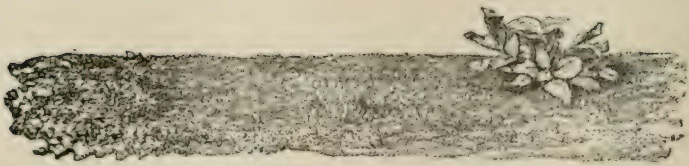
No. 3. June 28th. No. 4.

No. 3. July 21st. No. 4.



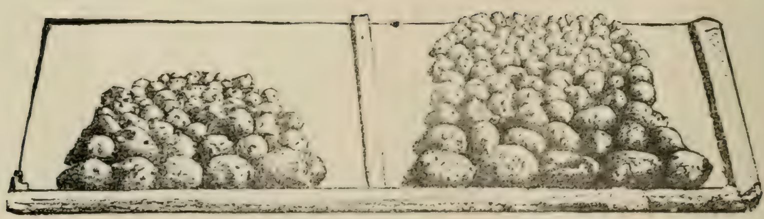
No. 3. Result. No. 4.

THIRD EXPERIMENT.



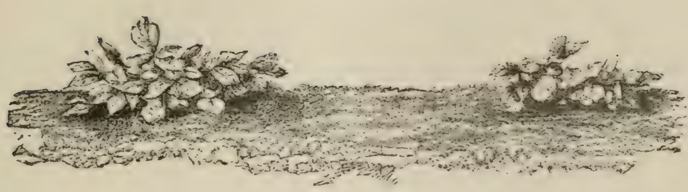
A 1. June 28th. A 2.

A 1. July 21st. A 2.



A 1. Result. A 2.

FOURTH EXPERIMENT.



B 1. June 28th. B 2.

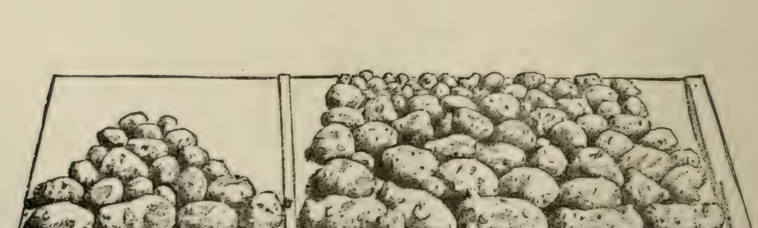
B 1. July 21st. B 2.

B 1. Result. B 2.

FIFTH EXPERIMENT.

E 1. June 28th. E 2.

E 1. July 21st. E 2.



E 1. Result. E 2.

SIXTH EXPERIMENT.

F 1. June 28th. F 2.

F 1. July 21st. F 2.

F 1. Result. F 2.

Question. Do you consider the scab caused by insect or fungus growth?

Mr. Hersey. I believe that it has been decided it is fungus growth, and that the insect comes as a consequence afterwards.

Question. Do you think the result would have been the same had you allowed all the eyes to remain?

Mr. Hersey. No, sir, I do not think it would. There would have been more of them; there would have been more of the larger ones and rather more of the small ones.

Question. I would like to inquire whether it is presumed that all of the eyes in the large potatoes grow?

Mr. Hersey. No, sir, it is a fact that it is only the very strongest ones, as a rule, that grow. A potato in growing, when a single eye starts, grows up like a tree almost, and when it comes out of the ground perhaps from one single eye there will be a dozen branches, where if you plant three or four eyes they are not branched so much and the result is that from the whole potatoes the size of the stalks is larger than the stalks that come from a single eye.

Question. I understood you that by cutting the potatoes it reduced its vitality: does it not equally reduce the vitality to remove the eyes?

Mr. Hersey. Certainly; that is one of the points.

Question. Do you advise putting in two large potatoes in a hill, right along in a row?

Mr. Hersey. I do not advise anything, only try them. I advise you to do that.

Question. Have you ever tried thinning out where you have seeded heavily?

Mr. Hersey. I have not, because I do not think it quite practicable in field culture.

Question. I would ask whether you would put two whole potatoes in a hill, or one?

Mr. Hersey. That would depend upon how I was going to plant. In raising potatoes of course I should put whole potatoes, and I think about fourteen inches apart.

Question. How far apart would you put the rows?

Mr. Hersey. About three feet apart. I should pick out potatoes that were not quite large enough for sale, simply because it would be economical. Perhaps the difference is not so great, and yet the difference between the single eye and a ton of whole potatoes was four hundred and seventy-five bushels to the acre.

Question. Have you ever tried the comparative merits of small-sized potatoes and large ones?

Mr. HERSEY. Not side by side. I now have an experiment under way trying the difference between a small potato and a large one, and I am not satisfied with the result. I do not believe it. The result was largely in favor of the small potato, but I don't believe the small potato is any better than the large one, but if it follows for six or seven years I shall have to give it up.

Question. I notice that you want the potato to sprout before you plant them to see that they are good. Would you have these sprouted in the cellar or taken out to the air and exposed?

Mr. HERSEY. I would have the potato sprouted only just enough to see its vitality. A potato that has a long sprout on it is very likely to get injured and if you injure the sprout it weakens the power of the potato. It should be sprouted only enough to show that the eye is alive and in good condition; that is what we ought to try to do, select the seed and take proper care of it.

Question. If you plant in the years to come will you use whole small potatoes or whole large ones?

Mr. HERSEY. In order to save the large ones for sale I should take those that are just below that, but from the experiments that I am trying I am not sure but that I am doing wrong.

Question. Do you think it makes any difference about the shape of the potato?

Mr. HERSEY. In a trial of seven years in the selection of long potatoes and the selection of a particular shape, as you speak of, it has made no difference at all. The shape is in the variety, not in the selection. I was told you could get a potato any shape you pleased simply by selection. I am satisfied that it would not make any more difference about the shape of a potato than it would the shape of a squash you would plant.

Question. Do you consider the potato an especially exhaustive crop to the soil?

Mr. HERSEY. The potato is especially exhaustive in potash, but I do not see that the potato is exhaustive to the soil only in certain directions. The time is coming when farmers are going to be intelligent enough to feed their land according to what it wants. Now it is said that if you plant a piece of potatoes three or four years in succession your land runs out. Why? The cause is this. The barn manure which you apply has not its proper proportion of potash, therefore you exhaust your soil in potash and you overload with phosphates. Now, suppose you want to balance them. You go into a rotation of crops; you plant grain and then you begin to balance up your ground by taking out a larger proportion of phosphates. Suppose you plant wheat there; you take out the nitrogen and so you even up your ground; put on a crop of grass afterwards and then you go on and raise potatoes again. Suppose, instead of doing that, you put on enough potash to balance your manure; you put potash on and that balances it and you go on. I have got land that I have raised potatoes on ten or twelve years, raising at the rate of six hundred and sixty-six bushels to the acre in potatoes for ten or twelve years. Why? Simply because I balance that land up with potash. That is the whole story. If you are going to plant potatoes year after year, as you exhaust that land in the partially decomposed vegetable substances the land will become hard in time, if you confine yourself to commercial fertilizers. You can put on a proper balance so that there will be enough potash, nitrogen and phosphates, and yet the land becomes exhausted of that material which lightens it up and loosens it. You must raise a grain crop and plow it in.

Question. Are you any more liable to raise scabby potatoes from scabby seed?

Mr. Hersey. I do not *know* about scabby potatoes; my experience is that it makes no difference.

Question. About this small potato business. I wish to ask you, do those potatoes ripen as early as they did when you first commenced?

Mr. Hersey. Yes, they do just as early; it don't make any difference at all; you always get them early because they start off early.

Question. Would you recommend in the selection of commercial fertilizers the ordinary combination found in our fertilizers, or would you select one made especially for the crop?

Mr. Hersey. I cannot say that I have had any experience in buying special fertilizers for special crops. I do not know what I should do. I suppose I should try some experiments first before I settled down to anything. I make my own fertilizers; there are seven of us join together and put in machinery so that we buy the bone and reduce it and grind it, and then buy our chemicals and make whatever we want. We make about fifty tons a year, so that really I have not had very much experience in buying commercial fertilizers.

Question. How deep do you plant potatoes?

Mr. HERSEY. I plant on my high land at home quite deep. I plant them down, I should say, five inches certainly, but I do not cover them quite level the first time.

Question. Do you cover by machinery or by hand?

Mr. HERSEY. A good deal of my work is done by hand because my land is all experiments. I do not allow a man I hire to go on my experimental land; that has to be done by hand work.

Question. How much commercial fertilizer would you apply in the hills?

Mr. HERSEY. I put into mine as I make it so that it costs about twenty dollars an acre, equal to one-half a ton or thereabouts.

Question. How do you apply it?

Mr. HERSEY. I put it in the hill reduced so that it don't hurt the plant.

Question. Should you take the fertilizer and strew it along and let it mix, or mix it first with earth?

Mr. HERSEY. If I used Bradley's I should mix it first with either dry earth or dry muck. I should rather have muck. When you mix this material beforehand there is an operation which changes the character of the material it is mixed with, and part of the substance which is in the superphosphate enters into the earth so that it is alike. If you put a little in the earth there is not power enough to it to mingle with the soil as readily as it would if you put it in already mixed.

Question. The main question to all of us who are living in a comparatively old section and a country where the potash has been well used up is, whether it is profitable for us to raise potatoes? I think it is not and would suggest that Mr. Hersey tell us in what form we could add to our land of the material which is lacking, potash, to help us produce our potatoes. What form shall we put it?

Mr. HERSEY. There are a good many hard questions propounded in this world and the questions which have now been propounded are questions which I cannot answer, and the question as to whether the people in this section of the country can afford to raise potatoes is one for them to settle rather than me. I should not know the surroundings. I could not tell them because I do not know the condition of their soil, but I could give suggestions in a general way. If I had old land that had been run out in potash I suppose that if I wanted to raise potatoes I should first raise some other crops on it, and I should try to get some grain crops to plow into it, and then I should add to my manure ashes if I could get them. If I could not of course I should go and buy some kind of German potash salts. I buy muriate of potash. I am not sure whether any rules can be laid down by anybody by which any people in any portion of the United States can take up any particular crop and make money out of it. The making of money depends more on the man than it does on the particular thing that he is going to do. It is said that some men will sit on a rock and get rich, while others will grow poor on a manure heap. Now, it depends so much on the man that you cannot lay down a general rule. If there is a good market for potatoes here at a fair price, the farmers can turn that into money, but possibly there may be other crops which would be more profitable. I question whether it would be better here or anywhere to raise all potatoes. I believe it would be using the land better to have a rotation of crops, and here probably you might plant wheat in connection with your potatoes and get more money out of it than you could to plant either alone. I could give you no instruction in regard to this except that each man carefully try it for himself, and keep exact accounts and see which crops on his farm pay the best. The time has come when farmers should know just what they are doing; the time has come when they should open their books and keep accounts so that at the end of the year they will know just or very nearly how much each crop has cost them. I do not know whether they have exhausted their land or not. They may have sold a crop and got a great price for it and taken it out of their soil, but I do not think this is so great a danger as a great many do, because I think there is a way to put it back.

CHEMISTRY OF THE POTATO.

By W. Balentine, Professor of Agriculture, State College.

It is unnecessary to give a detailed description of a plant so well known as the potato. It may be well, however, to call attention to the peculiar habit it has of throwing out underground shoots which differ in character from the true roots of the plant by gradually enlarging at the ends and developing into the tubers to which the plant owes its value.

These shoots are looked upon as underground stems and have for their office the storing up of the material which has been assimilated by the roots and leaves. They differ from the true roots in performing no part in gathering material for the growth of the plant. Around the thickened stem or tuber are arranged leaf buds which under proper conditions develop into shoots or stems of the plant.

The tubers furnish the material for the growth of the new plant until the roots and leaves are sufficiently developed for the plant to maintain an independent existence. The potato, like the Indian corn, is one of the few plants that America has added to the cultivated food plants of the world.

At the time of the Spanish conquests in South America it was cultivated by the natives near Quito. It is said to be native of Chili, Peru, Columbia, Mexico and the southwestern portion of the United States. At what date and by whom it was introduced into Europe is uncertain.

The potato is mentioned in Spanish books as early as 1553, and in English books some ten or twelve years later. Both England and Spain claim the honor of being the first to introduce the potato into Europe. For many years it was there cultivated as a curiosity and it is only a little more than one hundred years that its food value has been generally recognized.

The general impression is that as a food potatoes are chiefly valuable for the starch they contain. Good authorities have even gone so far as to make that statement. Possibly this is true in the majority of cases ; but owing to great variability in the composition of potatoes it is doubtful if it is wise to accept the statement without qualifications.

Nobbe found in potatoes at the time of planting

77.79	per cent	water,
1.97	"	cellulose,
14.91	"	starch,
4.11	"	protein,
1.22	"	ash.

This analysis shows an exceptionally large amount of protein and the amount of starch exceptionally small ; yet it serves to illustrate the point that potatoes are not always chiefly valuable for the starch they contain ; for in this case the proportion of protein to starch is greater than in Indian corn.

The average composition of potatoes is often quoted as being about as follows :

Water,	75.0	per cent.
Protein,	2.1	"

Starch,	18.8	per cent.
Sugar,	3.2	"
Fat,	0.2	"
Ash,	0.7	"

But in a substance which varies so widely in composition, such an average is of little value when applied to a particular case.

L. Raab examined twenty-two different varieties of potatoes and found a variation in starch contents from 9.54 per cent, with a total dry matter of 16.96 per cent, in the "Zebra," to 26.74 per cent starch, with a total dry matter of 34.96 per cent in the "Carmoisinrothe Larnet."

The variation in the composition of potatoes is not confined to different varieties. The composition of the same variety varies with soil, climate, season and manuring.

Raab in investigating the composition of potatoes in different seasons found the following variation in starch contents:

	1st year's harvest,	2d year's harvest.
Gleason Late,	9.00 per cent,	17.05 per cent.
Rothe Niexen,	26.00 "	15.19 "
Early Callao,	26.74 "	19.69 "
Eng. Fourball,	25.74 "	24.25 "
Marjol Niexen,	14.04 "	9.00 "
Schwese Riesen,	10.87 "	26.74 "
Mohawk,	15.42 "	15.65 "
Clima,	27.78 "	25.24 "
6-Wocken-Kartoffel,	9.50 "	9.00 "
Riesen Marmot,	19.80 "	17.99 "
Bisquit,	11.77 "	18.70 "
Amenck Rosen Kartoffel,	16.11 "	25.80 "

The lesson to be drawn from the analyses given above is that some lots of potatoes are worth treble what other lots are worth, whether they be used as an article of diet or for making starch.

I know, also, of a case in which a man selling directly to consumers gets ten to fifteen cents more per bushel for his potatoes than the market price, on account of superior quality.

An analysis of the ash of the potato, by E. Hyden, shows:

Oxide of iron,	1.92	per cent.
Lime,	2.03	"
Magnesia,	4.26	"
Potash,	64.80	"
Soda,	1.44	"

Chlorine,	3.39	per cent.
Sulphuric acid,	4.72	"
Phosphoric acid,	16.84	"
Silica,	1.36	"

In this analysis the potash is higher and the phosphoric acid lower than usual.

An average of thirty-one analyses cited by Johnson gave 19.1 per cent phosphoric acid and 59.8 per cent potash.

On account of the high percentage of potash in the ash of the potato, heavy potash manuring has been advocated.

Experimental data as well as the practical experience of many farmers teach us, however, that the potato will in the majority of cases respond quite as well to nitrogenous or phosphaic manuring as to potash.

It may be well to examine a little more closely the signification of this 59 or 60 per cent potash found in the ash of potatoes. It must be remembered that the total ash represents on the average only about 0.7 of one per cent of the fresh potatoes; and 0 7 per cent of 60 per cent is potash, which would equal 0.42 per cent reckoned on the fresh substance.

At this rate a crop of 200 bushels would take from the soil 50.4 pounds of potash.

A soil that is capable of producing 200 bushels of potatoes is in condition to produce two tons of English hay, which takes off on the average some 53 pounds potash. Two tons of clover hay would carry away some 73 pounds of potash; so that a crop of 200 bushels of potatoes will carry away no more potash from the soil than two tons of hay. The quantity of nitrogen and phosphoric acid taken from the soil by a crop of potatoes is as large if not larger in proportion to the potash taken away as in hay.

In 1875 and 1876 Fittbogen, Gröuland, and Fraude undertook some investigation on the disappearance of the starch in the seed potato during the growth of the plant. From the same lot of seed potatoes seventy tubers were selected weighing from 63 to 73 grammes each. Sixty of these were planted in six rows, ten potatoes to a row, on April 13th. The ten remaining potatoes were analyzed. From time to time the six rows were dug up and the seed tubers analyzed. The first row was dug up on May 1st, seventeen days after planting, and the last on Sept. 22d, one hundred and sixty-two days after planting.

The following table shows the result of the analysis:

	Weight at the Time of Planting.						
	April 13. Grammes.	May 1. Gr.	June 18. Gr.	July 2. Gr.	July 25. Gr.	August 20. Gr.	Sept. 22. Gr.
Water	513.58	595.15	628.28	603.63	445.93	177.69	53.02
Organic Substances	182.97	125.01	50.30	33.13	20.34	14.37	14.58
" " with Protein	12.93	9.16	3.96	2.14	1.38	0.91	0.93
" " " Starch	138.74	89.96	26.16	11.45	8.53	6.82	7.76
" " " Grape Sugar	2.15	7.93	8.86	8.49	2.40	0.20	0.09
" " " Cellulose	5.13	4.95	4.16	3.79	4.24	4.09	3.39
" " " Fat	2.87	1.25	0.61	0.36	0.34	0.26	0.29
" " " Undetermined matter	21.15	11.76	6.82	6.93	3.45	2.09	2.12
Ash	6.91	6.33	2.70	2.72	2.46	2.37	2.86

It will be noticed that both starch and protein decrease quite rapidly in the seed tuber from the time of planting up to the time of harvesting. The sugar increases for a time but finally almost disappears. The inference to be drawn from these analyses is that the starch and protein are used up in supporting the growth of the young plants springing from the seed tuber. It appears also that at least a portion of the starch is converted into sugar before being transferred to the growing plants.

Microscopic examination of the seed potato during the growing season by the same investigators and others corroborates the evidence given by chemical analysis.

The experiment suggests the propriety of using large potatoes for seed, in order that the young plants may be well supplied with nourishment during the early stages of growth.

A large amount of experimental work has been carried out, both by practical farmers and scientific men, to settle this point. And yet the question comes up for discussion nearly every year in our agricultural papers, together with the question of the advisability of planting whole or cut potatoes.

The most extensive and carefully conducted experiments bearing on these points that have come to my notice are those by George Maw reported in the Journal of the Royal Agricultural Society of England for the year 1867. In a series of 39 trials, 25 were in favor of large sets while 14 were in favor of small sets for seed. The gains in the 25 comparisons in which the large sets gave the greater yield were sufficient to counterbalance the gains of the 14 trials in which the small sets gave the greater yield and leave a net balance of 1 ton 10 cwt. per acre in favor of the large sets for the 39 trials.

Mr. Maw sums up the results of his experiments as follows:

Firstly. Every increase in the size of the sets from 1 oz. up to 8 ozs. in weight, produces an increase in crop much greater than the additional weight of the sets planted. The net profit over and above the extra weight of sets in planting 4 oz. sets in lieu of 1 oz. sets amounted on the whole series of experiments to between 3 and 4 tons per acre; and the further profit on the increase of the size of the set from 4 ozs. to 8 ozs. averaged about 5 tons per acre; all of the intermediate steps partaking proportionally of the increase.

Secondly. The advantage in favor of large sets is more marked in late than early varieties.

Thirdly. In the use of small sets of from 1 oz. to 3 ozs. in weight, a larger balance over and above the sets was obtained by planting nine inches apart in the rows than at wider intervals.

Fourthly. Increasing the intervals at which sets are planted, even of the largest size, in the rows to more than twelve inches diminishes the crop, and wider intervals induce no increase in the weight of the individual sets.

Fifthly. It may be broadly stated that the weight of the crop is proportionate to the weight per acre of the sets, and the small sets will produce the same crop as an equal weight per acre of large sets. The fact is, however, of limited application, as a weight of very small sets equal to a weight of full-sized potatoes could not be got into the ground except by planting them so close as to be prejudicial to the crop. The advantage, therefore, of large sets remains unimpaired.

Sixthly. Weight for weight cut sets produce as nearly as possible the same weight per acre as whole potatoes; but for the reasons given above the weight of the sets should not be reduced by sub-division.

Seventhly. Smaller sets give a larger produce in proportion to their weight than the larger sets.

Eighthly. When the intervals between the sets in the rows are diminished to less than a foot, the produce of each individual set is proportionally diminished. Though this is not necessarily accompanied by a diminution of the weight of the crops, no increase in the produce of each individual set is caused by placing the sets at wider intervals than a foot.

Hellriegel found as the result of his experiments that it was immaterial whether whole or cut potatoes were used for seed, provided equal weights were planted on equal areas. The same authority found that large sets gave larger yields of potatoes than small sets where the same number of sets were planted on equal areas.

Lehmann and Ulbricht found that the whole potatoes gave larger potatoes than cut sets, but less in number and that the weight of the harvested potatoes was less when cut potatoes were used for seed, while the number of potatoes was greater.

The average of eleven trials at the Maine State College, reported by Professors Farrington and Jordan, was in favor of large potatoes for seed.

The experiments of Prof. Alvord and Mr. Emery at Houghton Farm, running through two years, with several varieties of potatoes, gave results favoring the use of large potatoes for seed.

Many other experiments might be cited having a bearing on these points with similar results. It would seem from these experiments that the points in connection with planting large or small potatoes, and in connection with planting whole or cut potatoes, are as definitely settled as they are ever likely to be. It is perhaps not necessary to cite any experimental data to show that the potato tubers are increasing in size (weight) as long as the tops remain green. Fittgogen, Gröuland and Fraude, however, have presented such data which have been verified by the work of Nobbe in the same direction.

Nobbe has done some very instructive and practical work in connection with the preservation of potatoes after harvesting. Tubers of known weight and composition were taken for the experiment and were kept at a temperature varying from 50° to 70° F. for a cool temperature, and 77° to 86° F. for a warm temperature. For a dry atmosphere tubers were kept under a glass bell jar over sulphuric acid, which keeps the atmosphere in the confined space very dry, owing to the absorptive power of the acid for moisture. Those tubers kept in a moist atmosphere were under a similar bell jar over water. The condition of the experiment for each lot of tubers is shown in the following table:

I	In light, dry, cool,	V	Dark, dry, cool,
II	In light, dry, warm,	VI	Dark, dry, warm,
III	In light, moist, cool,	VII	Dark, moist, cool,
IV	In light, moist, warm,	VIII	Dark, moist, warm.

The experimental tubers were weighed every week, but the final weighings, which took place at the end of six months, will be sufficient for our purpose.

	Loss.
Dry, cool,	In light 34.05 per cent. " dark 34.50 per cent.
Dry, warm,	In light 57.05 per cent. " dark 68.65 per cent.
Moist, cool,	In light 20.15 per cent. " dark 13.35 per cent.
Moist, warm,	In light 57.70 per cent. " dark 62.10 per cent.

	Loss.
Dry light,	Cool 34.05 per cent. Warm 57.05 per cent.
Dry, dark,	Cool 34.50 per cent Warm 68.75 per cent.
Moist, light,	Cool 20.15 per cent. Warm 57.70 per cent.
Moist, dark,	Cool 13.35 per cent. Warm 62.10 per cent.

Cool, light,	Dry 34.05 per cent. Moist 20.15 per cent.
Cool, dark,	Dry 34.50 per cent. Moist 13.35 per cent.
Warm, light, Warm, dark,	Dry 57.05 per cent. Moist 57.50 per cent.
Warm, dark,	Dry 68.75 per cent. Moist 62.10 per cent.

From the tables it is seen that the loss in weight depends, first, on temperature and, second, on moisture of the surrounding atmosphere.

It was found on examination of the potatoes at the end of the experiment, that there was present

I	87.8	per cent of the original starch.
II	59.0	" " " "
III	65.0	" " " "
IV	50.8	" " " "
V	60.4	" " " "
VI	63.9	" " " "
VII	64.6	" " " "
VIII	54.4	" " " "

There are several practical lessons to be learned from a study of the results of this experiment.

First—There is a considerable loss in the weight of potatoes during six months when kept under the most favorable conditions.

Second—The loss in weight is least when the potatoes are kept in a cool, moist place.

Third—The loss in dry matter is least when the tubers are kept in a cool, dry place.

Those who store potatoes for future use or for the market should take the above facts into consideration, and remember that fifty cents per bushel in the spring does not represent as much money for the crop as fifty cents per bushel before the potatoes were stored in the fall.

Although there has been a large number of experiments carried out with a view of determining the effect of different fertilizing material with potatoes both on the quantity and quality of the crop, the results have been unsatisfactory so far as furnishing data for formulating rules for practice. The same may also be said with regard to experiments in cultivation. There are so many things that come in to vitiate the work done in these directions, such as condition of soil, climate, and season, that it is extremely difficult to obtain results that are in any way comparable.

One of the great difficulties to be met with in some parts of the country in the cultivation of the potato is the potato rot. This disease has been described, its cause pointed out and suggestions offered for its prevention, in the Report of the Board of Agriculture for the year 1882, by Prof. C. H. Fernald, who has made a careful study of the disease.

It would, therefore, be out of place for one less versed in the subject to attempt to throw any further light on it from a scientific standpoint.

But in studying this matter with a view of ascertaining what methods had been attempted by farmers for the prevention of the disease, and what methods, if any, were successful, I came upon the following extracts from a report of John Fryer in the Journal of the Royal Agricultural Society for 1874. He says: "On looking back for nearly thirty years over memoranda respecting the treatment of the potato crop with special reference to the disease, I find only one set of experiments that have to any extent lessened the amount of loss. These experiments have all been based on the fact that covering up the haulm to within a few inches of the end greatly hinders the progress of the blight; and ultimately it was found that the nearer a horizontal position the haulm was placed in, the greater was the immunity from disease.

"The first occasion on which the experiment was tried was two or three years after the appearance of the disease, when a large field was operated upon, the haulms being deeply molded up on one side only; and the flattening down of the earth upon them was completed by hand labor. In that season this field remained green and growing up to Michaelmas, nearly every other field in the kingdom having been blighted in the latter part of August.

"The plan was continued for a time, until the disease all but disappeared, when it was given up. Three years ago a trial of it was again made. A small portion of a field was laid down and the result was so satisfactory that last year nearly fifty acres were operated upon; and with great advantage as will be shown by a detailed statment of results at the end of this paper.

"Careful observation brought to notice one important fact, viz: That those rows yielded the most and finest tubers, which were laid down toward the east, thus allowing the sloping side of the ridge to be exposed to the afternoon and evening sun.

"The theory as to the causes of the benefit secured I leave to others to suggest. Whether it be that the descending spores of the fungus which produces the disease drop from the flattened stalks on the earth instead of descending to the root, and thus lose their power to do mischief, or whether laying down checks for a time the too rapid and succulent growth of the top and thus prevents a weak growth of the tuber, it is difficult to decide; at any rate, a large saving is effected by the process."

Below are given the results in detail of Mr. Frye's experiments. Equal lengths of each plot were taken up, all having been cultivated alike, and growing side by side.

		st.	lbs.
1	2 Rows of King of Potatoes not moulded up:—	st.	lbs.
	Diseased tubers,	4	11
	Good "	3	12
	Excess of bad,	0	13
	2 Rows of King of Potatoes, the haulm laid down:—		
	Good tubers,	6	1
	Diseased tubers,	1	8
	Excess of good,	4	7

Another part of the field:—

		st.	lbs.
2	2 Rows of King of Potatoes not moulded up:—	st.	lbs.
	Diseased tubers,	4	0
	Good "	2	10
	Excess of bad,	1	4
	2 Rows of King of Potatoes, the haulm laid down:—		
	Good tubers,	4	9
	Diseased tubers,	1	10
	Excess of good,	2	13
3	2 Rows Regents, moulded as usual:—	st.	lbs.
	Good tubers,	16	8
	Diseased tubers,	14	0
	Excess of good,	2	8
	2 Rows Regents, the haulm laid down to within 6 inches of ends (rather *overdone*):—		
	Good tubers,	19	5
	Diseased tubers,	4	6
	Excess of good,	14	13
4	2 Rows Regents, moulded as usual:—	st.	lbs.
	Good tubers,	4	0
	Diseased tubers,	1	13
	Excess of good,	2	1
	2 Rows Regents, the haulm laid down:—		
	Good tubers,	6	0
	Diseased tubers,	0	9
	Excess of good,	5	5

Many others have reported favorable results in arresting the progress of the potato rot by laying down the stems of the potato plant when the disease first makes its appearance, and covering with earth.

In this paper, the writer has only attempted to dwell upon a few points of practical importance in connection with potato growing on which the evidence is tolerably clear.

To discuss all of the data on this subject that have accumulated from scientific experiment and investigation would require more space than could be profitably devoted to it in the Report of the Board of Agriculture.

METHODS OF GROWING AND EXPERIMENTS IN SEEDING.

The following methods of practice in the growing of potatoes and experiments in seeding have been compiled for the purpose of placing the results of experimentations into available form for the study of those who may wish to acquire a knowledge of what has been done in this direction.

CUTTING AND SEEDING POTATOES.

From the Experiment Department of Houghton Farm.

By Prof. H. E. Alvord.

The best method of cutting potatoes for planting has been long disputed and given much attention at farmers' meetings and in the agricultural press. It was decided a year ago to endeavor to contribute something to the public knowledge on this subject, by making comparative plantings at Houghton Farm, and, instead of reporting the result in figures, exhibiting the potatoes themselves, just as grown, at the County Fair, with such marks and explanations as would enable every one to judge for himself as to the facts.

Accordingly, at the New York State Fair of 1884, Mr. N. F. Pierson of Seneca Castle, Ontario County, the largest and best informed grower and dealer in seed potatoes in the State, was engaged to make up a collection of a few pounds each from one hundred to one hundred and fifty varieties successfully grown by him, to include a number belonging to all the established classes or families of potatoes. Mr. Pierson kept the seed during the winter very successfully and sent the collection to Houghton Farm in the spring of the present year. As received on the first of May, the potatoes were in excellent condition and represented 130 varieties, divided as follows:

8 new early varieties, 32 approved early varieties, 24 new late varieties and 66 approved late varieties.

The place selected for planting was part of an old garden cropped for two or three years with onions and cucumbers for seed. The soil was similar to the black soil so well known in the onion-growing districts of the county. It was not first-rate potato ground, but was convenient for the purpose and well protected from interference and accidents, which was an important point. The land, after being put in good mechanical condition, received a moderate and very even dressing of muriate of potash and phosphate of lime, harrowed in.

The land was carefully laid out in squares, a space nine feet square being allowed for every variety. It was decided to plant the varieties in three different ways as to form of seed, and with three hills in each way, to guard against accident. This gave nine hills of every variety, and the whole field was planted three feet apart both ways. A large stake marked with the number of the lot was set at the middle hill of every square. It would have been difficult to find anywhere a piece of land more uniform in every respect throughout its area and less liable to affect single hills of potatoes from local causes.

The potatoes were planted on the 20th of May (the ground not being suitable earlier) and as I selected and cut all the seed in person, while my principal assistant, Mr. Emery, planted every hill, I am certain that in this part of the work all were treated exactly alike, and there was no possibility of error. The squares of different varieties were so placed that the hills of like seeding formed rows across the field, and the different kinds were planted in the same order as that in which they were exhibited at the Fair. The earliest varieties were together at the left and so on to the right, where the latest varieties were placed. Of every variety three hills were planted with one fair whole potato, about the size of a hen's egg; three others had in each hill one good-sized piece of a good-sized potato, the piece having three or four eyes on it; and the three remaining hills were planted each with one eye upon a rather small piece cut from a good-sized potato. It is needless to add that throughout the growing season the hills of the whole lot were treated exactly alike; no operation was performed which would affect the produce of one hill that was not applied to all the hills the same day. The usual culture of the field potatoes was followed, but very little hilling was done.

The season was extremely unfavorable for the crop. During the months of June and July, the rainfall was less than four inches, instead of from ten to twelve inches for the same months in several previous years. At the time, therefore, when the young plants most needed water to make their growth, they got none, but were, instead, subjected to the most intense dry heat. It soon became apparent that this would tell disastrously upon the production of the crop, but as all varieties and the different ways of seeding fared alike, it was felt that the experiment might be profitably completed. The early varieties naturally suffered the most, and this was apparent to every one who saw the exhibit. Abundant rains in August were of great benefit to the late varieties, and these were mostly in vigorous growth when it became necessary to dig them for the Fair. All were dug between the first and the twelfth of September. At this time one of the early kinds (the Bermuda Pink Blossom, an important potato) was still green and growing, and of the late (88) kinds, 50 were ripe, while 33 were more or less immature.

The harvesting was carefully supervised by Mr Emery, one hill at a time, and everything half an inch in diameter was saved. The total product of every hill, when dry and clean, (but not washed,) was weighed, all the tubers counted, the number merchantable counted, and then the whole put away in a stout paper bag, plainly marked, all the facts being recorded.

For exhibition at the County Fair, the General Superintendent kindly prepared an inclined table, especially suited to the exhibit, one hundred feet in length, and occupying one side of the large tent devoted to Farm Produce. On this table the potatoes for exhibition were arranged in three rows, according to the different methods of cutting and planting the seed. One hundred and twenty-eight (128) varieties were shown, and the whole product of three hills of every variety, that of each hill in a small wooden tray by itself. There were thus 384 trays in all. The back row of 128 were from the whole potato as seed, the middle row from the usual cutting, and the front row from the single eye planted. Every hill or tray was plainly marked with the name of the variety and the method of seed planting. Examined from left to right, every row shows the effects of the same way of cutting upon different varieties. From back to front, in sets of three, the effects were shown of planting the seed of the same variety in different ways. As a whole, the potatoes were inferior in quality, although in several cases single hills produced from three to five pounds. But that was immaterial—the exhibit was not intended as a *show* but as *an object lesson*, giving at a glance the results of the three ways of planting. Large cards accompanying the exhibit gave the average results in figures. These may be condensed as follows:

The Average of 128 Varieties of Potatoes. —— Method of Seed Cuttings.	Whole No. of Potatoes per Hill.	No. of Merchantable Potatoes per Hill.	Average weight per Hill -ounces.	Average weight of tubers -ounces.	Computed Product per Acre -bushels.	Land Required for 100 bu. -sqr. rods.
Whole Potato. (Back row)..	20	9¼	48¾	2.4	316	51
Usual Cuttings. (Mid'le row)	13	6½	33¼	2.5	215½	74½
Single Eye. (Front Row)...	10	5½	28¼	2.8	185½	86¼

One set of these figures may be deceptive. Although it appears that the average weight of the potatoes in the front row (single eye planting) was the greatest, the number of large potatoes was greater in the back row, and the largest potatoes were there also. Therefore, in every way of viewing it, so far as this one trial is concerned, the planting of fair-sized whole potatoes was the most satisfactory in result. And this was not the result with only a single kind, but the average of 128 different kinds treated exactly alike in every respect, except the form of cutting of the seed.

The tabular record in detail forms a mass of figures quite confusing unless studied very closely. But with patience, a good many interesting facts may be obtained.

First, to show the effects of the season better than the brief statement already given, this arrangement has been made:—

	Product 3 hills whole potato.	Product 3 hills usual cutting.	Product 3 hills single eye.	Product of nine hills.
40 Early varieties........	116½ oz.	78¾ oz.	67¾ oz.	263
64 Late varieties	132¾ oz.	89 2-5 oz.	73 1-6 oz.	295¼

As far as a comparison of varieties is concerned, the following facts appear,—but it is unfair to judge of the merits of any kind from observation in a single season.

a. In productiveness alone, the seven varieties leading stand in this order: — American, Giant, Burrough's Garfield, Cheeseman's Seedling, Riker's Graft, Chief, Beauty of Hebron, O. K., Mammoth Prolific.

b. In greatest number of merchantable potatoes this seems to be the order of preference:—Farina, Blush No. 2, Chicago Market, Defiance, Beauty of Hebron, Rural Blush, Burrough's Garfield, Adirondack.

c. Of the varieties in the two lists just given, the following are objectionable because rough and of bad shape:—Chicago Market, Burrough's Garfield, Adirondack, American Giant, (rather deep eyes), Cheeseman's Seedling, Defiance.

d. And this leaves as favorably recorded on account of gross productiveness and merchantable in regard to both quantity and condition, the Beauty of Hebron only.

WHOLE POTATOES BEST FOR SEED.

By Charles S. Plumb, New York State Experimental Station.

During the growing season I often had occasion to explain to visitors why potato plants on certain plots varied so strikingly in size. Nine rows, each sixty-six feet long, were planted in each of the plots. The rows were planted in threes—first single eyes, next halves, and last whole potatoes, to be repeated three times. The striking feature was that when the tops were in their prime there was a very noticeable regular gradation in the size, ascending as a step-ladder, the single eyes being lowest and smallest, the halves next, and the wholes highest and largest in every way.

In each plot thus planted that has come under my observation has this been true, and I have noted that almost invariably the plots having the largest seed pieces produced the largest tops. Further, in the fall, as the potatoes were dug and exposed side by side, each row by itself, singles, halves and wholes, the same gradation was most manifest, as the appended figures will show. In 1883 five plots of one-tenth of an acre each were planted to single eyes, ordinary cuttings and whole potatoes, there being three rows per plot of each seed. A summary of the yields, in bushels, per acre, is as follows:

Seed.	Large.	Small.	Rotten.	Total.
Single eyes	137	30	21	188
Ord. cut	181	43	24	248
Whole	195	74	54	323

Two other plots of one-twentieth of an acre each were planted to single eyes and whole potatoes, with the following results in bushels, estimated per acre:

Seed.	Large.	Small.	Rotten.	Total.
Single eyes	152	29	9	190
Whole	162	143	19	324

In 1884 the question of influence of seed was again tested. Twenty plots were planted to single eyes, eight with quarter potatoes, five with halves, and three with whole tubers. All the plots were one-twentieth of an acre in size. The four sets of plots give the following averages for each lot, as the weights harvested from each, the difference between the merchantable tubers and the total weight giving the quantity of small potatoes:

Seed.	Merchantable. lbs.	Total. lbs.
Single eyes	490.5	524.8
Quarters	677.8	733.1
Halves	838.5	915.0
Wholes	958.1	1,089.1

The results attained by the Ohio Experiment Station are practically the ones thus far reached by the New York Station. In the Ohio Report for '83, page 94, I note: "Our results for both 1882 and 1883, so far as yield is concerned, appear to favor large seed." On page 94 the Report for '84 states: "The results with whole seed, and the different cuttings, bear out the same conclusions as previous years. The whole seed and large cuttings show yields in every instance superior to small cuttings." The results for '83 and '84 of the Ohio Station with one-eye pieces and whole tubers were as follows:

Year.	Seed.	Bushels Large tubers.	Bushels Small tubers.	Total bushels.
1883	One eye.	127.2	7.9	135.1
1883	Whole.	241.8	21.9	263.7
1884	One eye.	87.4	3.8	91.2
1884	Whole.	158.8	13.2	172.0

The various popular methods of potato seeding have their advantages, but, other things being equal, from past experience in the field in a perfectly practical way, personally speaking, I would prefer to plant either large halves, or whole medium-sized tubers. Why? The larger the tuber the more vigorous the eyes, and the earlier and stronger the resulting plants. The extra expense of planting whole tubers would probably be more than repaid in increase of crop over single-eye or cut-tuber planting, while from the two latter methods there is a much greater liability of suffering from drouth, while the tops of the growing crop will not produce the strong stocky growth resulting from medium to large whole seed.

I fail to see strength in a correspondent's statement in The Tribune "that the largest potatoes in a hill are often quite unripe, having been caught in mid-growth by the freezing of the leaves and cessation of assimulable supply." Firstly, the mid-growth of potatoes occurs during the hottest season of the year, when we least expect freezing; and, secondly, should freezing take place, all the potatoes in the hill would suffer equally; hence the advocate of small tubers gains no point, but places himself in an untenable position by such an argument.

POTATO CULTURE.

By Prof. SAMUEL JOHNSON.

From Bulletin of Michigan Agricultural College.

The writer has received a number of letters from different parts of the State of similar import to the following, from a well-known farmer of Ionia County:

"MY DEAR SIR:—I desire to ask a few questions as to your experience at the College farm, in the planting and raising of potatoes, as to the amount of seed to be put in a hill, the distance between the rows, the distance between the hills, in the rows, the proper time to plant for winter use, etc.

"Considering the importance of the potato crop, it does seem to me that more should be known as to the best method of raising the crop.

"Of all the farm crops raised in no one is there such a diversity of practice as in the cultivation and raising of potatoes."

This Bulletin is sent out as a reply to queries of this sort, and with the hope that it may be of use, not so much to the potato specialist as to those who have had but little experience in growing this important crop, or who have never given much attention to their methods.

SOILS AND FERTILIZERS.

The soils best adapted to the potato are sandy and gravelly loams. Clay soils, if the season be wet, produce very poor potatoes, and they will be much more liable to rot than those grown on sandy land.

An old pasture turned over or any sod ground is specially fitted for the growth of the potato.

A little well-rotted compost harrowed in thoroughly upon such a sod, to give the plants a good start, will usually give a fair crop upon comparatively poor soil. The potatoes grown upon sod are usually smoother, less liable to rot and of superior quality.

The application of fresh stable manure is not desirable on potato land, as it frequently results in a diminished yield and greatly increases the liability to rot.

Mucky soils in a dry season often produce a good crop; but as they are deficient in organic matter an application of leached ashes will be found desirable to supply the potash essential to the growth of the potato.

Ashes may be considered as a special fertilizer for potatoes, adding to the yield and improving the quality.

They can be used on the hill or in it. A good way is to mix them with the earth that covers the seed, or as a top dressing after the plants are fairly started.

PREPARATION OF THE SOIL.

The soil should be thoroughly plowed and harrowed until it is well pulverized and leveled. More potatoes can be grown in drills three feet apart and from twelve to eighteen inches apart in the drill than when the ground is rowed each way and the planting is in hills three feet apart.

It is more work, however, to keep the potatoes clean, and necessitates more or less hand hoeing.

In field culture we think rowing both ways and planting in hills three feet apart each way the most economical and satisfactory. In cultivation keep the land free from weeds and as level as possible; avoid hilling up, because hills heat and cool more rapidly than a level surface, and feel the effect of drought more. Use a marker that makes a deeper furrow than the corn marker. The varieties that produce tubers close together require deeper planting, or the upper ones will be exposed above ground. It is better to cover such varieties to the depth of five or six inches.

Deep planting, especially on sandy soil, is a good rule to adopt in potato culture.

SEED.

For seed select perfect specimens of good shape and of medium size rather than the largest potatoes, and cut with three or four eyes on a piece. Some growers think it best to cut the potatoes some days before planting, spread them on a floor and sprinkle with gypsum or land plaster.

I am of the opinion that it is quite as well to cut them when planted. It is often, however, desirable to have the cutting done before the hurried time of planting.

My own experience leads me to question the practicability of cutting to single eyes and planting three or four eyes in a hill. We prefer one piece with three or four eyes to less or more seed.

The expense of cutting to one eye is no small item.

If the weather is dry there is so little of the potato that it dries up altogether or makes but a sickly growth. The larger piece has vitality enough to start a good healthy plant.

TIME OF PLANTING.

Some growers favor early planting. Some seasons the early planted give best returns, and other seasons the late.

We generally intend to plant the main crop about the middle of May, and while no rule can be adopted as to time, we are inclined to the opinion that in most localities in Michigan it is early enough.

CULTIVATION AND HARVESTING.

If the potatoes are a long time coming up, it is best to run over the field with a light harrow. Anything that will stir the ground sufficiently to cause the death of the little weeds and break the crusted surface will answer. When the rows can be seen, with a shovel plow cover the rows of new plants with about two inches of earth. This should be done thoroughly. Frequent cultivation during the growing season is essential to a good crop, and if attended to properly there will be little need of hand labor.

In August it is well to go through the fields, each hand taking from four to six rows, and pull any large weeds that may have escaped the cultivator.

Dig as soon as thoroughly ripe, and when the ground is dry, if possible. Store in a cool, dry place.

We have never had a potato digger that proved satisfactory, and still continue to dig in the old-fashioned way with hooks.

VARIETIES.

We have been testing several of the newer varieties for some years. The Beauty of Hebron and Burbank's Seedling are our main sorts for field culture.

They yield well and are of excellent quality. The Early Ohio, Clark's No. 1, the Rural Blush, and the White Star are good yielding sorts, but they have not proved equal, with us, in smoothness, uniform size and quality, to the two varieties first named.

RESULTS FROM PLANTING DIFFERENT AMOUNTS OF SEED ON COLLEGE FARM.

1. The question is often asked, in planting potatoes, what amount of seed will give the best returns in yield and quality.

Potato growers differ greatly in their views,—from a single eye to each hill to a whole potato.

I am of the opinion, however, that most of the tests made indicate that when potatoes are cut to about three eyes to the piece, and one piece planted in a hill, the yield and quality will be better than with a greater or less amount of seed.

2. Desiring to add our mite, in determining this question, five plats of potatoes were planted on June 2, 1885, of the Burbank variety.

The soil was a sandy loam, well adapted to potato culture. No fertilizers were used except a dressing of well-rotted barn-yard manure, which was plowed under. The plats were put in good condition, rows three feet apart, and potatoes planted eighteen inches apart in row.

During the season of growth the soil was thoroughly cultivated and kept free from weeds.

3. The following notes give the appearance of the vines and other items of interest during the growing season, while the table gives the number of plats, amount of seed, date of planting and digging, weight of large and small potatoes, total weight of each plat, per cent of small potatoes.

NOTES ON POTATO EXPERIMENTS.

June 25. Those from one eye are very thin. Did not come up as well as the others. There are from one to two stalks in a hill. Those from two eyes are larger and not so thin; but not so large as those from more seed. From three to five stalks in a hill. Those from three eyes are making good strong growth, with from five to eight stalks in a hill. Those from one-half of a potato are making rank growth, having tops nearly as large as those from whole potatoes. Those from whole potatoes present the largest growth, having from five to ten stalks in a hill. The tops are not as rank as some of the others; they are long and slim.

June 30. Vines from whole potatoes are largest; and from one eye the smallest.

Those from one eye do not spread out so much.

July 7. Same as last observation.

July 14. Those from whole potatoes and those from half are nearly same in growth. Those from one eye are large, but there are only two or three stalks in a hill.

The vines from three eyes are very strong, making vigorous growth.

Observations were taken at various times during the season, but there were no apparent changes from condition referred to in these notes.

The table gives the results so far as yield is concerned. There was very little difference as regards the quality. The potatoes from whole seed were not quite as smooth as those from a less amount of seed. They grew more rough and scraggy than the others. The table indicates that three eyes in a hill gave the best results as to quality and quantity of *large*, *marketable* potatoes:

*No. of Plats.	Date of Digging.	Amount of Seed in each Hill.	Weight of Large Potatoes, lbs.	Weight of Small Potatoes, lbs.	Total Weight of Potatoes, lbs.	Per Cent of Small Potatoes.
Plat 1............	Oct. 17....	1 Eye.	84	20	104	19
Plat 2............	" 17....	2 Eyes.	104	40	144	28
Plat 3............	" 17....	3 Eyes	152	34	186	18
Plat 4............	" 17...	½ Potato.	140	42	182	23
Plat 5............	" 17....	1 whole Potato.	130	58	188	31

* Potatoes were planted June 2.

We intend to continue this experiment through a series of years.

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FACTS ABOUT POTATOES.

From Country Gentleman.

By President W. I. CHAMBERLAIN, Iowa Agricultural College.

A few notes on some of the eighty-four varieties of potatoes planted last year on the College farm may be of value to your readers. On about fifty varieties we have notes running back two or three years. Of eight varieties classed as "extra early," the Beauty of Hebron, Pearl of Savoy and Early Ohio rank highest in good qualities. Beauty of Hebron averaged for two years 117½ bushels per acre, Pearl of Savoy 136, and Early Ohio 111. The first of the two years was very wet, and potatoes rotted badly. Only the sound ones were measured. Last year was unprecedentedly dry, and yet Early Ohio yielded 158 bushels per acre in rows 32 inches apart, Pearl of Savoy 152, and Beauty of Hebron 123. The average of five years past gives Beauty of Hebron 164 bushels per acre, and Early Ohio 135. Until last year rows were 41 inches apart. Pearl of Savoy is of high cooking quality, and promises to outdo Beauty of Hebron in yield, and equal it in flavor. Early Ohio takes third rank among the extra early varieties, because it is, under average conditions, comparatively a light yielder. This year, with heavy and equal manuring, of all it was our earliest potato of 84 varieties, and our heaviest yielder, too. It was nearly mature before the drouth became severe, and hence suffered less than later varieties.

Of 24 varieties of "medium early," the best three are here given with their two years' average, the first under rot and the second, drouth: Lee's Favorite, 134; Early Howard, 112; Boston Market, 103. Of 27 varieties of "medium late," the two best are Queen of the Roses, 125, and Hamburg, 124. Of 29 late kinds, the best are: Chief 142; White Elephant, 137; State of Maine, 135. This year the late and medium late varieties gave very light yields.

The eleven varieties named I can recommend for quality on the whole, and for quantity, considering the adverse circumstances.

A FEW EXPERIMENTS.

To illustrate the value of having considerable bulk of potato with the eye or eyes used as seed, the following tests were made: Small chips, an inch across and about one-quarter inch thick, and containing one eye, were cut from medium tubers. They were planted like the rest, which were cut to about two eyes. Nearly all came, but slowly and weak. The roots were often examined and it was seen that they were not strong and numerous, like those from large cuttings, and the vines were late and slow. They had to wait for new roots to start out along up the stem. The yield was thirty-six bushels, as against one hundred and three from good-sized two-eye cuttings planted at the same time and under the same conditions otherwise.

Another row was planted with Early Howard cut to one eye, with a cylindrical piece of tuber one-half inch in diameter and an inch deep into the potato. The yield from these cuttings was fifty bushels per acre, as compared with one hundred and thirty-four bushels planted regularly. These small cuttings gave later ripening. Large cuttings from large tubers seem to aid in producing early potatoes. These extreme experiments seem to show that the more nutriment the vine gets from the tuber or piece of tuber used as seed, the earlier and more vigorous will be the start, and the better the yield. Each eye, in my opinion, should have nearly or quite a cubical inch of potato to push it at the start. Large tubers, of varieties like Beauty of Hebron, that have few eyes, can be cut to one eye, so as to give that amount, provided some of the eyes at the "seed end" are cut out and thrown away. But Pearl of Savoy and and Early Vermont and many other varieties can hardly be so cut. One-eye sets, under the very best conditions (*i. e.*, if large and "mealy," and in best soil and with best tillage), seem to yield larger tubers on the average. I do not think they will yield so many bushels per acre as two-eye sets. This year we shall test two-eye sets side by side with the same cut in two, and with the same with one eye clipped out, and all the substance of the piece left to push the other eye.

DEPTH OF PLANTING.

Empire State was planted at different depths with the Aspinwall planter. Two inches deep gave fifty-six bushels per acre, three one-half inches deep gave seventy-four bushels, and four three-fourths inches deep gave one hundred and one bushels. The vines were earliest and strongest where the machine planted deepest. The rows were side by side, and were planted the same day, May 12th, the same way, and all other conditions exactly alike. In a dry year and in deep, mellow soil, deep planting seems best. Two inches is the minimum, and four three-fourths the maximum depth of good work done by the Aspinwall planter in our rather soft, sticky soil. The average depth at which the bulk of our planting was done was three and one-half inches, and the potatoes had what is called level culture, *i. e.*, only a very slight ridge was thrown up by the cultivator. The deeper plantings were somewhat harder to dig. The McCallum digger took them clean but it was harder work for the team.

DISTANCE APART IN THE ROW.

The planter can be set to drop 14, 18 and 27 inches apart. Two rows of Dakota Red were planted at each of these distances. The yields were: 14 inches apart, 70 bushels; 18 inches apart, 58 bushels; and 27 inches apart, 40 bushels per acre.

FERTILIZERS.

With the fertilizer attachment different quantities of pulverized slaughter-house refuse were scattered in the rows with the (Chief) potatoes. The yields were:

Without fertilizer,	88	bushels	per acre.
With 240 pounds per acre,	76	do.	do.
600 " "	80	do.	do.
960 " "	101	do.	do.

On our rich, mellow soil, where manure has been freely used, foreign fertilizers did not seem to produce paying results. Farther tests will be made on poorer soils.

POTATO BUGS.

The drouth and heat brought them in great numbers and made the vines specially subject to their attacks. Hand-picking was tried, but promised to cost from $2 to $3 per acre, and so London purple was used. Barrels of water were placed in a wagon, and rows were sprayed with a weak solution of London purple by means of a force pump with small nozzle. The man stood in the rear end of the wagon and worked the pump, holding his finger over the nozzle so as to cast a fine spray over five rows at a trip most thoroughly. One-half pound of London purple or Paris green is enough for a barrel of water, if frequently stirred. The work was rapid and effective, and cost, aside from cost of force-pump, only about fifty cents per acre.

MANURING FOR POTATOES.

By Sir J. B. LAWES.

From New England Homestead.

Although I consider that the use of complete artificial manures involves too great a cost for their employment in the growth of ordinary farm crops, perhaps an exception may be made in regard to potatoes, a crop which requires a large supply both of potash and nitrogen.

At Rothamstead we have grown nine crops of potatoes in succession upon land which for fifteen years previously had received no yard manure, and the average yield of the last three crops has been 400 bushels per acre, calculating the bushel to weigh 50 pounds. The manure used each year has been 300 pounds of sulphate of potash, 350 pounds of superphosphate of lime, and 400 pounds of salts of ammonia; while in another experiment, instead of the salts of ammonia, 540 pounds of nitrate of soda were applied. The produce from both manures has been almost identical.

The sulphate of potash supplies about one hundred thirty pounds of potash—and we find very nearly the same amount in the crop. The phosphoric acid, on the other hand, is much in excess of the requirements of the crop, and it might be reduced one-half. The salts of ammonia and the nitrate each supply about the same amount of nitrogen—eighty-seven pounds—and of this the crop does not take up more than fifty pounds; there is, apparently, therefore, a considerable loss of this substance; but at the same time any reduction in the amount of these manures would be followed by a reduction in the crop. The loss of this costly manure ingredient is a most serious matter, as unfortunately there is but little prospect of recovering, in succeeding crops, any appreciable amount of the thirty-seven pounds not taken up by the first. By means of the same mineral manures alone we have grown—over the same period—one-half the crop we obtained by the application of minerals with nitrogen, the soil having supplied a sufficient amount of that substance to give a product of two hundred bushels; but one-half of the minerals applied remained inactive in the soil; these, however, might be made available to the crop by an application of nitrogen.

The quantity of potash removed in potatoes is very large. In the four hundred bushels it amounts to about one hundred thirty pounds. Compare this with the amount removed by animals. An ox, weighing 1400 pounds, which was killed for the purpose of analysis, contained only two and one-half pounds in the whole carcass and offal. Hay is another crop which takes a good deal of potash from the soil, and farmers in England rarely grow either hay or potatoes for sale unless there are facilities for the purchase of town dung. Artificial manures are certainly not used alone by practical farmers in the growth of their crops.

We always, however, obtain a larger crop of potatoes where we apply the mineral manures (potash and phosphoric acid) alone than where we apply the nitrogen without the minerals. This is shown by the following table, which gives the yield per acre (in pounds) on each of the five plots 1883, being the ninth in succession without any change in the quantities or kinds of manures; their chemical composition is also stated:

Plot.	Fertilizer.	Yield in lbs.	Yield in bus. of 50 lbs.	Per cent of Minerals.	Per cent of Nitrogen.
1.	14 tons of dung..........	13,440	269	3.50	1.09
2.	Minerals without nitrogen,	11,201	223	3.86	0.73
3.	Nitrogen without minerals,	7,020	141	2.64	1.44
4.	Minerals and ammonia....	19,820	391	3 67	1.08
5.	Minerals and nitrates	18,120	362	3.86	24.80

The character of the manure is most clearly shown in the composition of the crop. In No. 2, manured with minerals, the minerals are five times as high as the nitrogen; while in No. 3, where ammonia or nitrates are used, the minerals are considerably less than double the amount of nitrogen. In both cases there is a waste of power, shown by small crops and unused manures. The loss, however, is not equal in both cases, as the minerals remain in the soil to be taken up at some future time, while the nitrogen is probably lost.

POTATOES FOR PLANTING.

By A. W. CHEEVER.

From New England Farmer.

On several occasions we have alluded in the columns of the Farmer to the superiority of unripe potatoes for planting. Our attention was first called to the subject on learning that the market gardeners and some of the farmers of the Middle States, particularly Virginia and Tennessee, have been in the habit of sending North for the potatoes they plant, because seed of their own raising produces crops far inferior to those grown from Northern seed. The explanation given is that seed raised in the warmer climate of those States cannot be kept over from harvest time till the following planting season in suitable condition to plant. In other words, those States are south of the natural home of the potato, and to grow it successfully special measures must be adopted to counteract the unfavorable influences of a warm climate. Some of the enterprising farmers in these States have hit upon a new plan for raising their own seed. They grow one crop for market early and then re-plant their ground for a second crop, which they keep over winter for the next spring's planting. We are not aware how extensively this method has been tried, nor with how great success, but the hint led us to try some experiments in this direction, which, to say the least, have been very interesting.

Three years ago we planted a few square rods to potatoes on the third day of July. The seed planted was somewhat wilted, but there was vigor enough to give a good stand of vines, though they were less coarse and rank than they probably would have been had the seed been planted upon equally rich soil early in April. The seed was rather under market size and was planted whole. The crop was a fine lot of very smooth, handsome potatoes, nearly all too small for the table and too unripe to be eatable. They were kept in a cellar under the same influences affecting potatoes of the main crop, but while the earlier lots sprouted, as Early Rose potatoes usually do, before it was time to plant them, these late ones remained quite dormant till late into the spring. They also seemed much less wilted than the ripened crop. Having neither farm nor garden to plant that spring, we gave the late-grown seed to a neighbor to plant, and heard nothing more from them till autumn, when we saw a very handsome lot of first-prize potatoes exhibited at the Franklin Farmers' Club

Fair, and learned that they were grown from the seed we had given to the grower, and not the least remarkable fact was that this was the largest and handsomest crop of potatoes the grower had ever raised. Whether the lesson proved sufficiently impressive to ensure a repetition of the experiment we have not learned, probably not, for it would require the preparation of the seed a year in advance, and we are all, or most of us, too busy with the affairs of to-day to look very far into the future.

Last summer, when digging our early potatoes, we found in one hill the old potato still sound, and with a tiny sprout just starting to grow. As a matter of curiosity we carefully planted this old potato, which had borne one good crop, in good soil, and by a little watering and mulching got it well started into growth, though the weather at the time was excessively dry. The beetles were fought and late in the autumn we had the satisfaction of digging a second crop of potatoes, (there was but one tuber,) from the same seed. Last April this potato was cut in three pieces, and the pieces planted a foot apart in the drill near other potatoes of the same variety. The product was remarkable, yielding at the rate of over three hundred bushels per acre of very handsome potatoes, and decidedly better than any other hills in the garden of the same variety. From these two experiments we are led to believe that farmers here in Massachusetts may yet find it practicable to plant potatoes late in June or early in July every year for producing seed for the next year's planting. The experiments also suggest the inquiry whether Mr. Hersey's larger yields from small seed during six years trial may not be due, in part at least, to the fact that his small seed was less ripe than the larger seed. In Aroostook County we understand the potatoes are generally dug before the vines are dead, the season being only just about long enough to grow the crop to a good table condition. The winters being longer there, the potatoes are doubtless planted before they have had time to waste their vitality by growing long sprouts in the cellar. The advent of the early Rose has shortened the period of growth of the potato crop of the country, which saves us several weeks of beetle fighting, but it calls for more care and skill in keeping our early ripened crop over in sound, vigorous condition for planting the following year.

NATURAL HISTORY AND PATHOLOGY OF THE TRICHINOUS INFECTION OF MAN AND ANIMALS.

By NOAH CRESSEY, M. D., V. S., Ph. D.

Given at Farmers' Institute at Bryant's Pond.

Amid the various sources for the transmission of disease from the lower orders of animals to man, especially those of a parasitic origin, there is none more dangerous in character nor more loathsome and foreboding than the one caused by the presence of minute worms in the flesh of swine, which of course, in our present habits, we are ever liable to consume. The increasing prevalence of this entozoic contamination of one of our staple products of food has awakened new zeal among the sanitarians both at home and abroad; but until the public mind is more enlightened on the subject, and the real nature and symptoms of this almost intractable malady better understood, we are ever liable to encounter new outbreaks, even under the most favorable circumstances.

In view, therefore, of the great liability of such a calamity within the borders of your State, from want of adequate knowledge among the people, we deem it expedient and opportune, on this occasion, to treat the subject in detail, and thus set forth the natural history of the parasite and discuss the morbid changes that occur in the animal body when trichinous pork has been eaten in a raw or partially cooked state. Such meat is now well known to be exceedingly dangerous as an article of food, and often gives rise to one of the most obscure and fatal maladies that the physician has to contend with in human practice. Hence the necessity for the general diffusion of knowledge that we may guard ourselves against this parasitic invasion and thus more accurately scrutinize the intent of those sensational and exaggerated reports from abroad, which have already unjustly compromised the honor and activity of one of our leading industries.

DISCOVERY OF THE TRICHINÆ SPIRALIS.

This parasite was first described and named by Prof. Richard Owen of London, in 1835; and though frequently seen by scientific observers it was only regarded as a microscopic curiosity for more than a quarter of a century. His attention had been indirectly called to the subject some two years previously by John Hilton, demonstrator of anatomy at Guy's Hospital Medical College, who had observed a peculiar appearance of human muscle, and thought it depended upon the formation of very small *cysticerci*. He made a communication to the Medico-Chirurgical Society in 1833, which was regarded with much favor at the time, and has now become historic in English bibliography, as the first published account we have of the abode of the worm in question.

Dr. Warmald of the St. Bartholomew School had frequently observed the same abnormal and *specked* condition of certain muscles. The gritty sensation he had perceived and the blunting of the edge of his scalpel, in dissecting, caused him one day to mention the fact to Prof. Owen. This led to some inquiries concerning the nature of these little calcified bodies in the flesh, and the distinguished anatomist at once requested a specimen for microscopic examination from the next subject he should find thus infected. It was not long, however, before his wish was gratified; but ere he had time to investigate the matter, one of the students, now better known as Sir James Paget, the renowned pathologist, dissected some of these calcareous cysts, and with the aid of a microscope, which he borrowed of Dr. Robert Brown, the celebrated botanist, he actually saw this living entozoon first coiled upon itself and in a dormant state.

This discovery enlisted Dr. Brown's attention, and he accordingly rendered his student friend valuable assistance, by "dexterously pulling a worm from the cyst" for examination. Dr. Brown therefore first saw this interesting parasite in a free and larval state, liberated from its prison life.

Portions of this trichinized muscle having been "distributed far and wide," much interest was awakened in scientific circles concerning its natural history. The medical profession therefore very naturally turned their attention to Prof. Owen, who of all English naturalists was best prepared to throw a gleam of light on the subject. He found each capsule to contain from one to three small, hair-like worms, invariably coiled up in a conical form; hence he gave it the very appropriate zoological name the parasite now bears. But, as this examination was made with a low magnifying power, he did not perceive that this little helminth had any internal organization. Consequently he arranged it among the lowest of the entozoa, in his new-made class Protelmintha.

SUBSEQUENT INVESTIGATION.

Dr. Arthur Farre* by his careful dissections soon distinguished an alimentary canal, which at once elevated the parasite in the classifi-

*London Gazette, December, 1835.

cation of naturalists to the order of nematoid worms. Yet he was unable to decide which was the anterior extremity, and for nearly fifteen years there was no advance of anatomical knowledge on the subject.

It therefore remained for Prof. H. Luschka of Tubingen University, in 1850, to point out more accurately the internal structure. He carefully traced the digestive canal, discovered the sexual organs of the female, and conclusively proved that the mouth was situated in the pointed end of the worm, and not in the blunt extremity, as was generally believed. He described the cyst in its advanced stages, and demonstrated for the first time a complicated system of blood vessels, and an external membrane of connective tissue by which it is surrounded. In his observations on the vitality of the trichinæ, he found that they survived putrefaction and freezing of the muscles.

Dr. Herbst, a German helminthologist, followed in this line of investigation, and his experiments on dogs actually solved the question concerning the propagation of trichinæ. He was the first to rear encapsuled flesh-worms in the muscular tissue, and claimed that in this state only they were transferable from one animal to another.

Dr. Kuchenmeister, having previously shown the transformation of measles or hydatid tæniæ into tape worms, was led to the supposition that the trichina might be a juvenile form of a known nematode; and after a series of observations, he declared that this flesh-worm was the larva of the *Trichocephalus dispar*.*

A new impulse, however, was given to trichinal investigation in 1859, by Prof. Virchow's† experiments. He fed a dog upon trichinous meat, and in four days found a large number of these nematodes fully developed and sexually mature in the intestines, but he failed to observe the migration of the new-born worms which Herbst had previously demonstrated. This was owing partially to his having killed the dog too early, and also from the fact that he selected an old animal for the experiment, through whose firm tissues the young trichinæ scarcely ever penetrate.

Prof. R. Leuckart,‡ of Giessen, followed up the researches on the embryology of the parasite; he made a series of experiments on trichinal infection that were very comprehensive, and did much to

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*Animal and Vegetable Parasites, Sydenham Ed., 1857, Vol. I, page 221.

†Cyclopedia of Anatomy and Physiology, Vol. II, page 126.

‡For a summary of his views see Burk's translation in Quar. Jour. of Microscopical Science, Vol. VIII, page 168.

advance the science of helminthology. He corrected his own previously-expressed opinion on the validity of Kuchenmeister's observation on the transformation of the flesh-worm into *trichocephalus*, and thus confirmed Virchow. He also showed that the young trichinæ in the intestines became the encysted worm in the muscles, and he believed that they reached there by migration through the tissues, as graphically illustrated in Kestner's circular figure, on our fine lithographic plate. Others, however, claim that the distribution of the trichinæ over the body in so short a time can only be effected through the circulation of the blood.

NATURAL HISTORY OF THE PARASITE.

These famous microscopic entozoa that so frequently contaminate our pork, and are known among naturalists as the *Trichina spiralis*, present in their evolution three well-marked stages of existence for us to study, which really anticipate the larva, pupa, and imago phases of development in the winged insects. The natural history of this flesh-worm, therefore, becomes not a little interesting and worthy of special notice in this connection when we endeavor to explain the precise manner of its infection, the phenomena of certain symptoms, and the ultimate cause of death in the human victim.

The encysted worm that Owen described is now well known to helminthologists to represent the *larval* condition of an adult nematode. It detracts nothing, however, from the honor of his discovery, observes the late Professor Cobbold, that these little worms have turned out to be the wandering brood of a more highly-organized and dangerous parasite.*

The body of this flesh-worm is very slender and scarcely visible to the naked eye. It tapers anteriorly, and therefore the head is at the pointed end of the worm. The mouth is round, unarmed and very small. The alimentary canal is straight, and is divisible into three distinct parts, corresponding to the œsophagus, stomach, and intestines.

The male is much smaller than the female, as will be seen in comparing them on the plate, under the same magnifying power. The tail of the male worm is furnished with two lateral appendages, well defined, as seen at Fig. 2. The cloaca situated between these points is reversed during the generative act.

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*See his classic work on the Entozoa, An Introduction to Helminthology, Lond., 1869, page 335.

The adult female varies from three to four millimeters* in length, with the vulva situated near the end of the anterior fifth of the body, as represented at Fig. 5. There is but a single ovary, and the many ovules are plain to be seen through the smooth integument in various stages of development.

The sexually mature female is one-eighth of an inch in length, while the male is only about two-thirds that size. The female is ovo-viviparous, and thus brings forth its young alive, as seen at Fig. 4 on the plate. The young trichinæ begin at once to migrate from the bowels and perambulate the entire system of voluntary muscles, as portrayed in the circular figure. At last they become encysted, and there remain forever at rest, until they perchance shall have been eaten by some other animal, when they in turn will be set free, and thus complete a zoological cycle of existence.

It should be remembered that it is in the *encysted* state, as seen in 2 and 5, that the trichina is transported from one flesh-eating animal to another. Pigs are not born with these entozoa, but get them in some kind of food, probably from the flesh of rats and mice, and when once swallowed by the hog or other animal the gastric juice, in the process of digestion, soon dissolves this albumino-cretaceous cyst, when the parasite will be liberated from its prison life, and in a few days become a full-grown worm, within the stomach and intestines, ready to propagate its countless young.

The red voluntary muscles, says Dr. Thudichum, are the "promised land of the trichinæ." There they migrate, grow, and enshrine themselves. Although the young trichinæ, on the seventh day and later after infection, are found in almost all the organs of the body, yet they do not grow or become encapsuled in any other tissue. The trichinæ, according to his observations, arrive in the muscular tissue with the blood. The diameter of the smallest capillaries in the muscles is much less than the diameter of the young trichinæ, so they are certain to be arrested. They then penetrate the single or double coats of the muscles, and are at once in the interstitial spaces between the muscular fibers. Many trichinæ unquestionably never enter the sarcolemma, and become encysted, but when they do the fibers become permanently destroyed. At the end of the third week after immigration, the inflammatory irritation of the muscular fiber has reached its highest point, the trichina is nearly full grown, and becomes fixed to the spot where it is to be encapsuled. Several of

*.09 to .11 of an inch (nine to twelve hundredths of an inch.)

these worms may wander in the same track, and ultimately be enclosed in one lump of exuded matter.

This parasite, which undoubtedly infects a large number of animals, has frequently been found in the rat, mouse, cat, hedgehog, fox, mole, and hog, and is liable to be transmitted from one carnivorous animal to another through the meat. The Commission of the Royal College of Physicians of Vienna report that the main course of the infection in the hog is from the rat, and nearly one-half of all these vermin examined in Moravia were found infected with the encysted trichinæ; and it is not improbable, as Fleming observes, that the rats were primarily infected and have thus transmitted these parasites from one generation to another by virtue of their carnivorous habit at times to devour each other.*

TRICHINIASIS IN ANIMALS.

The history and symptoms of this disease in the lower animals have not received that attention, in a sanitary point of view, which the importance of the subject demands. That the malady in question has often been mistaken for "hog cholera," which at a certain stage it so much resmbles, no one can doubt. In fact, many of the symptoms of the swine plague are so closely allied to those seen in experimental cases of trichinal infection that it must be exceedingly difficult at times, if not impossible, to draw the line of demarcation which pathologically separates these two diseases, without a careful microscopic examination. It therefore becomes germane in the consideration of our theme to note some of the more prominent features of this parasitic affection that have been observed in experimental animals.

Professor Gerlach† of the Berlin Veterinary School found that pigs from three to six months old became much more easily infected than those of a more mature age. In mild cases, the symptoms were not characteristic of such intestinal disturbance. The appetite, though somewhat capricious, was soon regained and the animal resumed its usual habits of life again.

But in more severe cases, where a larger amount of trichinized food has been given, the symptoms were well marked and of a two-fold character. The loss of appetite, occasional vomiting, and the general depression that ensued always served to indicate the initial

*Veterinary Sanitary Science.

†See his able paper on the subject in the 7th Public Health Report of the Privy Council, London, 1865.

stage of parasitic invasion. A diarrhœa soon followed, attended with more or less fever, restlessness, and prostration, but these symptoms were often variable both in time and degree, according to the susceptibility of the animal. In young pigs, the gastro-intestinal irritation not infrequently proved fatal within ten days after feeding them with infected meat.

The second phase of the malady is indicated by rheumatic pains and soreness of the muscles, which appear in the second or third week, when the larval trichinæ commence their migration through the tissues. These symptoms come on gradually, as the others disappear, and thus vary somewhat in character, according to the group of muscles invaded by the parasites.

In this stage, hogs manifest a restless disposition, lying down and getting up again as if to change positions for comfort. They walk with a tottering gait, are stiff and unsteady in all their motions. Hence the reason why they seem to prefer to lie stretched out, as if to rest their weary limbs, from which position such affected animals often require help to rise.

When the muscles of mastication and deglutition are invaded, the hog manifests great difficulty in eating and it is often impossible for it to swallow even liquid food. Symptoms of lock-jaw therefore frequently supervene and thus become a serious complication, especially if the throat and the respiratory muscles are also affected. In such cases, the breathing is labored, and there is more or less wheezing. The voice of the animal, Gerlach noticed in several instances to change very materially, and it even became aphonic from the invasion of these parasites. Consequently, such afflicted animals have no power to squeal, even when disturbed.

The tongue and under lip are frequently swollen, and sometimes the cheeks and the muscles of the neck are also involved, giving a general odematous appearance about the head. The eyes become suffused with tears, and the conjunctiva wears a reddened hue for several days.

With such a group of symptoms present, a shoat must lose condition rapidly and thus become very weak and emaciated in a short time. But the symptoms of experimental cases of trichinization, according to Gerlach, are quite variable, depending largely upon the quantity of infected meat that had been administered at one time.

Where the quantity was small, the animal seemed to suffer but little from its effects, and yet after repeated trials he found the entire muscular system as thoroughly invaded with the parasites as where the quantity was large and thus produced severe trichinisis or was followed by a fatal termination.

Hence we are led to infer that hogs may become infected by this noxious flesh-worm without ever showing the slighest symptoms of disease through life. Again, a mild type of this trouble would never be noticed by any farmer in the State, and undoubtedly many cases of trichiniasis have occurred, which were treated for "hog cholera" or "black tush."

Nearly all mammalia can be artificially infected with trichinæ, but our danger comes wholly from the porcine race. Swine are the bearers of this parasite which affects mankind. Hence the necessity of more carefully studying the various diseases of the hog, and accordingly exercising greater care in the rearing of these animals for the market, that our own tables may be protected and our lives prolonged.

HISTORY OF THE DISEASE IN MAN.

Though much had been learned concerning the natural history of this parasite, especially through the investigations of Leuckart and Virchow, yet Dr. Zenker of the Dresden Medical School supplemented these observations in a timely manner and threw new light upon the subject, in a medical point of view. He found upon microscopic examinations, free and living trichinæ in the muscles of a servant girl who died in the hospital, at the age of twenty, of what was supposed to be a typhoid fever. She was taken ill January 12, 1860, and fell a victim to this strange malady within a month. Her symptoms were severe, and in some respect resembled rheumatism, with painful swellings of the limbs. The history of the case, therefore, was of more than usual interest to the profession, and excited not a little clinical inquiry, but no one mistrusted the cause of the trouble. It was soon ascertained, however, after Zenker's post-mortem disclosure, that she had assisted in the making of sausage on the 21st of December previously, and that she had partaken of some of the raw meat only a few days before her illness. This led to his well-known investigation on the nature and pathology of trichiniasis, which has been so extensively published to the world, and has already crowned his life with a diadem of philanthropy, that scientific men will ever revere.

The discovery of this parasitic disease in man, which had undoubtedly existed for ages, aroused at once the zeal of professional experts and veterinarians, and was the dawn of a new era in sanitary science. Here was the key which has now successfully unlocked the mysterious history of many epidemics, that had heretofore baffled the medical wisdom of all nations to explain. With this helminthological revelation, human and comparative pathology joined hands to explore certain realms in the causation of disease, and thus point out the remedy that was destined to relieve the sufferings of millions of human beings that might fall victims to this parasitic malady.

The symptoms of trichinous infection in man will depend largely upon the quantity of diseased meat that has been eaten, and also upon the stage of the malady. The invasion of the disease is marked by local irritation within the intestinal tract, caused by the liberation and development of the encysted trichinæ that the patient has eaten. The millions of new-born worms that immediately follow give rise to nausea, loss of appetite, inflammation of the mucous surface of the bowels and diarrhœa. Peritonitis may sometimes occur, from the perforation of the intestinal walls, in the escape of the larval parasites.

The second stage is characterized by general symptoms, muscular pains, rheumatism, etc., occasioned by the migration of the worms in the various parts of the body. There is great soreness, œdema, and stiffness of the muscles. Lassitude and profuse sweating not unusually occur in severe cases, and in this respect it resembles typhoid fever, for which it has many times been mistaken. This stage commences in about ten days from the first illness, and lasts four or five weeks.

In the third phase of the malady the trichinæ have become encysted, the fever, soreness, and inflammation begin to abate, and the patient is in a fair way to recover. In many cases there is a complete restoration to health again, but often it leaves the system in a very prostrate condition, according to the amount of muscular lesion that has taken place.

Those suffering from a mild and insidious form of the disease are not unfrequently able to walk about, yet feel tired and exhausted. They may have a good appetite, and the bowels regular. In such cases the pulse is but slightly disturbed, and the patient sleeps soundly, as though nothing was the matter. Lancinating pains soon are felt, especially in the neck and extremities. In fact, they are neither sick nor well, observes Leuckart, and yet they feel strangely and are unable to account for it. Following this transition stage, the pains become more intensified in certain muscles, and with more or less swelling.

Thus a chronic febrile condition sets in, differing from the usual type only in the absence of *acute* symptoms. In other cases a high fever occurs suddenly, with severe bronchial catarrh, and the patient often succumbs to such an attack in a few days, which of course is very terrifying to the friends, and especially so when it shall have been ascertained that the whole cause of the trouble is this dreaded parasite, consumed with the meat from a fine domestic hog, reared on his premises and fed by his own hands.

MEANS OF PREVENTION.

Although the swine of every land may occasionally be infected with this noxious parasite, still the frequency of its transmission will depend in a great measure upon the habits of the people. In those countries where the practice of eating raw pork and sausages so extensively prevails, of course the parasites contained in the flesh will be transported to the human stomach unmolested, but no fears need be anticipated from even the free use of pork if it has been subjected to a sufficient degree of heat, in the process of cooking, to destroy every germ of animal life: then it would be as harmless from this cause as fish, beef, or venison.

The ravages of this loathsome malady from the use of diseased pork are not confined to any country, and I believe it prevails more extensively than is generally supposed. Dr. George Sutton of Aurora, Indiana, who has been examining pork killed in the State, in 1875, says he had found from three to sixteen per cent of the hogs affected with this disease—differing in various localities—and that, taking the rate at four per cent, we have put upon the market from the Western States 221,484 diseased hogs, or about 44,296,800 pounds of infected meat, every ounce of which might produce disease.*

The Committee of the Chicago Academy of Science has shown that the percentage of swine infected by the trichina in the Western

*A report on Trichinosis, from the Transactions of the Indiana State Medical Society, 1875.

States is greater than in Germany, still, the disease is of rare occurrence on this side of the Atlantic compared to the old country; and we can ascribe no cause for the greater prevalence of this disease in Germany, except it be the habit of eating their ham or sausage in the raw or uncooked state.

Thus our only safety from the use of pork, which is always more or less liable to contain trichinæ, from any part of the country, is through *cooking*. Salting and smoking, unless long continued, have but little effect upon the vitality of these parasites. Raw ham or sausage should never be allowed upon a sanitary bill of fare; and even boiled ham, when large and fashionably prepared, as seen in many of our eating saloons to-day, not unfrequently contains these living worms. Hence our lives may be prolonged and our health improved by more attention being given to the domestic duties of the household. Then will all meats be served upon our table in a manner both to nourish and promote our happiness.

As another means of prevention, special attention should also be directed to "village hogs," that are allowed to roam at large and thus become public scavengers. In fact, the known habit of swine to root in their own excrement affords another means for the spread of this contagious malady. If one hog in a pen or drove becomes infected, the rest are almost sure to be in due time; for that the trichinæ may pass away with the discharge from the bowels, and thus be taken up by the others, there can be no possible doubt.

More attention, also, should be paid to the cleanliness of our public slaughter houses, with a view of controlling the ravages of all infectious and contagious diseases among our domestic animals, which often arise from want of sanitary regulations in their management. Besides, few butchers have the necessary knowledge to guard the people against the possibility of infection in the meats they vend. All public abattoirs, therefore, should be under the supervision of a competent veterinary surgeon, who should have full control of our meat supplies, and thus be able to prevent an infected article from ever reaching the table even of a single plebeian family.

SANITARY INSPECTION.

The actual recognition of this parasite in the flesh of swine during life, observes Leuckart, is of great importance. The symptoms in many of the artificial cases of infection are not characteristic. The appearance of the capsule has been claimed to be diagnostic, but when present its color is not alone sufficient to distinguish it from the surrounding tissues, unless calcified If the muscle is quite *red*, however, trichinæ are very liable to be present.

Accordingly the microscope is our only means of determining their presence beyond a doubt. This investigation is best made during life, by harpooning a piece of muscle for the purpose, and the regions of the neck, shoulders, and fore-limbs seem to have the preference. But in the dead animal, Leuckart has found the diaphragm to contain the largest number of young trichinæ, and the tenderloin, larynx, and tongue are also easily accessible to these wandering parasites.

In severe cases of infection the muscles of the posterior extremities are also found to contain them, but when trichinæ cannot be found in the anterior parts it is useless to look for them in the hind legs. Trichinæ are frequently more abundant at the extremities of the long muscles than in the central portions, consequently these parts shonld be chosen for examination.

To get the best view of the encapsuled worm, lay bare the fibers by separating them from the surrounding connections. Take up a small portion with the forceps and thus separate in the direction of the fibers a portion of tissue not more than a millimeter (.03 of an inch) in thickness. Avoid the blood vessels and nerve filaments, and select a sample near the tendon, as the trichinæ are most abundant in that portion. Place the specimen on a glass slide and with mounted needles spread it out to double its width. Moisten the slip with a solution of caustic potash, says Leuckart, and after a few moments, when the muscle becomes clear, lay on a cover of thin glass, flatten out the sample, under pressure, and remove the air-bubbles. By holding the specimen now towards the light, capsules can be seen by the naked eye, as small, clear specks.

These parasites vary in appearance, according to their age and degree of development, but their absence cannot be relied upon from the results of a single specimen examined. When the cysts are calcified they can readily be seen by the unaided eye, as little white points in the muscular tissue.

In all such microscopic examinations of infected meat great care should be taken to have the glass slips and covers free from all foreign substances, specks, etc., which have so often been mistaken and confounded with the object in question.

The claim is made that the southern hogs that roam free through the woods do not have trichinæ, so that if this be true, the lovers of southern bacon can indulge their taste freely. An ounce of hog's muscle has been found to contain 85,000 trichinæ, and forty millions were estimated to be in the body of a man who died of trichinosis. Thus far Germany has been ahead of any other country in the record of cases and endemics.

The following table shows the instances of trichiniasis in the United States.*

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*I am indebted to the Report of Dr. C. W. Glazier, prepared for the U. S Marine Hospita service, for many facts and references not otherwise obtainable, and for the table of localities.

TRICHINOSIS IN THE UNITED STATES.

Year.	Locality.	Reporter.	Number of cases.	Number of deaths.	Reference.
1856	Iowa	Dr. Timm	1	1	Virch. Arch. Bd. xxix.
1864	New York	Schnetter	4	1	Am. Med. Jour., February 20, 1864.
1864	... do	Professor Dalton	1	.....	Trans. N. Y. Acad. Med., 1864, N. Y. Times.
1864	.. do	Dr Voss	4	......	Aitken Prac. Med., vol. i., p. 160.
1864	Cheektowaga, N. Y	Dr. Kronbein	2	2	Buffalo Med. and Surg. Jour., June, 1864.
1864	Marilla, N Y	Dr. Dwyler	6	2	Am. Jour. Med. Sci., July-September, 1864.
1865	Massachusetts	A Sawyer	......	......	Bost. Med. and Surg Jour., 1865, p. 16.
1865	N. Y. (in hospital)	Dr. H Coupland	1	......	From Path. Soc Lond., 1874; case diagnosed enteric fever.
1865	Linn County	Dr H. Wilson	6	.....	St. Louis Med. Rep., 1866, Chicago Med. Jour., 1866.
1866	Marion, Linn County, Iowa	Dr. H. Restino	9	5	N. Y. Med. Rec., August, 1866, Flint's Prac., p 487.
1867	New York Hospital	Dr. E. C. Seguin	1	1	N. Y. Med. Jour. vol. iii, 1868, p. 116.
1867	Massachusetts		6	......	Med. Times, April 20, 1867, p. 431, Davaine, Cobbold, p. 169.
1869	Albany, N. Y	Dr. Hun	2	1	Trans N. Y. State Med. Soc , 1869, p. 157.
1870	Saxonville, Mass		?	1	Lond. Lancet, 1871, p. 515.
1870	Lowell, Mass		......	......	Do.
1870	Marengo, De Kalb County, Ill		8	3	N. Y. Med. Jour. xi, 1870, p. 107.
1874	Aurora, Ind	Dr. Sutton	......	......	A report on trichinosis as observed in Dearborn County, Indiana, in 1874; reprint from Trans. Ind. State Med. Soc., 1875.
1874	Detroit, Mich	Dr. Keifer	1	1	
1874	Port Huron, Mich	Dr. Northup	4	1	Mich. Bd. Health Rep., 1875.
1879	Brooklyn, N Y	Dr. William Maddren	5	2	Proceedings Med. Soc., County of Kings, 1879.
1879	Martinville, N. J	Dr. E. J. Bergen	4	1	Letter to Surg. General M. H. S.
1879	Milford, Ind	E. P. Gilpin	5	3	American Practitioner, September, 1879, p. 135.
1880	Newark, N. J		4	......	N. Y. Paper.
(*)	Bridgeport, Conn	Prof L. E. Sanford, Yale College,	.....	...	Number of cases a long time ago.
(*)	Newark, N. J	Dr. A. Boll	4	.....	Epidemic in German family a long time ago.
(*)	Baltimore	Prof. Michæl	......	......	Diagnosis is not confirmed by post mortem.
(*)	New York	Specimen shown to Dr. Thayer	......	......	Microscopist, N. A. Jour. Homœp., No. viii, p. 317, N. Y. Free Press.

*Date uncertain.

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Transactions American Public Health Association, Ninth Session.

DISEASES OF DOMESTIC ANIMALS.

By Noah Cressey, M. D., V. S., Ph. D.

Given at Institute at Poland.

Mr. Chairman, Ladies and Gentlemen:—That I may systematize the thoughts of your Secretary, and bring home to you the various diseases of animals in a familiar way, it will first be necessary for me to make you acquainted with the anatomical relations of man to animals. That we have a close structural relationship with the lower orders of animals no one will doubt; that eyes are eyes and ears are ears, and that hands are forward legs or wings, and that our legs are actually hind legs you will not question. Therefore, if we endeavor to talk about a disease, lameness and the various injuries that the joints may receive, I shall be obliged to point out the true morphological relations between the joints of man and animals. It will be necessary, therefore, in order to understand me when I talk about a certain joint whether I call it a stifle or a knee, that you shall comprehend its position anatomically. Accordingly, I will go over the subject hastily and thus indicate the comparative relations of limbs. If we talk about a hand or arm we must understand that it is a forward leg. And if we commence at the shoulder we shall understand that our shoulder-blade corresponds to the same bone in the horse, which the collar rests upon. Then comes the large bone of the arm known as the humerus. In the horse that is buried deep within the muscles and is not free to move in all directions. In fact, the leg emerges from the body at the elbow joint: and the shoulder joint is therefore buried in the muscles. The humerus is shorter than in our arm, deep seated and hardly to be felt, except down near the olecranon joint which corresponds to our elbow. This point of the elbow, which is so often injured, thus giving us such painful sensations, exactly corresponds to the place where the shoe-ball occurs in the horse, from lying down upon the shoe.

We have in our fore-arm two bones; the one forming a joint here at the elbow with the humerus above, is known as the ulna. That joint is hinge-like in action: we have the power to place the hand the other side up without turning this bone at all. That is accomplished by the bone on the other side, called the radius. In the horse and ox we do not find that form of motion. Those animals have not the power to turn their forward feet back pointing towards the hind legs. That is because the radius and ulna have grown together and are immovable one upon the other. That power which we have, and which the cat and other carnivorous animals possess in a wonderful degree, is known to physiologists as pronation and supination. This enables us to seize anything, to grasp what we wish, in any shape or position. The dog has the wonderful power, while digging in the ground, of turning his foot either way. This power of pronation and supination, therefore, belongs to animals which have a radius and ulna, but if grown together there is no such motion. Cuvier found a single bone of an animal, a large ulna and radius grown together, and with only that to guide him, to the wonder of the world, he unhesitatingly declared that it belonged to an herbivorous animal. When asked how he dared to venture such a statement, said, "here is the ulna and radius firmly united. The animal had, therefore, no power of pronation and supination : the forward legs were used simply as pedestals to stand upon ; all animals which use their forward legs for that purpose only are herbivorous" in habit. The bear, the dog, the tiger and various other animals have the power to thus turn their forward feet ; they can use them to apprehend their prey ; employ them in combat, and for various other purposes. Cuvier's careful observation on that point went far to satisfy the world that he was a prophetic naturalist. But to-day that is very familiar knowledge ; many a student of anatomy would now be able to say the same thing, which then seemed so wonderful. The porcine race are the only animals in existence where these two bones are free which have not the power of pronation and supination. But the pig can use the forward feet to hold the ear of corn that he may gnaw the same.

CARPUS OR FORWARD KNEE.

The next joint below we call the wrist, and that corresponds to the horse's forward knee. This is the carpus, made up, in our hand, of eight bones but in the horse only seven, each of which has a special name. There is only one point in particular here that I need to call your attention to, and that is the one most frequently seen in a knee-sprung horse, which is one with a weakness in the carpal joint, so that the leg has a tendency to bend forward and thus become lame and often unfit for use.

This bone is from such a knee-sprung joint and the disease in question is an exostosis, a regular fungoid growth of bone on the outside; it looks like a spavin and has been called a spavin of the forward knee. The disease that gave rise to this formation was an ossific inflammation, or one attended with the deposit of bony matter. It is such an inflammation that produces the real spavin; but there is no difference in the two forms of disease, only different joints are affected. This ossific type is hereditary, and knee-sprung horses not unfrequently have a very great enlargement on this joint.

That disease is very common, and is caused in a large degree by carelessness, in driving horses rapidly down hill and while there is an effort to hold back the load. Such efforts have a tendency to create weakness in that joint. You often see a watery infiltration there which is the same disease that is known in the human race as "white-swelling." A knee-sprung horse is not a promising subject for treatment. Care in shoeing will do good in some cases, and it is well to feed your horse from the floor and not from a high rack. Compel him to feed from the ground, and he is obliged to throw these forward legs back in order to get his head down. That effort will often be exceedingly beneficial, and decolorized iodine is a valuable liniment when freely applied. This disease is a permanent blemish and must be regarded as an unsoundness in every case.

The three bones below this joint are very marked, and of such a character that you want to remember them. The large bone in the middle is the cannon and the two little ones behind are known as splints.

COMPARATIVE MORPHOLOGY.

Now you want a little morphology, which is the science of form, and treats of resemblances and differences in structure. Morphologically speaking, my hand represents the horse's fore foot, and the cannon bone is the metacarpal to which the middle finger is attached, the two splint bones therefore correspond to the metacarpals of the ring and fore fingers. The fetlock joint of the horse's fore foot corresponds to our great knuckle. The upper and lower pastern and coffin bone of the horse are homologous to the upper, middle and lower bone of the middle finger. The coffin bone was thus named because it fits into the hoof so perfectly. The hoof corresponds to the nail. The bottom of the foot is the end of the finger. The frog has no representation in the human hand; it is a new developed structure lying in the sole of the foot. We therefore shoe the nail, which, instead of being simply in front, as in the finger, grows around behind and comes together, but not united; you can soak the hoof and thus spread it open. Accordingly, the part which we shoe corresponds to the end of our nail, and the hoof, like the nail, is much thicker at the bottom than up close to the hair.

We get fetlock joint diseases not infrequently. You often see a crooked fetlock joint in a horse. That often arises from the carelessness of the blacksmith in paring off one side of the hoof more than the other, so that the foot is not level. If the hoof is tipped to a considerable degree the wear comes nearly all on one side of this bone, and I have a specimen in my cabinet where this is worn through the outer portion of the bone so that I can see the spongy portion within.

We now come down to the parts below, which correspond to the finger joints. The first joint below the fetlock corresponds to the middle joint in your finger, the one which so often receives injuries and which has caused severe lameness and taken dollars from your pockets by having a disease develop there, what is known throughout the English speaking world as ring-bone. This is a ring of bone surrounding that joint and in such a way as to make it grow together. When the two bones have become united solid, there is said to be an anchylosis of the joint with an exostosis, and no longer any motion of the parts. In a section of an anchylosed joint you cannot see the line of demarkation that seemed to separate one bone from the other. The cartilage or gristle that tipped the ends of these bones has been entirely ossified. This specimen which I show you is a unilateral or unsymmetrical ring-bone, which is a cured ring-bone. A ring-bone is therefore cured when the joint has become anchylosed, grown together so there is no longer any motion. When that has taken place the horse can no longer limp, for the point is now solid. Those who claim to cure ring-bone by cleaning out the joint and taking away all the troublesome matter, as a jeweler would clean a clock, are not successful simply because they have not the power to stop the process which nature is carrying on there. But we may hasten this very process of healing. Instead, therefore, of keeping the horse for a year or more, the work may be accomplished in six or eight weeks, and thus get several months use of your horse

When you have a disease which is going to involve a joint in a bony anchylosis, this ossific inflammation must not be stopped by cold applications, but hastened with all speed and discretion, and a blister is at once called for, to be rubbed into the hair. A good one for this purpose is made of Spanish flies and lard made into a salve, to which may be added red precipitate of mercury, which is an exceedingly active agent. That being applied produces a tremendous inflammation on the skin, the result of which is to hasten the bony union, but that is a little slow. If the owner is impatient and wants his horse sooner, "firing" may be resorted to at once, and in fact, is the most efficient mode of surgical treatment.

When we attempt to treat a spavin or ring-bone we want to do it nicely so we will not leave a blemish; and there need not be any scar left from firing and blistering, if it is properly done.

On the splint-bone we get a disease just like that of ring-bone, from an injury with the opposite foot, or any accident. It is more frequently seen on the inside of the leg. We there get a little bony process by which the splint-bone is grown onto the cannon-bone. That is known as a "*splint*." The horse is lame as long as this is growing on, but he ceases to limp when it becomes anchylosed to the cannon-bone. This process can be hastened, in the majority of cases, and it will be completed within a month. We fire and blister this in precisely the same way as in the case of a ring-bone or a spavin. There is one indication by which you may feel sure that your horse has a "splint." When a horse is thus troubled you can test it in a way that will be very satisfactory to yourself. If you find no indication of disease elsewhere in the leg, and if you don't feel sure that it is here, drive the horse; and if no limp on a walk or a canter, but does limp on an ordinary trot, and the slower he trots the more he limps, you may be sure that is a *splint*. Rub your hand down over the leg and if there is a *splint* of any considerable size you will feel it like a button under the skin; but sometimes they are so small that they do not show. Colts in the pasture have been lame for weeks with a splint and recovered and nobody suspected any such trouble. In fact we find horses that were never known to be lame, with splints grown on perfectly solid. And one thing I wish to call your attention to in connection with this—and I shall be disputed right here unless Maine is different from other portions of the country—that while it is commonly believed that splints are always on the forward leg, they are in fact quite as common on the hind leg. Horsemen generally dispute me sharply on this point. While lecturing in Vermont, once, a horse doctor said that I had made a great mistake in saying that horses had splints on the hind leg. I replied that I had several specimens to illustrate the trouble in question which he doubted. But you see the difference between the cannon-bones of the fore and hind legs, so you will have no doubt as to which is which from these specimens.

DISEASE OF THE FOOT.

Coming to the foot, I will not speak of all the diseases that horses are liable to in these joints, but I will call your attention to some that are quite marked. On this coffin bone are two cartilaginous ears that in a state of nature remain soft all through life; but sometimes ossification occurs in them and thus makes side-bones as seen in this specimen, but if only on one side the foot it is no longer symmetrical. So if now you take a pair of pincers and grasp the horse at the heel he will cringe exceedingly, because there is a tender spot. This is an excrescence and a deformity; still, after it is grown on the horse may not be very lame, but it is a blemish and constitutes an unsoundness hard to detect.

Another type of bony growth occurs on top of this little pyramid. You see here a ragged piece of bone growing out that you know is abnormal. A large tendon comes down here to elevate the toe. In certain cases this disease is produced by a tread, the calk of the shoe on the other foot may be placed at the edge of the hair on the top of the hoof. A bony deposit occurs here, which is known as a disease ossification of the pyramidal process. But the treatment is such that you will not care to undertake it, as it requires much surgical skill in every case of this kind.

Question. Is a splint an unsoundness in a horse usually?

Dr. Cressey. Not after it has grown on. While he is lame he cannot pass muster with the surgeon for perfect soundness; a horse lame from any cause is unsound for the time being.

Question. May not a horse have a splint and never be lame?

Dr. Cressey. Yes, it is possible, but such cases are very rare; if the horse is lame that is proof in itself, and if he isn't, you wouldn't know that he had a splint.

Question. Could you not see it?

Dr. Cressey. There are lots of splints that you cannot see or feel, even when a horse is quite lame.

A Farmer. I have a horse with a splint that was never lame. I owned him before he had the splint, and have owned him ever since.

Dr. Cressey. That may be one of those peculiar bunches that has grown wholly on the cannon bone. If the splint becomes involved the chances are he will be lame while it is growing on.

The word navicular means boat-like. That little boat shaped body lies on the bottom of the coronet bone here and serves as a pulley for the tendon to pass over into the bottom of the foot; this pulley process keeps the tendon off from the joint, a splendid provision of nature. Otherwise it would interfere with the joint, and the tendon would wear out in a short time. The navicular trouble, therefore, is one of the ugliest types of disease, one of the most mysterious that we have to contend with, one that is almost sure to be overlooked by the ordinary farrier; in fact, it is a lameness that is exceedingly difficult to explain; but if you will listen for a moment I will give you the key so that you can diagnose this form of disease. In talking about any other part of the body the word joint means a union of two bones; but the "navicular-joint," so called, is a union of the inside of the tendon with the outside of this little bone, that is covered on the outer and under surface with a smooth, glistening membrane. There is a little capsule and synovia, or joint-oil, is secreted. A horse often gets badly strained here, inflammation sets in and interferes with the synovial secretion and the play of this peculiar joint. When a horse stands with his leg vertical and rests on the heel the cord is put to the stretch. If he raises his heel the cord is relaxed. If he stands with the foot pointing out in front the cord is relaxed, and in that way the horse gets relief. A horse with the navicular disease, therefore, is a "pointer." There is usually no malformation of the foot, but after some years' standing you will see the heel becoming contracted, the foot will not be so large, it will not be nourished as well, it will not be used as much, the horse will do most of his work with the other foot. As soon as he stops he raises the heel, and after standing a moment he puts the foot out forward. When you see a horse with this disease standing at a post you will see him shift from one of these positions to the other. Such a lame horse will nod every time he steps on the well foot. You might think he would bow when he steps on the diseased foot, but it is not so; he throws his whole weight on the well foot and thus steps *gingerly* on the other, which is so characteristic of the trouble in question.

Question. What causes this navicular disease?

Dr. Cressey. A strain; stepping on a rolling stone may start it, by producing an injury to the cord, setting up a little inflammation. Of the hundreds of such injuries, some result in this disease and others recover without serious trouble.

Question. Will not horses frequently point their feet when standing and yet not limp any.

Dr. Cressey. There may be other types of sore feet that would make a horse point, besides the navicular disease, but you will not often see a horse in this position that is not lame. In relation to treatment I would say that the blister, which is naturally resorted to, can never reach the case ; the trouble is deep seated in the bottom of the foot. It is, at least, an inch from the surface in any direction, and you can see that it would be of no use to blister the fetlock. The majority of veterinary surgeons all over the country do that and take their pay for it ; it is not only useless but it is an imposition upon the public for a professional man to do that ; and yet some of the professors in colleges recommend it. It is a species of quackery, that should be exposed. But the proper treatment is not one that any of you will care to undertake, because it is pretty difficult, and may seem severe. The point of injury is an inch from behind, an inch and a quarter from the sides, and there is only one way to reach it, and that is by a seton through heel and frog. Soften the foot well, hold it up and plunge a large seton-needle right in at the hollow of the heel and carry it through to about the center of the frog ; tie the seton around and draw it to and fro every day for about a month. It will bleed quite freely and thus relieve the parts somewhat. Apply some blister salve to the seton and make it run fearfully ; get up an issue there. That will cause the diseased part to heal, for your seton passed within a quarter of an inch of the diseased part, and when well done, rarely fails to cure.

In the hind leg, we have no difficulty to treat until we come down to the knee joint, which is the stifle near the flank and corresponds to our knee. The hip joint is buried in the muscles and therefore not easily got at by way of treatment. The stifle bone is our knee-pan. It is pretty hard work to dislocate ours, but in the horse it is very easily done—dislocated on the outside. When that has occurred you can throw it back into place by a certain motion, and there will be no further trouble from it, unless the horse by accident throws it out again, in which case it would be well to resort to treatment. A stifle shoe, with three calks about three inches long, coming together at a point, and put onto the well foot. This will raise that foot up so he cannot stand on it ; if the horse attempts it, he will fall ; he will try it once or twice, but will give it up after a few efforts, then he will be obliged to stand on the leg we are treating, and that is what we want. The application of an arnica liniment, or vinegar and wormwood, will be called for, and apply it over the joint and dry it in with a hot brick You can be sure that you have got it back into place, because the horse cannot step until you do.

A gentleman came to my office some time ago and wanted that I should look at his horse that had his stifle out. Said I, "where is he?" He said, "he is out at the door." "I guess not; I guess your horse with a dislocated stifle is not able to be driven. His stifle may have been out, but it isn't out now, for he could not step with such an injury. But it may have slipped back into place of itself, and that is often the case."

We get a stifle joint disease in cows that is very troublesome. In the Farmington valley, in Connecticut, a tuberculous disease has been prevalent in their cows, connected with a disease of the joint, known as tubercular synovitis. It starts from an injury and is followed by a tuberculous deposit that sets up an ulceration and absorption of the articular cartilage of the joint, and the cow becomes very lame. When that disease first appeared at Farmington, none of us understood what it was, and it was known only as the "Farmington cattle lameness." But it may be the Androscoggin valley cattle lameness just as well. The trouble is that the cartilage is absorbed on one condile and not on the other, and thus the joint is distorted: the cow will be extremely lame, stepping with the lame leg several inches wider than natural, and you will find an enlargement around that joint, an ossified deposit like the excrescence of spavin and ring-bone. That is a form of lameness that is not very effectually treated, and but few cases recover from that. I fed those cows largely on bone meal; I applied a good strong iodine liniment to the part, and gave them as much rest as possible, took them out of the pasture and gave them a box stall.

The next joint from our knee is the ankle, which corresponds to the hock joint of the horse; and this reminds me of a little story that may interest you. While serving once as an expert, in the Superior Court of Connecticut, the Judge attempted to make the case a little clearer, by asking me to show the relation between the bones of our hand and a horse's foot. Thinking he was not quite up in his anatomy sufficiently to understand me, even though a Judge, I hesitated a moment. He said, "Well, no matter, I take it it is an axiom that my knee corresponds to a horse's forward knee." Said I, "I beg your pardon." The Judge, being indignant to have his knowledge questioned, said, "I don't ask any man in the witness box to beg my pardon ; I am quite a horseman myself and a lover of the noble animal, and have studied it a good deal, and I therefore repeat, defying contradiction, that my knee corresponds to a horse's forward knee." Every eye was upon me for a moment, and I stepped forward a little dramatically and said, "I beg your pardon, your honor's knee is on your leg, and if you have any limbs that correspond to a horse's fore legs they must be your arms." I left the Judge in his cold consolation and went on with the statement, but he didn't interfere again. A similar case occurred in Missouri with a Professor of Surgery. He had a lame colt under treatment belonging to President Laws of the State University, and Professor McAllister called my attention to the case, and I found that the forward knee had been injured. While talking freely about the knee and putting his hand on his own knee, I said, to use the language of the plumber, "The thing you are talking about and the thing you are thinking about, are two different things altogether." Said I, "Do you understand that your knee corresponds to the knee you are treating in the colt?" "Why, of course," said he. Said I, "That knee that you have hold of on your leg is not a forward knee, is it?" The doctor saw the point instantly, and said that was too good to keep, and he wanted to sell the President in the same way. So he called the President there, and said, "Dr. Cressey has taken some exception to my notion that this joint corresponds to our knee." "Strange," says the President, "I guess we shall not have to be corrected on that; he must be joking." I said, "No, Dr. Laws, I am not;" when he said, "It cannot be otherwise." Said I, "Do you mean to say that you are satisfied that the colt's lame knee corresponds to your knee?" Dr. McAllister took it out of my hands, as he wanted to play the joke himself, and said, "Our knee is on our hind leg," and the President, being convinced, said, "What a set of fools we are, we don't even know the comparative relations of man and animals." Said I, "If we should put ourselves in the position of a horse we would have our arms as forward legs ; our legs would then be hind legs ; our knees would be stifles ; our ankles would be hock-joints, and if the horse should go as we do he would put his hock on the ground, making a foot eighteen inches long ; while, if we should walk as a horse does, we should step on the end of one toe, the nail being the hoof."

Now we will look at the spavin joint, which is the one that is so easily sprained. The ladies sprain their ankles easily by stepping sidewise, especially with the high heeled shoes that many wear. We frequently sprain this joint also, and it is an easy matter to wrench this joint and even cause displacement. Now remember that the horse's hock joint is our instep, and instead of being down in the boot, all clothed in tight, like ours, it is raised up from the ground, with the heavy weight of a horse on top, and do you wonder that a horse gets his ankle sprained, for this is the spavin joint. A sprain in these parts is usually followed by an ossific inflammation, with a deposit of bony matter, and when this occurs the bones commence to grow together, which occasions severe pain, pressure, and more or less enlargement. We have seven bones in this joint which are known as os calcis, the astragalus, the cuboid, the scaphoid, the ento-cuneiform and the messo-cuneiform. All those bones are closely bound together. In this specimen we have an anchylosis or bony union, of the scaphoid and the ento-cuneiform, and which at an early stage was an incipient spavin. In the natural course of events those two bones would have grown firmly together, and thus become anchylosed in spite of treatment. It might stop here; but it may involve the attachment of the cuboid on the outer side, also the messo-cuneiform; and then all four become attached to the end of the cannon-bone. It may seem like a wonderful statement to make, but there are more horses lame from spavins of this kind that no man can see or feel during life than from those which show these bony enlargements. Hence you often hear a man say, "My horse has no spavin because there isn't any enlargement," and that calls to mind an interesting case. The horse was owned by the superintendent of the Hartford and New Haven Railroad, and was brought from central New York a few years ago. He was lame when taken from the cars and after a few weeks, as he did not improve, Mr. Davidson consulted me, when on seeing the horse driven, I diagnosed an incipient spavin. "Nonsense!" said he. "No enlargement, no heat, nothing that you can see or feel." "Nevertheless," said I, "it is a spavin." The horse was put under treatment and I applied an active blister without firing, and in the course of a month or six weeks the horse began to grow better, and in few months was as well as ever. When he came to settle the bill he said, "Now there wasn't any spavin at all, you happened to put the blister on at the right time, but the horse would have got well without it. Still I did not change my opinion. His horse went nicely for two or three years, when he suddenly became lame in the other leg. He rubbed liniment, Kendall's spavin cure, salt and vinegar and everything else he could think of without any benefit, and after six months or more, the horse growing lamer every day, he brought him to me. "There," said he, "call that a spavin, will you?" there was not the slightest enlargement, but the horse was dead lame, and the other leg all right. I rode after him. Said I, "Yes, that is the very trouble again." Said he, "Don't you treat any other disease than spavins?" Said I, "Not in your horses." He was a little discouraged, for it was a fine horse and cost considerable money. I told him what I would do. He said, "Take him and do what you like ; I have got sick of driving that horse." This was quite a severe case and worse than before. I fired and blistered it. The horse, in the course of two or three months, began to improve. He turned the horse out to pasture late in the fall, and during a cold storm the horse was attacked with lung fever and died. He reported that his horse was dead, and asked if I wanted those joints. "Yes," said I, "and I guess it is providential." "Well," said he, "you have got to stand or fall by what we find." "Yes, and I suppose you will do the same?" He had the joints taken off and the meat removed from them nicely. I had called his attention to this very specimen that I now hold in my hand and told him his horse's joints would turn out like this. He brought these joints in and said, "Get that old bone you showed me ;" and on comparing the joints they were very similar. Any man could see that there was a spavin. I had cured one and the other was just on the point of being anchylosed when the horse died. The treatment is similar to that in ring-bone, firing and blistering. In fact ringbone, splint and spavin are the same disease, essentially, only located on different joints ; ring-bones are on portions before and behind, right and left ; splints on all the legs, growing the splints to the cannon-bone ; spavin on the ankle or instep of the two hind legs, while there is a similar disease forward on the carpus, which is the name of the whole joint that corresponds to our wrist, and hence carpitis is an ossific inflammation of that joint.

Perhaps I have talked long enough on this subject, but I want to make this matter plain to you. There is a great deal of ignorance, not only among owners of horses, but among the so-called horse doctors. I presume you have all heard and known of the treatment of ring-bone, by cutting out the bladder that feeds it. That is an imaginary bladder, and they cut right in behind and get hold of some sort of tissue, no matter what, and nothing of a diseased character whatever, for the same thing is found in a healthy foot, and the cutting out makes an awful sore. The result of healing up the sore, that the doctor has made, has a similar effect as in the firing and blistering; although he goes to work on a mistaken theory he has done that which hastens the anchylosis.

Question. I would like to ask if a horse that has had a spavin and been cured is any more likely to be lame again?

Answer. He cannot be lame again from that spavin, and he cannot have another spavin in that spot. A horse may be lame from another spavin, caused by the growing together of other bones in the same joint.

AFTERNOON SESSION.

Mr. Cobb called the meeting to order, and said:—We will now listen to further remarks by the speaker of this forenoon, but of a somewhat different character, as they will be more especially directed to the diseases of cows.

Dr. Cressey. Mr. Chairman, I would like to ask the Secretary if I shall go on and speak of such diseases as will naturally come in, as I did this forenoon, or shall I be subject to such questions as shall be asked me?

Sec. Gilbert. If it is your pleasure we will dictate to you somewhat. If you please you may speak first of milk fever.

Dr. Cressey. First for definitions. All diseases must be defined, that we may have a clear conception of what we are talking about. I cannot, therefore, better express myself in this connection than to refer to the fact that all sorts of diseases are spoken of under one name among certain peoples. The disease of garget was so prevalent here in Maine several years ago that the oxen had it, according to a communication to "The New England Farmer" by a citizen of this State. Now you see the misuse of a name leads to all sorts of errors and perplexities. Botanists and zoologists would all be at sea if they didn't have definite and well defined names. When we find the name "*Quercus Rubra*" in a work on botany or a government report or anywhere we know exactly what is meant; it is the red oak of New England. A disease, therefore, must have a specific name applied to it, that shall represent just that thing and nothing else; otherwise when discussing these matters with another we don't know what he is talking about. So let us first have the true definition of the trouble in question. Milk fever is a disease of the parturient female. The male cannot suffer from it, nor the cow at any other time than when she comes in. Hence the term, a fever which accompanies the incoming of milk; hence milk fever. A similar disease is seen in the human female under a different name; but the swollen limb which sometimes accompanies the disease, in the case of a woman, is called a milk-leg. The scientific name for milk fever is one which you should always remember, for it is the name which is used in scientific journals and veterinary treatises. It is parturient apoplexy. An apoplexy that is incident to the time of calving cannot occur in the male, of course. It is a disease of the nervous system, a rush of blood and a broken blood vessel, a capillary or one of larger size as the case may be, a clot formed in the brain and not absorbed; and death by paralysis usually follows. As a rule, there is not a rupture of any very large vessels. The capillaries, as you are aware, from the word *capillus*, which means a hair, are the small, hair-like vessels which connect the arteries with veins all over the body; they are the finest ramifications of the blood vessel system. Here, then, is a congestion. The word congestion is from the Latin words, "*con*," together, and "*gero*," I bear; it is a bringing together of the blood, a rush of blood to any given place, and those vessels are surcharged. This congestion is in the brain, the pressure becomes so great that one of these little vessels gives way, a clot is formed, known as an apoplectic clot. That clot, if it is large, cannnot be absorbed, and it will, therefore, undergo change to that degree that it will set up a diseased condition; and if it is large, you will comprehend at once "the dropping after calving." Remember this expression—it is a Scotch phrase—the cow has fallen and cannot get up. So much for definitions. Now for the symptoms. Good cows in poor condition rarely have the disease, and poor cows in any condition are rarely affected. I mean poor milkers. "Deep milkers," as the expression goes, and those in fine condition are the subjects of parturient apoplexy. Puerperal fever is the term for the disease in the human subject. The puerperal fever in woman isn't an apoplexy necessarily, but a disease which follows parturition. Milk fever indicates a congestion at the base of the brain with the results that follow. Poor cows have no excess of blood, and therefore there is no occasion for the vessels to be surcharged, when the blood ceases to flow to the calf. You are aware of the shock and change that takes place in the parturient female when the large amount of blood which has been flowing to the offspring is suddenly turned back into the mother's circulation at the time when parturition takes place. In the case of a plethoric, thoroughbred cow, in fine condition, this large amount of blood when thrown back upon her system produces a sort of stagnation for a time, and the vessels must be very strong to withstand the pressure. If they give way then we have parturient apoplexy. We get all phases, from a mere congestion which soon passes away with no very serious trouble up to the critical stage where we get an absolute rupture of a vessel. We have a disease in the human female like that of the fine fat cow, when she dies suddenly within six hours after childbirth. The family physician reports the case as one of puerperal fever or eclampsia. It is essentially like a fatal case of milk fever in a cow. There is an apoplexy in woman, a blood vessel has given way; she lies powerless, looking at a certain fixed point about the room until death occurs. A case of eclampsy is an awful scene to behold, and yet the cow dies in the same way in milk fever. Now we come to the physiology, the pathology, and the true principle involved, so that we can give the reason why, etc. You can see, therefore, why an ox cannot have this disease, or a cow at any other time than the coming-in period. Only fat cows or those plethoric in habit, are the usual victims, because when the quantity of blood is small and they are naturally poor milkers, they are not subject to such change in question, therefore the blood vessels accommodate themselves more readily to this condition and thus our ordinary native cows usually go through without any trouble. Consequently, don't keep your cow too fat just before coming-in. One of the worst features we have to contend with in milk fever is constipation, and the family physician will admonish your wife to keep the bowels open for several days before the critical period. Do the same thing by your cow; keep the bowels loose, for a bowel full of fecal matter is a mechanical obstacle that is often very troublesome. Under such circumstances, watch the bowels; feed moderately, give occasional doses of physic, if necessary, for a week or ten days before the coming-in period. If you keep the bowels active there is more blood going to those parts than there would be in constipated cases, and flows more freely, while in constipation you have a diminished quantity of blood in the bowels. If you give a dose of drastic physic the flow of blood from the other parts of the system to the bowels will soon be indicated. Aloes or a dose of salts will often accomplish this. In this way a dose of physic relieves a headache. You all know, and ladies especially, that a good cathartic pill is the best dose in the world to get rid of a headache. Take a good sharp purge that will make the bowels move, and the blood will leave the head and go to the bowels. In the case of cows we have every variety of condition from one that does not suffer at all to the one that will fall, never to rise again, of milk fever. There are a few axioms in veterinary practice that should not be lost sight of. The earlier the cow comes down with milk fever the more likely is the disease to be fatal. An apoplexy or a milk fever stroke that takes a cow within the first six hours, if fat and fine, as many are, has but slight chance of recovery. The first questions I ask a farmer that comes to me in such a case are, "when did the cow calve? when did she show weakness and inability to stand? is she a fine cow, a thoroughbred Jersey or Shorthorn?" If she is such a cow, and the symptoms I have mentioned followed soon after the dropping of the calf, I am obliged to say to the owner, "I hardly think I can save your animal." Why? Because I am afraid that the changes that have taken place at the base of the brain are such that I cannot relieve her. I therefore catch my knapsack of medicine and hasten to the cow as quickly as possible, that we may see her before the fatal change has taken place. Now for the treatment. As the disease is caused by a determination of blood to the head, you readily see the physiological indications. It is so plain, in fact, that you will never forget this point. If now by throwing that blood back into the system the vessels are so full that the blood cannot circulate without some danger, you would expect to find a hot head, horns, and ears in the majority of cases. For a common sense view of treatment the good lady of the house, suffering in that way, would say, "Give me some camphor to cool my head." Why do camphor, ether, alcohol and various other things of that kind cool a person's head when thus applied? If you never thought of it before, you may say it is a good deal of a philosophical question. But the answer is very simple. Water sitting on the stove evaporates. It took heat to drive that water into vapor; and that amount of heat carried off is of a definite quantity. Therefore, the amount of evaporation that will take place from a hot surface serves to reduce the temperature so much. You can make water evaporate, but when you take a substance that will evaporate in air at an ordinary temperature, like ether or camphor, and apply that to a hot surface it will cool the surface with wonderful rapidity. The temperature may also be reduced by the application of cold. Accordingly, many ladies have found that ice water, or water from the pump in winter, cools her head better than alcohol or camphor, and to warm this water up to that of an ordinary room requires heat. It therefore receives this heat from the body. Now the cow with a hot head may be treated with bags of pounded ice placed between the horns, or the application of cold water.

Dr. Tucker, of Brattleboro, Vt., is about the only medical man that I ever met who fully adopted this plan of treatment as applied to domestic animals. Several years ago, in one of my lectures for the University of Vermont, in that place, Dr. Tucker called the attention of the audience to the successful application of this principle, in a well marked case of milk fever in his own cow, and stated that he showered the cow's head, which was very hot, with a stream of cold spring water, for half an hour, and relieved the animal.

Cold contracts and heat expands. Therefore treat your cow with either ice cold water or ice bags, for one thing. You have been driving the blood away from the head. Your next point is to coax it away from the head. Set the boys at work with hot vinegar and pepper rubbing the legs and bringing the blood down into those parts which are cool, simply because the warm blood has gone to the head. If a fire occurs in the centre of your village everybody rushes there from the other parts, and the outskirts are therefore deprived of the usual number of men, and so with the brain. The moment trouble occurs there the blood abandons the extremities, and they become cold. Rub the legs sharply with liniment, wrap them up in blankets and keep them warm. What warms them up? Not the mechanical friction of your hands, but this process calls the blood back, and the blood is warm. The hot air that warms the car does it precisely as the blood warms the legs. The friction simply coaxes the blood there again. Throw a blanket over the body of the cow to prevent evaporation; keep the circulation active; leave the head exposed to the cold air. Another way to coax the blood away from the head is to give drastic physic, and this may be done at the same time you are rubbing the legs, and then the bowels and the legs will be calling the blood away from the head at the same time. By persevering in these you may relieve the cow without the lancet; but if all these fail, then with the lancet open the vital stream and take blood enough from the system that a rupture of a blood vessel may not occur.

The usual dose of physic for a cow in milk fever is a pound of Epsom salts, dissolved in thoroughwort tea, which is familiar to you all, a good remedy, and a grand mixture for cattle. Steep it as you would common tea; put it in cold water and let it come slowly to a boil, and it is then as strong as you can make it; and this decoction is much stronger than an infusion which is made with cold water. If you want to increase its virtue add West India molasses, a pint for a dose, take also some sweet oil or lard to help it on. With the syringe give a similar injection, or one of castile soap-suds. If necessary, take away the faeces, but that is rarely called for in the cow, although I have been obliged to do it in order to give a cow an injection. The faeces that come from the lower bowels will be hard, dry and impacted. Give one injection and then another, pausing only a few minutes between, until you have used a wash-tub full of the liquid, if necessary. Don't be afraid of it; it will do no harm. Don't use it too warm so as to scald the mucous membrane. Melted lard may also be given, or sweet oil, by injection, but castor oil is much more efficient. But if all this fails and the eyes are becoming glassy and even set, so that you can open the lid and touch the cornea without her winking, then resort to more effectual remedies. Give calomel in sixty grain doses and as a last resort give twenty or thirty drops of croton oil in some sweet oil. That is a very powerful medicine; half a drop is a dose for a human being. Death is pretty near if you do not hear from that. To show you how this will work to advantage many times, I will give you an illustration. Mr. Henry Holland, a grocer in Amherst, had a cow taken with parturient apoplexy and I was called to see her; within a few hours the cow's eyes were nearly set and she could not get up. We commenced to dose her in the manner I have described, and for three days we followed it up. I was there four or five times a day and late at night. I gave that cow five pounds of salts, five gallons of thoroughwort tea, 180 grains of calomel in three doses of a dram each, five pints of sweet oil, two pints of castor oil, thirty drops of croton oil, and a wash-tub full of injections. The third morning when I got there she did not appear any better than before; but soon I saw winking of the eyes which was a faint glimmer; I went into the house and waited a moment for them to finish breakfast, and we went to the barn, and the old cow was standing up. She turned around and the bowels began to move and we had a perfect freshet of faeces for several days; it was nearly impossible to control this diarrhœa; but the cow got rid of her disease shortly. One symptom you will observe in all cases of this disease where the cow is severely attacked within six or eight hours, they lose their affection for the offspring and have no inclination to recognize the young; she heeds not the bleat of the hungry calf; she is unconscious of her condition, and that alone is a symptom that looks grave. When a female loses her affection and her care for her offspring, then you may know that you have a grave case to treat and one that is liable to prove fatal.

Sec. Gilbert. We would like to hear something about garget.

Dr. Cressey. True garget, not such as the ox had, is a disease that is otherwise known as mammitis. The mammary gland, the udder, is involved in this disease, an inflammation of the milk producing glands. In the majority of cases in the human subject the termination is an abscess, or broken breast. That trouble is sometimes speedily cured, but usually it fades away into a chronic form and lasts a long time. The other three-fourths of the udder gives milk, precisely as one breast of a woman does while the other is diseased. One breast of a woman is precisely homologous to one-fourth of the udder of the cow. In the female of the dog and the hog, you know, we have a division into ten, twelve or fourteen parts. But we find the congestion in the cow mostly confined to one-quarter. Rarely is the whole involved. If it is, it may prove fatal. Such is not garget but true mammitis that the cow dies of. Yet when the trouble shall taper down from a mere congestion of the part to the chronic or sub-acute form, and the milk is diminished in quantity and watery and contains cheese-like particles, "garget proper" is the usual term applied. A large number of cases of garget are owing to injuries; the toe of the boot and the milking-stool have been the cause many times. Frequently the careless hired man or your impatient son, anxious to get off to the spelling school or elsewhere, has hurried up the milking; I am sure that a large number of cases are induced by improper milking. The best workman you can hire upon the farm is he who is the best milker, if you are in the dairy business. An old milker is always better for the health of the cows than the boys who want to get away to balls and games. But true garget, where there isn't a large amount of inflammation, may arise from several causes. A cow that has calved in a damp, cold barn, not properly cleaned out, and is compelled to lie on wet and soiled bedding is very likely to have the garget: and so is one that calves in the pasture late in the fall or early in the season and lies on the cold, damp ground. Our good wives would suffer from mammitis by such exposures, and the cow is not exempt from all dangers by exposure to the weather. Want of care is, therefore, a great cause of much of these troubles. Certain kinds of feed also produce a gargetty flow of milk. Acrid bush tops of various kinds which the cows nibble when feed is short in the pasture, will give rise not only to this, but to a disease of the kidneys that shows itself in bloody urine, known as *hematuria*.

The treatment will vary according to what the cause was. If the cow has calved on cold, damp ground, put a hot poultice right upon the part, something warm, sweating. If it has occurred from any other cause and is extremely hot and painful, dress it with cold water. It will have the same effect as applying cold water to the head, which I have described. As to the use of saltpetre, that only has one effect, and that is a diuretic on the kidneys, increasing the flow of the urine. Garget root is a febrifuge, and has a particular effect on the milk glands. It makes an excellent medicine for a gargetty cow. It may be mixed with gentian and annis; but do not use too large quantities of the pulverized garget root, for there is danger of poisoning the cow.

Mr. Cobb. Is that treatment better than to give aconite?

Answer. Aconite is a mere fever drop; it is a merely homœopathic way of giving a sweat. They give the human subject small doses of it diluted in water, and it will produce a sweat; but you cannot sweat a cow; a horse will sweat profusely, but you never saw a cow sweat.

Mr. Cobb. It generally relieves the cow.

Dr. Cressey. It has as good effect as cold water, and not much more. The effect your aconite has is that of a febrifuge upon the general system, but in many cases of garget there is no systemic disturbance, and no occasion for such a general medicine. The disease is local, in a majority of cases.

Question. How much saltpetre is it safe to give a cow?

Answer. I have known a man to give a quarter of a pound at a dose; but an ordinary tablespoonful is a good dose once per day.

Question. What do you consider a safe dose of pulverized garget root?

Answer. An ordinary tablespoonful to a dose; I would not give more than that; I would rather repeat oftener than to give larger doses; it would be liable to interfere with digestion. I know when I speak of this I am touching on a sensitive place with many who believe it is *the* cure for garget, and have a sort of mania for using it, but it has no specific effect, as many claim.

Mr. COBB. Is the action of saltpetre anything like that of aconite, upon the system of a cow?

Answer. The two things are diametrically opposite. The principal effect of aconite is that of a febrifuge, while that of saltpetre is as a diuretic.

Mr. COBB. Which works the quickest, saltpetre or aconite?

Answer. In a case of that kind I should say both of them would be sort of general. I denied to the *New England Farmer*, several years ago, that saltpetre was a sure cure for garget; it is one of the remedies we may use to advantage, but not a sure cure.

Mr. COBB. Don't you call aconite a good medicine to use in the treatment of milk fever?

Answer. I never think of using it. I give it to a horse when I want to sweat him; but you cannot get that effect on a cow; you can only get a general systemic effect. I do not give aconite to bovines at all. Some of the best works on practice do not even mention aconite as a medicine for cows. We give it to the horses because it will sweat them.

Question. Is there anything that is a sure cure for garget?

Answer. No, sir.

Question. Is it possible for a cow to be sick with the true garget and not show it in her udder or milk?

Answer. You can't have a snow-storm without snow.

The Questioner. I lost a cow this year and an old cow doctor said it was garget, but there was no apparent trouble with the udder or the milk.

Answer. I am told that in Maine oxen have the garget.

Mr. Cobb. Yes, and some of us believe that is true.

Dr. Cressey. What are the symptoms?

Mr. Cobb. They will become stiff and stupid, and their brisket is dry and "brash."

Dr. Cressey. Why not call it rheumatism, or gout?

Mr. Cobb. They never had a cold.

Dr. Cressey. How do you know? A majority of cases of garget are from taking cold. Why use that word? Don't call white black, simply because it is more convenient.

A Farmer. We don't know any other name up here.

Dr. Cressey. Am sorry for you then, surely.

Sec. Gilbert. I want to repudiate the idea that all people in the State of Maine believe that oxen have the garget.

Dr. Cressey. You see the importance of a definition when we are discussing a disease. Our definition of garget is, "a disease resulting from inflammation of the milk-secreting gland;" and that excludes at once the possibility of an ox having it.

Mr. Cobb. Isn't it just as common for a cow to have garget at the time of her drying up, as when she is coming-in in the spring?

Dr. Cressey. Not in my experience; I rarely see it.

Question. Is high feeding, on corn and cotton-seed meal, a cause of garget?

Answer. Yes, if it produces a general plethora of the system. When cows are very highly fed on nutritious food this is the first place where it shows itself. The ordinary feed, grains and cereals, the cows will bear without so much danger, but cotton-seed meal is very heating and exciting indeed.

Question. Which is the most likely to produce it, corn meal or cotton-seed meal?

Answer. I should fancy an excess of cotton-seed meal would produce it quicker than corn meal. I shouldn't want to attribute it to either one of them, unless these other causes that I have spoken of were excluded.

Question. Do you think cotton-seed meal is more heating than corn meal?

Answer. More exciting in that particular direction; I do not think there is more heat producing power in it, however.

Sec. Gilbert. Whether an excessively heat producing food would be more likely to produce a disturbance there than one of a different nature?

Answer. Anything that will constipate the bowels and interfere with the circulation of the blood within the abdominal cavity will interfere with the action of the udder.

Mr. Cobb. Isn't cotton-seed meal more likely to keep the bowels open than corn meal.

Answer. Yes, as a rule I think it is, but it is more exciting to the mammary gland. That is the point in question. You should give a liberal amount of carrots and potatoes when you are feeding cotton-seed meal.

Sec. Gilbert. One of the difficulties that the cattle commission have been called upon to investigate a good many times has proved to be an impaction of the omasum.

Dr. Cressey. That in itself is not a disease, but an incident of several diseases. In milk fever there is often a thorough impaction of the third stomach, which is about as large as an old-fashioned iron tea-kettle. If you cut it crosswise you will see a series of leaves; and they are always full of the residuum of food that is undergoing digestion. Any disease that shall involve the circulation of the abdominal cavity will interfere with the process of digestion in the third stomach, or manifolds; it is frequently seen in milk fever, enteritis and various other diseases. It is rare that you find a cow sick or dead from any general fever without an impaction of the manifolds. In Texas cattle fever we find it almost invariably; in pleuro-pneumonia not infrequently; and in tuberculosis and various other types of disease you will find this trouble. Hence it is not a disease proper, but a consequence of some disease that involves the circulation. In such cases open up the bowels by salts and lard, injections of thoroughwort tea, &c.; this impacted matter must be expelled.

Question. I understand you to say that garget is never found except in milch cows. Do heifers that haven't come in ever have it?

Answer. There is sometimes a determination of blood to the part and what is called milk-coming before calving: that is, you sometimes have to commence to milk a heifer before she calves. That is not a case of garget proper.

Questioner. The case that I refer to was that of a calf. Older men told me it was garget. She seemed to lose her appetite, and I gave her some garget and she ate it freely.

Dr. Cressey. Did she have enlargement of the udder?

Questioner. No.

Dr. Cressey. If there was no enlargement of the udder and she had not begun to give milk, I see no reason why any one should call it garget. Remember the definition that I have given.

Question. In giving a horse aconite, how much would you give for a dose?

Answer. Put ten drops on a lump of sugar and give it about once an hour. That is my way of giving aconite. Don't dilute it in a pint of water. When given on sugar the horse will eat the sugar and never taste the aconite at all.

Question. Would you water a horse before he is fed, or after?

Answer. If a horse isn't warm or sweaty I would give him water before I feed him, so there will be a free flow of gastric juice. After an animal has been fed, you don't want to allow them to take a large amount of water. Do not water your horse when he is sweaty and tired.

Sec. Gilbert. There is one other matter that these farmers are interested in and would like to hear discussed. That is the disease which broke out at the College farm last winter and destroyed that herd, tuberculosis; and if you will please to describe the disease and indicate its probable extent and danger, it will be interesting to all hands. It will have to be done, however, quite briefly, as the afternoon is pretty well advanced.

Dr. Cressey. Tuberculosis is a synonymous term for consumption. It is a specific disease caused by a vegetable germ known as bacillus tuberculosis, which is of recent discovery. My paper on the subject will give you the essential points in the history of the disease. Discovery of the germ confirms the good work we have done in past years in the study of this contagious malady. That there was a virus that was destructive to life, there was no doubt. That many a grandmother had given it to a child that had roomed with her for years, there was no question. There is no doubt that consumption is absolutely contagious by the sputa that may be thrown out, especially if it contains these germs, and that it is a dangerous sickness in the household. The greatest care should be taken to prevent its transmission to other members of the family. Dishes should not be allowed to pass from the sick room to your table. The patient should be quarantined to a certain degree. The utmost cleanliness should be exercised, and great care should be given to ventilation. The sputa should not be allowed to dry on the spittoon or the floor. It is absolutely contagious by the inhalation of the germ.

Cattle put into stalls where others have died from the disease are almost sure to catch it, unless the greatest care as to cleanliness has been taken. Orts that may have been left by a consumptive cow and then thrown out to other cattle may be a means of contagion. Any cow or human subject that shall have consumption proper, or real tuberculosis, should be so thoroughly quarantined as not to have any cohabitation with healthy animals or persons, other than that which is necessary for their care and comfort. A consumptive hospital is an awful place to put a physician or a nurse into. If there is a hell upon earth it would be to take care of a lot of patients dying of consumption. It is an awful disease. It is a disease that is propagated by poisonous germs, like several others which are explained by the germ theory. In any such disease the greatest care should be taken to prevent any possible contact of healthy animals with those that are diseased. When such a disease gets into a herd it is likely to go through it. This disease is of such an insidious form that it is not easily detected; you never know that one is sick until you hear the cough. When you have killed some fine animal for beef you will find the lungs have grown to the ribs, so that you cannot pull the lungs out, and there are balls of hard yellow substance that looks like cheese attached to them, in some cases, and every part of such lung is tuberculous.

Sec GILBERT. Is it the belief of the profession that this disease prevails to any considerable extent among the New England stock?

Dr. CRESSEY. Very largely among certain breeds, the Alderney and Short-Horns more especially; but it is even found in native herds. It is much more prevalent than is generally supposed. Our attention is more frequently called to it in case of thoroughbreds because they are more valuable. It is called more particularly to our attention in the case of thoroughbreds, because they are more valuable animals; but many a poor cow coughs, grows thin, loses her milk and dies from this disease and nobody knows it. One such cow may infect the whole neighborhood by the intercourse she has had with other cattle. It is claimed that five per cent of the milch cows of Germany are affected with tuberculosis. The milk of an animal afflicted with this disease should not be used; and for children especially, for they drink so freely of it and their absorbent glands are so active that they are much more likely to become the victims to its terrible effects. Even boiling sometimes will not destroy the virus unless it is long continued.

TRANSMISSION OF BOVINE TUBERCULOSIS.

By Noah Cressey, M. D., V. S., Ph. D.

Given at Farmers' Institutes at Orono, Winthrop and Island Pond.

Nowhere in the struggle of life, against the manifold causes of disease, do we more effectually imperil our health and happiness than in partaking of animal food of a suspicious character; for the relation of man to the lower orders of animals, which has caused so much speculation among philosophers and naturalists on certain zoological affinities, is equally interesting and instructive in a *pathological* point of view. The skeletal framework and internal organization of the higher mammalia are not only morphologically identical with the structure of man, and thus subserve the same purpose in animal economy, but the blood is similar in chemical composition, contains the same anatomical elements, and is subject to analogous changes in disease; hence the liability of transmitting to the human subject some virulent blood-poison, through the medium of our animal sustenance.

The sterling achievements in comparative pathology, which the last decade has wrought relative to the germ theory, have not only awakened new zeal among scientific men, both at home and abroad, but have necessitated the recognition of a biological factor in the study of the etiology of many forms of disease. The results of these researches have revolutionized in a great measure all previous conceptions of the real nature of contagion; and it has now been conclusively demonstrated by the concurrent testimony of competent observers, that the disease-bearing germs of anthrax, tuberculosis, and other infectious maladies are tiny parasitic organisms that belong to the marvelous world of microscopic plant life. The practical advantages already foreshadowed by these investigations have attracted the attention of biologists throughout the world, and many powerful instruments have now been turned in this direction, to study the life-history of these germs, both in health and disease. Yet long before the *contagium vivum* had been discovered, pathologists, believing that the morbific principle affecting the system, in a large group of epidemic and sporadic forms of disease, closely resembled the action of a ferment, proposed the zymotic theory, which, though vague in its chemico-physiological significance, has been almost universally accepted by modern authors. The analogy seemed very striking in many respects, even when first enunciated, but the discovery that the active agent of fermentation was a minute vegetable organism, which grew and multiplied at the expense of the saccharine liquid, virtually paved the way for the germ theory of disease.

That all contagious diseases, therefore, have a continuous existence, like the succession of organized beings, and thus arise from the dissemination of these morbid germs, no competent pathologist will deny. As in the vegetable world each seed produces its kind, and the acorn never contains the germ of any other tree but the sturdy oak, so each infectious disease has its own specific virus, which can induce no other malady than the one from which it was derived. Thus every disease germ must come from pre-existing ones, and consequently the spontaneous origin of any infectious malady is quite as untenable, in the present state of science, as the equivocal generation of plants and animals.

With this idea in view, the very highest achievement in medical science is the requisite knowledge to point out such causes, rather than vaguely search the materia medica for a cure; and there is no theme connected with the science of dietetics more worthy of our daily consideration than the sanitary condition of the meat and milk that we consume. Though many inquiries have been made in this direction and valuable conclusions reached, yet in this broad field for scientific research, the accomplished laborers are few. But the hour has come when the sanitarian and physician, in response to a public demand, must join hands with the veterinary profession to explore certain realms in the causation of disease, and thus more accurately survey those boundary lines in pathology which seem to separate the human maladies from those of our food-producing animals.

In fact, there is no subject of more importance to the public health, or better calculated to enhance the cause of sanitary science, than the practical study of this diseased-meat question. The *doubtful* condition of some of our home supplies already indicates the solution of certain vexed questions on the transmission of tuberculosis, which had long been a stumbling-block to the medical practitioner until the discovery of the bacillian germ in 1882 by Dr. Robert Koch of Germany. The investigation of this subject, therefore, in all its varied relations is a work of vast importance, and one which the age now urgently demands in behalf of human welfare. Hence it will require, for the achievement of the desired results, not only the united efforts of professional and scientific men, but the influence of the press, and the sanction of our State authorities.

INFECTIOUS QUALITIES DEFINED.

The extent to which the different kinds of diseased meat are liable to be used will depend in a great measure upon the comparative frequency that these infectious maladies occur in a given locality, and the more insidious the nature of the disease the greater the liability of its transmission from animals being slaughtered, that are more or less affected. Hence a brief allusion to the more common forms of infected meat, with a review of some of the pathological conditions involved, will best serve our present purpose, and possibly throw a gleam of sanitary light on this much neglected subject.

All meat, therefore, from whatever source or condition of animal it may come, that would cause sickness, disease, or death in man if partaken as food, must be regarded in the light of sanitary science as *diseased*, and consequently unfit for human use in any form. Accordingly, an article of meat possessing such qualities must come from an animal afflicted with some form of an infectious malady, the germs of which are contained in the flesh, and are liable to be transmitted.

Hence, a disease in which a contagious virus is developed during its course, and the germs are present in the blood, renders the meat from all animals thus affected exceedingly dangerous as an article of food. In accordance with this definition there are a few diseases that absolutely render these animal supplies perilous to human happiness. Prominent among these may be mentioned malignant anthrax, tuberculosis, and small-pox. But the other maladies from which our slaughtered animals are liable to have suffered may greatly impoverish the nutritive quality of the meat, and thus render it unpleasant in taste and general appearance; yet, if the flesh contains no animal poison or other morbid products, no harm can possibly come from its use when served upon our table; and even a diseased article, when thoroughly cooked, may not prove injurious to one whose digestive powers are active.

It is not an easy matter, therefore, in all cases to decide whether meat is possessed of injurious qualities or not, without a careful inquiry into the history of the article, or a microscopic inspection. This is true of black-leg veal many times, and of other fine-looking specimens of meat that are affected with anthrax poison, which is ever liable to be transmitted.

Many varieties of diseased meat, however, are so palpable that even by the dexterity of the butcher's art it is impossible to disguise them. The tuberculous deposits upon the pleural membrane lining the chest cavity, thus causing the lungs to adhere to the ribs, or along the internal walls of the abdomen, are sufficient evidence to condemn the carcass.

TUBERCULOSIS INFECTIOUS.

As this disease is comparatively new to the veterinarian, especially when viewed in the light of the germ theory, its clinical history and pathology has not received that attention which the subject now demands. In order to prove that tuberculosis is a purely parasitic malady, caused by the growth and invasion of these vegetable germs, it is necessary to isolate and cultivate these *bacilli* in a state of purity, free from every heterogeneous element and until every morbid product from the infected animal and which might adhere to them, is got rid of. This Dr. Koch has done and these isolated germs he has transplanted in animals and by this inoculation he has produced tuberculosis with all the morbid phenomena, such as have been observed, following the experimental inoculation of the virus, as we shall notice further on. In fact, few are aware to-day of the extent to which this insidious malady prevails, but the rapid strides which it has made and the hold it has already gained on our stock, observes a well-known veterinary author, renders it one of the most important questions affecting the well-being of the bovine species.*

The *contagious* nature of tuberculosis, as shown by recent experiments on animals, can no longer be doubted, and it is now conceded by comparative pathologists that the bovine form of this disease is identical with that of man. Consequently there is great liability of its transmission, either by inoculation or ingestion. In fact, it has repeatedly been produced in rabbits, guinea-pigs, and calves by feeding them with tuberculous matter. Prof. Gerlach of the Berlin Veterinary School claims,† as the result of his researches, that this disease in cattle is very infectious, that the presence of a specific

*The Four Bovine Scourges, with an Appendix on the Inspection of Meat, etc., by Thomas Walley, M. C. R. V. S., Principal of the Edinburg Royal Veterinary College, 1879.

†The Veterinarian, London, March number, 1875.

virus is evident, and that even the flesh of such diseased animals under certain circumstances, and also the milk, possesses infective properties, though to a less degree than the cheesy matter from the lungs.

That tuberculosis is now rapidly on the increase no well-informed veterinarian can deny. It ranks among the few great scourges of the land; and though our losses, thus far, in live stock property have been largely due to other plagues which sweep their victims off in a summary manner, yet the ravages of this disease can only be realized, says Prof. Walley,* when we take into account the vast deterioration, the slow but certain decimation of many of our best herds, the destruction of our animal supplies, and also the danger to human life which can no longer be considered chimerical. Still there are many who from want of knowledge on the subject may even despise the pathological significance of this fell destroyer and thus ignore its deadly meaning; but when we see thousands of these tubercular deposits in a single slaughtered animal, we are forced to conclude that the use of such meat can in no way promote our healthfulness. Thus we have in every form of tubercle an implacable and destructive foe, and, in fact, there is no other morbid product known that is so *protean* in the number of functional derangements to which it may give rise in the animal economy.

HEREDITARY TRANSMISSION.

There is evidently a strong pre-disposition in neat stock for the production of tuberculosis, and cattle are far more frequently affected than other domestic animals. The temperament and physical conformation undoubtedly contribute much to its development; for animals of a phlegmatic type, with an attenuated form, long limbs, and narrow chests, are usually the first victims of the malady. Breeders should therefore strive to avoid the possibility of transmitting such diseased qualities. It is more frequent in cows than in oxen, and especially those kept in dairies for a length of time. Hence lactation is believed to be a predisposing cause. The condition also in which animals are kept is no small factor. The cold, damp sheds, the dark, underground stables, and other ill-ventilated abodes, as well as the character of the food, all conspire to rekindle those constitutional taints into morbid activity.

*Op. Cit., page 143.

If we inquire further into the causes of the increased susceptibility to the infection, as seen more especially in our thoroughbred stock, we shall find that heredity and multiplied consanguinity play no menial part. Any physical weakness which the sire or dam may possess is liable to be transmitted to the immediate progeny, but if one generation escapes, the trouble may appear in the next, in accordance with the well-established principle of atavism. Diseased conditions are also inherited; and I believe that there is no predisposing cause which exercises such a potent influence in the production of tuberculosis as the pernicious system of in-and-in breeding. Thus from parent to offspring, from one generation to another, we often see the fatal tendency transmitted in unbroken succession, and the more complicated the relationship becomes, the greater is the virulence of the resulting products. In spite, therefore, of the many palpable examples of this broken law, some breeders still pursue, year by year, the suicidal policy of clinging to *one strain*, regardless of the impending consequences.

Hence this insidious and malignant malady, soon to be recognized as *the dreaded* scourge of our land, is now being disseminated in every direction through the consanguineous infection of our thoroughbred stock. And Prof. James Law, F. R. C. V. S., of Cornell University, in alluding to this subject, says, "That the *esteemed* qualities have been preserved, strengthened and increased in this way there can be no doubt, but there can be just as *little* doubt that any inherited weakness or disease has been often transmitted and even intensified. I could mention particular families in our highest-priced breeds in which *tuberculosis* has become a fixed character;" and further on he observes that "excessive weakness and stupidity of the young is another common result of in-breeding."*

CONTAGIOUS BY CONTACT.

The observations of Dr. Grad, veterinary surgeon at Wasselonne, Alsace, on the spread of this disease by contaminated stalls, are very conclusive. On different occasions owners had informed him that they had lost several animals from consumption *in the same stall*. At first he did not attach much importance to the matter, but one day, when visiting the stables of an extensive farmer in Leinheim,

*Report of Am. Public Health Association, New York, 1875, vol. 2, page 250.

he was informed that annually for the last five years one of the cattle had died of tuberculosis in a certain stall. The last one he had the opportunity of examining, which had been there but ten months, but had all the symptoms of the malady, greatly emaciated, and troubled with a cough. Dr. Grad's attention was strongly aroused at such a state of things, and to test the matter scientifically he was allowed to select an animal for an experiment. Accordingly he chose from another stable a three-year-old heifer, in calf, that was to all appearances perfectly healthy. She was bred on the farm, had never been unwell, never coughed, and none of her progenitors had ever been affected with phthisis The cow remained quite well until after calving, when a slight cough appeared ; but it increased in frequency, emaciation gradually set in, with all the symptoms of tuberculosis, and in twelve months the creature was a mere shadow of her former self. The evidence therefore in support of this mode of infection Grad could no longer resist, as this was the sixth case that had occurred in this stall. Hence he very naturally inferred that the disease was probably transmitted by the ingestion of tuberculous matter expectorated by the cattle which had previously occupied the place.

The extension of the malady by cohabitation is, therefore, always liable to occur when animals are so arranged in the stable that the sick and healthy ones can get their heads together, or feed from the same manger. The hay may thus become contaminated, and the infection takes place through the digestive organs. The expired air also is not unfrequently so laden with virulent matter, especially in the advanced stages, that it is not safe for another animal to inhale it. This mode of transmission, which was first suggested by Dr. Morgagni, more than a hundred years ago, and has found many advocates among physicians and veterinarians, has now been confirmed by the experiments of Dr. Tappeiner of Meran, in causing animals to inhale the fine particles of tubercular matter from the air of a room in which the virus had been evaporated by a steam atomizer. Out of eleven puppies experimented on, ten showed well-marked miliary tubercle in both lungs on being killed within twenty-five to forty days—thus proving that this disease is contagious by the breath.

VILLEMIN'S INVESTIGATIONS.

In 1865 Prof. Villemin of the Val-de-grace Hospital, Paris, having conceived that human consumption in certain cases might be due to a specific virus introduced into the system, resorted to a series of experiments on animals to test the question. He was the first to demonstrate the contagiousness of tuberculosis by *inoculation.* Rabbits and guinea-pigs were selected, and the material employed was from the human lung. Inoculations were made in various parts of the body, but the results were uniform and of a serious character. Many of the creatures died, others, lingering in a depressed state, were killed, when well-marked tubercular deposits were found in all, especially in the lungs, and with more or less infiltrations in the other organs, thus showing that the disease had been transmitted.

These results, which gave him so much renown as a pathologist, led him to experiment with tubercular matter from other animals. Desirous, therefore, of testing the nature of the disease in cattle, he inoculated a rabbit with matter from a cow. The animal became emaciated, and in six weeks was destroyed. Its lungs were filled with hard, tubercular masses, and some of them had taken on a cheesy aspect in the center. The other organs of the body were affected in a similar manner as those in the previous experiments. Hence he concludes that bovine phthisis is *identical* with that of man.

Dr. Villemin has likewise demonstrated that the tuberculous matter produced artificially by inoculation possesses the same power of transmissibility as when the malady arises spontaneously, — thus proving conclusively that in tubercle resides a special germ which does not lose its identity by several removes, no more than that of small-pox.

This view of the subject is corroborated by the pathological researches of Dr. Lionel Beale of London, the celebrated microscopist, who declares that tubercle is a minute particle of living matter, and if inoculated under favorable circumstances it is almost sure to grow, multiply, and produce other morbid cells like that from which it was derived, though he doubts their vegetable origin. And furthermore, Villemin has always considered tuberculosis a *specific* malady, for he found that a very small wound and an inconsiderable quantity of matter used was a manifest proof that the intensity of the disease is independent of the *quantity* of the matter inoculated, and that the number and extent of the internal lesions have no relations to those at the seat of puncture. A disease, therefore, that can be transmitted from one animal to another by inoculation and thus the identical germs reproduced is, strictly speaking, *contagious.*

CHAUVEAU'S EXPERIMENTS.

Further and more convincing proof of the transmission of bovine tuberculosis has been furnished by Prof. Chauveau, of the Lyons Veterinary School, who for years has been experimentally studying the intimate pathology of the various contagia. The success of his researches has afforded some startling results pertaining to the use of diseased meat. The discovery, also, that certain rich virulent matter can infect as readily through the digestive organs as by any other channel has given him a world-wide reputation; and his well-designed experiments on cattle, which he instituted in 1868, have settled forever among comparative pathologists the question of the virulency of tuberculosis.

He purchased four calves the 18th of September, from a locality where this disease was unknown, which, upon rigid examination, were found to be in fine, healthy condition. The next day he administered an ounce of tubercular matter from an old cow's lung, including the hard and soft varieties, prepared in the form of a drench and given in divided doses. The first one, a year old, began to lose condition in about a fortnight, the respirations were quickened, though the appetite remained unimpaired. On the 5th of October he gave this calf another dose, but of different and more recent matter, and within a week the symptoms of tuberculosis were apparent. Emaciation proceeded rapidly, the coat became rough and staring, and the animal had occasional fits of coughing, especially after drinking.

The second calf, six months old, had on the fourth day a profuse and fetid diarrhœa, but of short duration, and the animal remained apparently healthy for three weeks. But the characteristic symptoms, as in the other case, soon appeared, with enlargement of the glands about the throat. The third one of the same age, having shown no signs of disease, was drenched again October 9th with another kind of matter, but this calf longest resisted the action of the virus, and not until the 25th was there any appreciable derangement of health; but from that time, however, the phenomena of tubercular infection ensued with amazing rapidity, and in a week the calf could scarcely be recognized.

At the close of the experiments, November 10th, the miserable aspect of the three infected creatures, when contrasted with the thriving condition of the fourth, left no doubt in the mind of even the casual observer as to the changes that had taken place. The post-mortem examinations revealed a perfect generalized form of tuberculosis, with the local lesion of the bowels, *tabes mesenterica*, shown in a marked degree, some of the glands being as large as a man's fist. The morbid deposits in the chest cavity, also, were none the less remarkable. The lungs were studded with crude tubercles, some forty in number, varying in size from a pea to a filbert. The bronchial glands were also involved, but the liver, spleen and kidneys were not affected.

Thus, in the space of fifty-two days, we have three typical examples, nearly uniform in appearance, of the artificial production of this malignant malady through the digestive organs. In presence of these facts, therefore, I trust that all inquirers after the truth of this matter will be forced to conclude with our illustrious pathologist that the virulence and contagious properties of tuberculosis are now demonstrated beyond a doubt. And the fact that bovine animals have contracted this disease through the agency of the feed gives us an additional source of danger, for creatures confined in the same stable or pasture, and drinking from the same ponds or troughs, are constantly liable to swallow some of these germs in the mucous discharges from the nostrils of their affected comrades. In fact, it is never safe to put another animal in the same stall where one has sickened and died of this complaint without thoroughly renovating the apartment. Nor would I allow an affected creature to mingle with the healthy stock about the yard.

DANGERS OF DISEASED MEAT.

The meat from cattle affected with tuberculosis is not unfrequently seen in American markets, especially in our larger cities, and even in country towns. Yet, owing to the lack of public appreciation of any sanitary police measures to control such traffic, little or no complaint is made when we are served with consumptive beef. Thirteen years ago, after many opportunities for observation on this subject, I called public attention to the prevalence of this malignant malady among our dairy stock, that I believed was not generally recognized; and I now affirm with renewed assurance, in a pathological point of view, that the *baneful* consequences to our health from the use of infected meat and milk are not surpassed in the whole catalogue of contagious affections.

Such infected meat, therefore, should not be used; for any organ or texture in which tubercle has been deposited is surely a dangerous article of food. Much will depend, however, upon the severity of the case and *extent* of the morbid changes that have taken place. Thus, from what is known in relation to the pathology of this virulent malady, we should at once interdict the sale of consumptive beef and milk, especially in the advanced stages of the disease, when the glandular tissues have become involved.

The relation of bovine tuberculosis to public hygiene was probably first suggested by Prof. Chauveau, who nineteen years ago had already indicated the real source of danger from the use of consumptive beef and milk. But no one has done more to promulgate these investigations, or has contributed more to the advancement of sanitary science in this direction, than George Fleming, F. R. C. V. S., Veterinary Inspector to the British army, and the accomplished editor of the London *Veterinary Journal*, who, by his encyclopædic writings, is an acknowledged authority on the subject. Thus, in a recent editorial, he says, "That the tuberculosis of cattle is a *transmissible* disease, and can be conveyed not only to animals of the same but also to those of other species in various ways, is now an *established fact*, upon the recognition of which we have for many years insisted; and, since we first called attention to it, some of the best pathologists in Europe have furnished additional testimony as to the readiness with which this transmission takes place, not only by *inoculation* or *ingestion*, but also, it would appear, by *cohabitation* of diseased with healthy animals.

Eight years ago Prof. Colin, of the Albert Veterinary College, contributed a series of observations on the *communicability* of tuberculosis, which were very conclusive, and threw a flood of light on this important sanitary question in relation to diseased meat, though the *bacillus tuberculosis* had not been discovered. Several prominent German and Italian authorities have also published their clinical experience in this direction; and lastly we have the celebrated Professor Orth of Gottingen, furnishing the results of his researches and experiments. All of these are only confirmatory, however, of what has now been stated, but this confirmation is not without its value, especially in this emergency, when public opinion needs educating on the sanitary conditions of our meat supplies.

In his experiments, fifteen animals were fed with tuberculous matter from a diseased cow, and nine of those were infected, of which four died. The remaining five, becoming extremely emaciated, were killed. On examination nearly all the organs of the body were found involved in tuberculosis. In all the lungs were affected, but the serous and mucous membranes, the lymphatic glands, the liver, spleen, kidneys, and omentum were infected in different degrees. Consequently, the transmissibility of this affection to animals being proved, he insisted that its transmission to man was possible, a fact which all pathologists now admit.

TUBERCULOUS MILK.

The recent investigations of Prof. Otto Bollinger, of the University of Munich, on the artificial production of tuberculosis as induced by the consumption of diseased milk, have thrown additional light on the subject. He claims that the milk of such animals has a pre-eminently *contagious* influence and reproduces the disease in other animals experimented on from that point of view. He believes also that such milk, even when *boiled*, still retains its injurious properties. Further, he maintains that beyond doubt the tuberculosis of the human subject, though not completely identical with that of the cow, is yet strictly analogous to it, and that consequently the *wide prevalence* of tuberculosis in the native herd, at least five per cent of which are affected, is a standing danger to health of the community.

Seeing the enormous mortality from consumption, more especially in towns, Prof. Bollinger believes it to be of the utmost importance to urge upon all classes, and particularly upon *farmers*, the absolute necessity of taking every possible means of *stamping out* the disease among cattle. Meanwhile some measure of safety may be secured by the rigid exclusion of all *diseased stock* from town dairies, a measure which forms a prominent feature in the programme of the recently-established Associated Dairy at Munich, where all the cows are constantly kept under skilled veterinary surveillance, and any that may exhibit the least symptom of tuberculosis are at once weeded out.

There is every reason, therefore, says Fleming, to *prohibit* the use of milk from cows affected with tuberculosis, and especially for *infants*, who mainly rely upon this fluid for their sustenance, and whose powers of absorption are very active. Even if it did not possess infective properties, its deficiency in nitrogenous elements, fat and sugar, and the increased proportion of earthy salts, would alone render it an objectionable article of diet. In fact, it has long been known that it was liable to produce diarrhœa and debility in infants; but though many children fed on such milk have died from tuberculosis or a localized type of it in the bowels, known as *tabes mesenterica*, the part probably played by this liquid ln its production has rarely been suspected.

He further observes, also, that, as the commencement of phthisis is generally so insidious in the human species, it is very difficult to arrive with any degree of certainty at the causes which directly induce or favor its development; but, from the evidence before us, it is to be feared that at least one of its sources must be referred to the utilization of the *carcass*, but more especially of the *milk*, of phthisical cattle as food. It is certain that tuberculosis is not uncommon and that it is a destructive disease among *dairy* cattle especially, and more particularly those in towns; that the udder of these animals is one of the glands not *unfrequently* involved; that infants and adults consume milk in somewhat large quantities,— and that phthisis is a very prevalent and fatal malady in the human species, and chiefly among the dwellers in towns and cities.

Dr. Bromley of Lancaster, England, found characteristic tubercular lesion in the pulmonary organs of two pigs, which had been fed with milk of a consumptive cow; while the mother of the pigs, on being slaughtered, exhibited no signs of the disease. And therefore the pigs could not have contracted it by hereditary influence, but these morbid germs were taken in with the milk. Hence the necessity of guarding ourselves against such a diseased article of food when brought to our table.

Prof. Gerlach, Dr. Toussaint, and many other veterinary pathologists, have now demonstrated, by hundreds of positive experiments, that this milk is *infectious*, and contains a *specific* germ that can be transmitted from one species of animal to another, and from animal to man, thus proving the *identity* of this dreaded bovine malady with that in the human subject.

SANITARY REGULATIONS.

The increase and sudden invasions of disease among our stock of late years should awaken new zeal in every farmer, and admonish the whole people of the necessity of having a vigilant inspector in every State, and authorized to act in every emergency. His decision, as a pathologist, should be *final* under all existing circumstances. The public must first be served. Its demands are absolute, and in the well-being of the greatest number the rights of individuals should never interfere. The want of such a sanitary organization has cost this country thousands of dollars on various occasions; and so long as our coast is allowed to remain exposed to the commerce of the world, without a veterinary surgeon at every port, it is purely a matter of chance whether or not we suffer from the malignant diseases of other lands.

Great Britain, after severe and repeated losses of her blooded stock, has seen the necessity of the adoption of such a sanitary measure for home protection. She has accordingly appointed professional inspectors at all the principal commercial points in her vast domain; and very recently, several important stations for pathological observations have been created by the British government. This was a noble move, and in the right direction; and we hope that other nations will follow her illustrious example in behalf of sanitary science. In fact, we need such encouragement everywhere, and the provisions of the Hatch bill fund, soon to be made available, may in certain States bring the desired results. No station work which the Board of Trustees can inaugurate will be more appreciated by the good people of Maine than in this line of experimental pathology; for you have within this State a malignant disease among cattle that is practically almost unknown. The nature of this malady is not well understood by the farmer, nor very much feared, though usually recognized as consumption. The cow that coughs, grows poor by degrees, even on the best feed, and at last fails in her milk, is frequently turned over to the butcher as the last resort. It is rare that an animal in this country is financially lost from this complaint. Some meat-vender will pick up these creatures at any stage of the disease for slaughter, and thus send the flesh to market; and as cheap lean meat is always in demand among the poorer classes, it is readily disposed of without complaint, whatever may be the ultimate effect of such a diet.

In fact, the traffic in diseased animals has now become so extensive that the State ought to control this matter by more active legislation. The public health has become involved, and the importance of a veterinary inspector, to thus protect our lives and health against the invasion of disease from this source, can no longer be questioned. My attention has been called to this subject many times within the last few years, and recently even beyond the borders of New England, consequently, I have felt it my duty to thus publicly warn our people against the baneful practice of consuming the meat and milk of tuberculous animals.

The wide prevalence of this disease among our native herds and thoroughbred stock calls for immediate sanitary regulations throughout the country. Our infant population, and even adults, who are already rendered more or less infirm by their unhealthy surroundings and neglect of domestic hygiene, are now rapidly falling victims to this infectious malady, especially in our larger cities, as statistics show. Hence, in a moral point of view, also, this extensive invalid class need protection, not only to save life, but to promote their social happiness.

DISCUSSION ON CATTLE DISEASES.

After the delivery of the foregoing lecture at the Farmers' Institute at Winthrop, the following discussion of the subject under consideration took place which was phonographically reported expressly for this report.

Mr. Gilbert. I do not propose to occupy time this afternoon myself, except to say a few words by way of introduction. It is well understood that there is some alarm throughout the State in regard to supposed dangers in the direction of diseases among cattle. It is not strange at all that such alarm has spread somewhat. It is the purpose of the meeting this afternoon to give such facts in connection with the matter of cattle diseases as shall so inform the people that they will fully understand the measure of danger to which we are exposed at the present time. The notice of this, unfortunately, was quite short Not knowing that we should be able to secure the services of the lecturer until late Saturday, we were unable to announce it except through the daily papers, and as comparatively few of the people in the country have access to them, the matter has not been so fully advertised as we should wish. It is our pleasure to have with us to-day a veterinarian who has been in practice for many years, who has been for years Veterinary Surgeon to the State of Connecticut, Professor of Veterinary Science in the Massachusetts Agricultural College, and also a lecturer in several of the New England States in courses on cattle diseases. He is thoroughly posted by study, by practice and by access to everything that we have in this country that is available on the subject. He will be ready to give you information on any point that you may see fit to bring out; and he invites you, through me, to see that any and every point on which you are interested in this connection is brought to his attention. He will open the exercises of the afternoon with a formal prepared lecture, and follow that with such a discussion as you may draw out of him. It is hoped that this important subject, although somewhat dry under ordinary circumstances, will be made of such interest that you will feel the afternoon has been well and profitably spent.

Dr. Cressey—After concluding his formal lecture said: Gentlemen, I have given you briefly all that is known on the subject except to enter into the discussion of the germ theory, which would prolong my lecture another hour. I have given you the facts as they are understood by the best authorities. I desire to say that when a diseased animal shall be found, it ought at once to be taken care of. The chairman of your cattle commission should have full authority to seize such an animal and destroy it, whether the owner is willing or not. The public must be protected. Your legislature, before it adjourns, should enact a law giving full power to the chairman of your cattle commission, so that this disease, wherever it appears, may be stamped out. But the sensational and exaggerated reports that have been in circulation in this State of late have done more harm to your stock industry than would be occasioned by the killing of a dozen such herds as that which has been on your State Farm at Orono. Wherever an animal is found to be really suffering with this disease of tuberculosis, it should be killed of course, but to excite and alarm the people is unnecessary and unwise.

Question. What are some of the first indications of tuberculosis?

Dr. Cressey. Coughing and growing poor; though many animals that are in fine condition cough.

Question. Do they always have a cough?

Dr. Cressey. Not always, but those that have the disease on the lungs do. Many of them have it by ingestion and the peritoneal cavity is affected, while the lungs may not show a particle of it. I have killed several animals and found the lungs perfectly sound, but any quantity of these tubercles in the peritoneal cavity.

Question. Do you say that tuberculosis and consumption are identical forms of disease?

Dr. Cressey. If you mean tubercular consumption, I do. The word consumption is also applied to the termination of lung fever. For instance, a man has had a lung fever and a deposit has taken place in the lungs which afterwards break down and become soft, cheese-like, and is therefore called caseated pneumonia. This type of the disease is called consumption, but it is not necessarily contagious. In the human subject three-quarters of the cases of consumption are tuberculosis, probably.

Dr. Twitchell. We do not have much fear of contagion from consumption, but it is feared from tuberculosis because it is a new name among us.

Dr. Cressey. I would not allow a child to sleep with a person sick with consumption, and I should consider it criminal carelessness on the part of a physician to allow it.

Dr. Twitchell. I hope that when the doctor's paper comes out in print it will receive a most careful reading, especially by those who may have read the reports of the investigation into the disease at Augusta within the past few weeks, so that they may see the opinions of other scientific men who are as eminent in the profession as those of the extreme school that some of us have listened to there. I would like to ask if this disease is transmitted by heredity, and how?

Dr. Cressey. Yes, it may be. In fact, any infectious disease may be transmitted by heredity when the germ exists within the parent animal though not necessarily sick, but the germ may be transmitted from the parent to the offspring, under favorable conditions. If the mother has the disease and the calf is born with it, that is a case of hereditary transmission.

Dr. Twitchell. There is an old theory that we may transmit a tendency, a weakening of the power to resist.

Dr. Cressey. No matter what the hereditary tendency may be, the disease cannot exist unless the germ has been transmitted.

Dr. Twitchell. As a disease, I suppose?

Dr. Cressey. No, the germ which causes the disease.

Dr. Twitchell. Is it congenital?

Dr. Cressey. An hereditary disease is congenital; that is, comes with birth. If it is hereditary the animal is born with it; that is what congenital means.

Dr. Twitchell. How early can we detect it?

Dr. Cressey. It will depend on where it is located. You might have a hereditary condition that renders the animal liable to this disease, and yet may go through life in health, and to the butcher as good beef. You may also have the ingested form, where the disease gets into the body by eating—as stated in my lecture. The lungs in such cases will not be affected, but the animal will grow thin, waste away and die with *tabes mesenterica*, as a child may from taking tuberculous milk.

Dr. Twitchell. The outward symptoms would be somewhat the same.

Dr. CRESSEY. No, very different. The cow would have a cough in one case and not in the other. Every animal that coughs has the trouble on the lungs. I have seen an animal in good flesh that had the disease badly, but did not cough.

Dr. TWITCHELL. What organs are affected?

Dr. CRESSEY. Almost the entire body, under different circumstances.

Dr. TWITCHELL. Can it be contagious before the tubercles break, before it passes into the stage of matter, as it is termed?

Dr. CRESSEY. Yes, in many cases.

Dr. TWITCHELL. The germ may be thrown off prior to that, I believe.

Dr. CRESSEY. The germ is what causes the whole trouble, and it isn't absolutely necessary for the material to break down. In fact, the germ might be less active in the last stages.

Dr. TWITCHELL. Would you consider that there would be any danger of contagion from an animal in which you could not detect the disease by any physical examination?

Dr. CRESSEY. Yes, but I would not kill the animal unless there was great suspicion. If I was ordered to go and examine all the breeding stock that has been sent away from your College farm, both heifers and bulls, with full power in the matter, I should not kill one of them that did not show palpable signs of the disease. If you do otherwise you will have to select a good many animals from other herds than those containing Orono stock. Under such a policy many fine animals in Massachusetts and Connecticut would have to be sacrificed, and Herd Book animals, at that.

Dr. TWITCHELL. How may we know whether we have any symptoms of the disease in our herds?

Dr. CRESSEY. Study up the subject thoroughly.

Dr. TWITCHELL. At what stage of the disease would the milk or the meat be injurious?

Dr. CRESSEY. When a cow coughs badly, has begun to grow thin, and the lung is involved, I should not call her fit for beef. But if I should see an animal in good condition, slick, and the lungs didn't adhere to the ribs, even though there might be a few lumps of cheesy matter within the lungs, I would not condemn it, nor do I think that the milk from such an animal would be dangerous.

Dr. TWITCHELL. Does high breeding of our Jerseys render them more liable to the disease?

Dr. Cressey. In-breeding is one of the prime causes of the spread of the disease by heredity.

Dr. Twitchell. My question is with cows bred with special reference to butter making qualities, not necessarily breeding in-and-in.

Dr. Cressey. I don't know as there is any harm in that, unless the animals you breed to might be infected.

Dr. Twitchell. How about warm, close barns, such as we have been lately in the habit of building?

Dr. Cressey. Cold, damp sheds, dark underground stables and ill-ventilated abodes all contribute to the production of this disease, and especially the warm stables with a vitiated atmosphere.

Dr. Twitchell. May the disease be as readily transmitted by the male as by the female?

Dr. Cressey. I think not.

Dr. Twitchell. You would not fear to use a male unless there were actual signs of the disease apparent?

Dr. Cressey. I would not. There are some very nice questions, however, on this point of breeding. There is a tendency in this diseased substance to be deposited in the ovary, among our thoroughbred cows, and those cows are constantly in heat, much oftener than the usual times, and yet they will not breed under the best service that can be procured, one or both ovaries have become affected and that prevents the ova from being impregnated, so, happily, in that case the disease is not transmissible. Yet, on the male side, we have the same self-regulating provision, for if the disease is only in the lungs of the bull, it does not affect his potency to beget stock, and unless poor from the effects of this disease I should not fear the result, but the organs of masculinity are not infrequently involved in the bull, and all such animals should be discarded.

Dr. Twitchell. It does not follow because the disease is in the lung that it is all through the system?

Dr. Cressey. Not necessarily.

Question. You would not be afraid to breed a cow to one of these fourteen Orono bulls?

Dr. Cressey. Not if they didn't show any palpable signs of the disease. If you cannot see anything wrong in the bull, no matter if he is the offspring of one of those cows—and there is an interesting point about that. The disease came on within a year, apparently, and if a bull is two or three years old and was bred before the disease appeared, he is scot-free, of course, but if any of them were bred just before the cow died, that makes a great difference. I would like to ask Secretary Gilbert if there are any calves now living that were begotten there after this disease broke out in that herd?

Sec. Gilbert. Not one; the last animal sold from the herd was a year and a half before the disease appeared.

Dr. Cressey. That is an important consideration. The disease went rapidly through the herd. I would not hesitate to breed a cow to one of those bulls that is now two or three years old, if the bull doesn't show any signs of disease to-day.

Question. Do you say it is not possible for a bull to transmit the disease if he shows no signs of it himself?

Dr. Cressey. I should not care to say it is impossible, because that would come within the line of heredity. If a bull is badly affected with a cough, emaciated, growing poor, I should not want to breed from him; but if I saw no signs of disease in the bull, if he chews his cud and looks healthy and bright, and can be run about the yard rapidly without coughing, without any signs of disease, I would as lief have him as the best thoroughbred bull in the Herd Book. If you discard these animals because tuberculosis has since prevailed in that herd at Orono, in order to be consistent you will have to include a large number of animals from some of the best thoroughbred stock in the State.

Dr. Twitchell. The statement was made on the stand at Augusta, by an expert, that a bull killed from the State College herd was found, upon microscopic examination, to have tuberculous matter in the lungs, and that he was absolutely unsafe to breed from, and that he would be sure to transmit tuberculosis to his progeny.

Dr. Cressey. If he could not see any disease without the microscope, it must have been miliary tubercle, and that is drawing things pretty fine. The danger of transmitting this disease by heredity is exaggerated. Should we dare to say that an apparently healthy young man and woman shall not be allowed to marry because some of their ancestors have died from tubercular consumption? Should we have a law by which a woman could get divorced from her husband if she discovers, by searching out his genealogy, that his great grandfather died of consumption? It is this exaggeration and excitement, these sensational and extreme statements, that are doing the greatest harm in this State.

Question. Is there no practical way by which milk can be tested, so that we may know whether it is safe to use?

Dr. Cressey. A needle in a hay mow could undoubtedly be found if sufficient amount of inspection is given to all the hay, but it may take an immense time to find it. If the microscope should be applied to every drop of milk, separately, in time we might discover a germ; but only a few germs would pass into the milk unless the animal is palpably sick. Then the milk is poor, unusually blue, not creamy, and hasn't that beautiful complexion that belongs to good milk. But if you have a tuberculous condition of the udder, then the very glands that produce the milk are discharging their sewage into it and the milk will be what is usually called gargetty, and in this the germ could be easily detected, but not found in good milk.

Question. Do I understand you to say that pulmonary consumption in the human family is contagious?

Dr. Cressey. No, not if you mean caseated pneumonia and not tuberculosis. In the various types of phthisical diseases, tubercle may or may not be present.

Question. Is caseated pneumonia what we call old-fashioned consumption that a person will be sick with for a number of years?

Dr. Cressey. No, old-fashioned consumption as you describe it is tuberculosis.

Question. That you consider contagious?

Dr. Cressey. Yes, sir, every time under favorable conditions.

Question. Is it contagious from animal to man and from man to animal?

Dr. Cressey. Experimenters have produced the disease in animals by taking the virus from man, and may be transmitted both ways.

Question. Do not animals often have a severe cough and not have tuberculosis?

Dr. Cressey. Yes, in many instances.

Question. How are we going to determine?

Dr. Cressey. You have got to be pretty sharp as a diagnostican.

Question. How do you account for the fact that you will sometimes see the father and mother of a family and several of the children die of what we call pulmonary consumption, the old-fashioned disease, and yet other children in the same family will live to a good old age in good health?

Dr. Cressey. If one generation escapes, the next may not. The good Book says the iniquities of the father shall be visited on the children of the third and fourth generations.

Question. Then the bull and the cow may both be affected with tuberculosis and the progeny may be exempt from that disease?

Dr. CRESSEY. Yes, possibly, in a certain case, but I should hate to breed from a bull and a cow, both of which were diseased.

Question. The lives we live have something to do with developing it?

Dr. CRESSEY. Certainly, as I have said, dark, underground stables, unventilated abodes, all conspire to re-kindle this constitutional taint into morbid activity.

Question. People working in shops and living indoors are more likely to develop it?

Dr. CRESSEY. Yes, the same disease would be more likely to come out under such ill conditions than if the person should go to mining in Colorado.

Question. Is tuberculosis more prevalent in animals that are stabled all the time than in those that are out in the pasture?

Dr. CRESSEY. I think it is, because it is these ill-ventilated abodes that predispose.

Mr. WINCHESTER. Once or twice in my life I have dressed fat and sleek beef creatures where the lungs would be all right, but on the lungs and on the ribs there would be a substance that looks like warts all adhering together.

Dr. CRESSEY. Could you pull the lungs out of the chest?

Mr. WINCHESTER. Oh yes, the lungs were all right and healthy, but these warts were attached to the lungs and the ribs and grown on to the whole of that cavity. The blood was all right, bright and natural.

Dr. CRESSEY. Those are what are called angel berries by Scotchmen; they are of all sizes from bird shot up to the size of your thumb, and looked like pieces of proud flesh.

Mr. WINCHESTER. No, these were yellowish. Would you consider such beef healthy?

Dr. CRESSEY. No, that is tuberculous infection. You will find some on the caul sometimes. I should throw such beef away. I have known such beef to be cleaned and sold in the market, but I do not consider it fit for food.

Question. Have you had occasion within a short time to examine cattle afflicted with tuberculosis?

Dr. CRESSEY. Yes, quite a number.

Question. Do you believe that this disease is more or less abroad?

Dr. Cressey. Yes, this State is not the only one afflicted with it. If you should kill every animal in the State, and then go to Massachusetts and buy others to take their places, you would not be any better off.

Question. Yet you claim that there is no special danger of a general outbreak?

Dr. Cressey. You are not going to see an epidemic like the epizootic in horses. There is no reason in exciting all creation because a few animals are sick. If you should go through the State and find how many animals are diseased according to the definitions I have given, you would find a wonderful balance in favor of health; even in the worst German herds only about five per cent are affected.

Question. In the case of a single sick animal in a herd, would you recommend the destruction of the others that have been exposed?

Dr. Cressey. No, unless an animal that had been in a contaminated stall right in the very place where this diseased creature had stood. It would be folly to kill the whole herd because one animal was affected.

Question. What would you advise us farmers to do in case we should detect a case among our herd?

Dr. Cressey. Kill that animal; thoroughly renovate the stall, scrape it out, cleanse it thoroughly. If you see an animal growing poor, showing symptoms of the disease, and you are not ready to kill it, quarantine it. And here is one of Nature's wise provisions about that, a sick animal separates itself from the herd, it stands under a tree nodding and sleeping, it will not run about with the others because it hasn't the strength, it will quarantine itself. You want to learn more about the business. I believe there is no kind of knowledge that it would be more to the financial interest of the State to disseminate than that in regard to diseases of animals and other branches of veterinary science. An agricultural college that does not provide lecturers on veterinary science does not fulfil the design of such an institution. They devote attention to fancy plows, new fashioned harrows and horse rakes, but on these vital questions, which so intensely affect the financial welfare of the State and its citizens, they do not give you a word of instruction. You send your boys there to be educated in the business of farming, and they come back and tell you they know nothing about the diseases of stock. It is unfortunate for the farmers that veterinary science has not been made a more important branch of instruction. You should ask the public to furnish money to conduct that college on a broader scale.

Question. I would like to ask if there is any remedy for an animal that is in the first stages of tuberculosis?

Dr. Cressey. No, nobody knows any remedy that will cure the disease, although much has been done to ward it off. We might by the use of antiseptics and tonics keep the animal alive for a few years, but I do not suppose that they could be cured.

Question. If a mother and sire are afflicted with tuberculosis, and the offspring is removed from the mother at birth, so it gets none of the milk, would that animal be more likely to be afflicted with this disease than a calf from healthy parents transferred to this diseased cow and reared by her?

Dr. Cressey. Yes, and I have a case in mind that will, perhaps, throw some light on the subject. A gentleman in Connecticut had a cow evidently sick with tuberculosis. She dropped a calf, grew weak and emaciated very rapidly afterwards. We allowed the calf to suckle from the mother for a week or ten days as an experiment. The calf grew so poor, and had the diarrhœa so badly that it could not stand and soon died, whether from the poor quality of milk I could not say, so I took a healthy calf from a native cow, and allowed her to suckle from this sick cow, until the cow died soon afterwards; we killed the calf, and it showed marked signs of the disease. That was brought about by diseased milk.

This infected milk contains a substance which, when fed, will produce tuberculosis. I do not wish to be misunderstood on this point, for it is of no use to get up an outcry and thus injure the State more than the destruction of a dozen such herds as that at Orono.

Question. Does this disease ever affect the udder?

Dr. Cressey. Yes, we have what may be called the gargetty type of the tuberculosis, producing a hardened condition, a gargetty bunch up within the udder.

Question. Please to describe a tubercle as we find it encysted in the lung or in the udder?

Dr. Cressey. I would like to say one word as to definition. I see that not only you, but hundreds in the medical profession, have gone astray on a single point. The noun tubercle can mean nothing else than a little lump of tuberculous deposit within the tissues, and when we use the collective term, "tubercles," we mean any mass or portion of that matter that is tuberculous; and any matter that is tuberculous has a cheesy product and a germ. A cheesy product that has no germ is pseudo-tubercle and is as harmless as cheese; but if a germ is within the tuberculous deposit then it becomes infectious.

Question. If your position is correct, why do the Massachusetts Commissioners refuse to allow Maine milch cows to be sold in that State?

Dr. Cressey. They must answer that question.

Question. Why do dealers refuse to buy them?

Dr. Cressey. Because they could not sell them. Prof. Stockbridge, the chairman of the Massachusetts Cattle Commission, has not heretofore considered this a contagious disease. I do not believe, however, the State of Maine furnishes any poorer beef or milk than the State of Massachusetts. I know they have plenty of the disease there.

Question. Was it right, in your opinion, to kill the herd at Orono?

Dr. Cressey. I think under the circumstances the Commission did just right.

Question. Were there not some that were not diseased?

Dr. Cressey. Probably there were. They had been mingling together. But it is of no use to make a sensation and convey the impression that all the cattle in the State are affected. A few years ago they had a scare in Illinois. They had a disease among their Jersey cattle that a famous doctor pronounced pleuro-pneumonia; they quarantined the State against every other State out there, and the decline in the price of Jersey stock in the country was a thousand times greater than that of all the animals originally quarantined there. That is what I object to, this everlasting hurrah which works such enormous mischief to the stock raising industry.

Question. If the barn is kept too warm, will that produce the disease of itself?

Dr. Cressey. No, not unless the germ is there. Unsanitary conditions have a tendency to rekindle this constitutional taint into morbid activity, but those conditions do not produce the germs. Of course the surroundings should be sanitary, neither excessively warm nor too cold. A barn should be dry and well ventilated. I do not believe in double boarded barns, unless ventilation is otherwise provided for.

Question. In order to maintain health the temperature should be kept at about such a degree, I suppose.

Dr. Cressey. Extremes should be avoided as much as possible. When the temperature is kept too high the process of respiration becomes abnormal, and tends to produce a diseased condition.

WESTERN COMPETITION.

By J. M. Deering, President of the Board.

Ladies and Gentlemen: It seems almost unjust in me to undertake to interest you with any thing that I can say. For certainly if appointed to this place for any qualification I possess, it must be because I have tried to deal honestly with the soil; and if put to the test this is the only qualification I should dare attempt to prove. But as it becomes my duty, and certainly pleasure, to address you for a short time upon matters bearing a close relation to the most important industry that exists, and though I fail to interest you, if I do the best I can, I feel assured you will expect nothing more. All who are engaged in tilling the soil represent an industry that was first given by God to man, with all the emoluments and privileges that by his intelligence and energies he could eke out by the sweat of the brow. Agriculture is an industry that underlies all others, and on the success and prosperity of which depends the success and prosperity of all other trades, professions and callings. While we must admit that a prosperous agriculture is the foundation stone of a prosperous community or even nation, we must also admit that other industries are greater benefactors to agriculture.

While to-day there is an earnest effort being made to improve the agricultural industry, between this and all other well directed efforts for improvement in other industries there should be no jealousy, no personal rivalry, but rather cordial good will and earnest co-operation for all true interests of the land, granting the fact that it is only through the channels of diversified industries that the teeming millions of toiling men and women of the country can obtain a respectable living. As farmers we should not be discouraged by short crops or partial failures, but bear in mind that if our industry is not favored to any great extent by our legislators and patriotic statesmen, we have nature's laws to help us out, of which no other industry can boast. And also bear in mind that life in this fast world, in whatever profession man is engaged, is a constant struggle for existence; and he who labors most persistently and practically, is the one to be found at the front in the acquisition of the comforts and the good things of life. The subject I have chosen I consider of vital importance to the farmers of our State, and, as I understand, has not been brought to the notice of the Board of Agriculture for some time at least, and if properly demonstrated would, in my opinion, be decidedly in favor of its prosperity.

Can the farmers of the State of Maine compete with other sections of the country in producing beef and dairy products, and also other farm crops? Why the subject is so forcibly impressed upon my mind, at the present time, is on account of the low prices of the majority of all farm products, and from continually hearing the statement made that we cannot compete with the West. Recently I had occasion to spend a few weeks in the great Northwest, more frequently called by those persons who are engaged in the business of selling homesteads to settlers, the promised land of America. It cannot be expected that I saw the whole West, but I did have the pleasure of spending a week with representatives of every State in the West and South, with the exception of Alabama and California. These gentlemen, many of them, were large farmers. Some I could mention had the present year as high as two thousand acres planted to cotton. Others represented wheat fields of five to seven thousand acres. Others were represented to own some hundreds and even thousands of head of cattle and sheep. And as these gentlemen were agreeable, intelligent and liberal in their conversation, it caused me to ask what might seem to them many foolish questions. And let me state that any and all of these gentlemen, no matter from what section of the country they hailed; no matter how close they were questioned, not one word of discredit could be drawn from them in regard to their own section of the country. If anything, theirs was a little the best.

In conversing freely with these gentlemen while passing through those beautiful wheat fields up through the Red River valley in northern Minnesota, and also along the Northern Pacific Railroad in Dakota, on an excursion trip given to the delegates of the Farmers' National Congress by the Minneapolis, St. Paul and Manitoba Railroad Company, from St. Paul to Grand Forks, via Northern Pacific, and returning by another route through Dakota, making many stops. One I will mention was upon the Lockhart farm, where seven thousand acres were in wheat this last year; and also the famous Dalrymple farm, with its forty-five thousand acre wheat field, where steam threshers could be seen in every direction, reapers with two and four horses attached cutting and binding. At the same time wagons could be seen crossing the fields loaded with grain going to the elevators situated upon the railroad, and team after team plowing as fast as the wheat could be hauled away and the straw burned.

With this situation of things and with a beautiful clear day, making it an easy matter for the visitor to look upon those lines of wheat stacks as far as the eye could reach, and just beyond this farm thousands of acres of land unimproved, is it any thing strange that the Maine farmer should be placed a little off his base? Now I must confess that I was somewhat enamored with the country, and began to think that I had pitched my tent somewhat outside of the best agricultural section of the country. Yes, it all looked well. It looked as though farmers were getting rich growing wheat. And it presented itself so forcibly upon my mind, that to satisfy myself of the fact as to whether or no the western farmer was not making more than his share in the profits of farming, I was obliged to appeal to a method of figuring. And in order to get satisfactory information I asked all the questions I could think of. I obtained an Annual Report of the Board of Trade of Minneapolis; I subscribed for an agricultural paper printed in St. Paul; I also consulted the United States Agricultural Commissioner's Report, and compared it with what little that I knew about Maine farming.

It is not my intention to speak one disparaging word of the West, for certainly, generally speaking, their soil is good and in many sections they have a beautiful country, but to compare notes and figures and ascertain if possible whether or not it would be sound judgment or good policy for the Maine farmer to dispose of his effects and remove to that so-called beautiful land in order to benefit himself in the business of farming. As we have just passed through this beautiful wheat country, let us take the wheat crop and figure for a moment. The United States Commissioner's report gives the average yield per acre for Minnesota in 1884, thirteen bushels, average price eighty cents per bushel, average value $10.40 per acre; Dakota, average yield sixteen bushels per acre, average price seventy-two cents, average value per acre $11.52.

Why I speak of this section of the great wheat belt is because the growing of wheat is made more of a specialty than in any other section of the West at the present time, and gives near the average of all the other States, making it safe to accept this section as a basis to work from.

How is it this present year? Upon the best farms they claim fifteen bushels yield per acre, while upon many a much less yield was harvested. At present wheat is selling at different stations upon the railroad from forty-seven to fifty cents per bushel. This would give for the best result $7.50 per acre. This shows a falling off in prices and also a depression in the business.

Now, what does it cost to raise an acre of wheat? I was told by a gentleman who represents a large wheat field in Dakota, that to hire the labor, the wear and tear on machinery, taxes and all other expenses pertaining to the running of one of these large farms would be somewhere between seven and eight dollars per acre. Now, if this be true, you can see at once the small margin these large farmers are working upon at the present time. He remarked that small farmers were doing the best. He says a man with a pair of good horses can plow, harrow, seed and harvest one hundred acres of wheat, if he is diligent from the time the spring opens until the ground shuts up in the fall. And if his crop yields him fifteen bushels per acre, at fifty cents per bushel, he receives $750 for his year's work. Let us bear in mind that this is not an average yield, but a good result. Some will not do as well, and perhaps some may be a little better. Now, this is the farmer's whole year's work, and if he is prudent and has not too large a family to support, and is content to live in a shanty and shelter his horses in a straw shed; and is lucky enough not to get blown out of existence by one of those terrible cyclones that visit that country frequently; and does not get short of wood, or coal, or provisions, or water during some of those blizzards that often blow a couple of weeks without cessation, perhaps he can save something. But what is he really doing? Why, he is simply selling his labor for $750 per year, and throwing in 1500 bushels of wheat and the fertilizing material from his soil to bind the bargain.

To prove that farmers are somewhat aware of the fact, let me read to you a few lines taken from the St. Paul Farmer: "Low prices and a decline in the average harvest have set the farmers of Rothsay, Wilkins county, to thinking over the ways and means out of the present depression. Like sensible farmers they have concluded that their cows must help solve the problem, and the Rothsay Creamery Company is the outcome." It goes on to say, "We consider this one of the most cheering indications that the farmers of the Northwest begin to consider their situation from a practical standpoint, that they must appeal to some method whereby to work themselves out of a depression into which a mistaken idea of what constitutes profitable farming has led them. And the present financial cloud that rests over the heads of the farmers of the whole Northwest can only be cleared away by the establishment of cheese and butter factories, or some line of cattle husbandry."

This seems to be sufficient evidence that the farmers of the State of Maine can compete with the West in wheat growing even with the poorest paying crop they raise.

The next crop we will compare is the corn crop. I will not be so unfair as to compare the State of Maine's corn crop with the State of Minnesota, when only the southern sections are adapted to this crop, with an average yield of only 20 bushels; or even Dakota with its 18 bushels average yield, but will take a crop right in the midst of the great corn belt, Kansas, if you please, with its bountiful average yield of 35 bushels per acre. Now, when the Maine farmer rides through a solid corn-field 400 miles in breadth and nobody knows how long, he will find himself off his base again. But I intend to figure this just as it is, let it come as it will, for or against us.

In conversation with a gentleman, he remarked, "You had better sell your farm for just what it will bring and come to Kansas, the banner corn-growing State." "Why," he says, "you can make more money in one year in Kansas than you can in Maine in five. Why, I was born in old Kennebec County and can well recollect how farming was done thirty years ago."

"It was a rock here, a stump there, cutting bushes, building brush fence, knocking around all winter in the cold." "Oh," he says, "I know all about the State of Maine; it is not worth living in as compared with Kansas." Thinking the gentleman was putting things rather strong, and mistrusting that he was a real estate agent instead of a farmer, I asked him if he would please tell me how large a farm I would have to own in Kansas and devote it to corn-growing to receive $2000 profit after all expenses pertaining to the farm were paid. After figuring for a while he replied 1000 acres. How do you get the answer? Well, he says, last year the average yield was 40 bushels per acre; corn was worth upon the farm 15 cents per bushel; it cost 10 cents per bushel to raise it; this is $4 per acre to raise it. Six dollars per acre the crop is worth, leaving two dollars profit per acre. This would require a nice farm of 1000 acres. I consulted the official report and found the average yield was correct, the price per bushel was all right, but found no data to prove that an acre of corn could be raised for $4. But we will grant it. Now, I am well aware that to plow an acre of land, free from stones, harrow it, plant and cultivate it, shock and husk the corn cannot be done in Kansas any cheaper than it can in Maine under the same conditions.

Now, as we are dealing in average yields officially, let us take the average yield of the State of Maine and see how large a farm we would have to own to receive \$2000 profit upon the same conditions as the Kansas farm. The average yield of corn is given at 35 bushels, the same as Kansas. Now comes the most difficult part of the question to settle—what does it cost to raise corn in Maine? I am well aware that the figures I am going to give will not be accepted by all farmers, but I have noticed by experiments given by farmers throughout our State, that the cost of raising corn has been considerably reduced within the last few years. This last year I kept an itemized account with five acres of yellow corn and also two acres of sweet corn. The yellow corn cost 33⅓ cents per bushel. Our average yield, 35 bushels, would make an acre cost \$11.62. Corn was worth 60 cents upon the farm, and this gives us \$21 for the acre, and we have \$9.38 cents profit per acre. This would require a farm of 213½ acres in Maine to be equal to a 1000 acre farm in Kansas.

How is it with sweet corn? This is a crop that Maine has the advantage in, on account of its reputation on the goods. Maine has the reputation of producing the best quality of sweet corn of any State in the country. It cost \$97.60 to raise two acres, and the crop sold for \$141.22. This gives me \$21.81 per acre profit. This would require a nice little farm of 91½ acres to be equal to 1000 acres devoted to growing yellow corn in Kansas.

These figures may look somewhat strange, but they are drawn from official statistics and practical experience, and they prove to be correct. It is not in profit per acre or average yield where the western farmer has the advantage over the Maine farmer. If there is any advantage it is simply in area, and I will leave that to your best judgment to decide whether that is an advantage or not. I have never yet seen a Maine farmer who could not do all the farming he wished to.

Potato crop. This crop needs no ventilation. There are only two States that show a larger yield per acre, and these are both New England States. One exceeds Maine only five bushels, the other four. Maine's average yield is 116 bushels. When the yield is lighter the price per bushel is higher. The great transportation regulator evens it up just the same with potatoes as it does with all other farm productions, beef and dairy products. This part of the subject brings us home to our old stamping ground, cattle husbandry, the foundation stone of a prosperous agriculture. In all older sections of the country it is indispensable on account of its contributing to the soil a fertilizing material that assists the growth of all crops. And in the new sections more convenient on account of not having home markets for other productions, and being easier conveyed to far off markets.

We find reported in the United States Commissioner's Report of 1884 whole number of cattle in this country 42½ million. We also find at that time 13½ million milch cows. According to the past increase probably there are more than 15 million at the present time. When we add to the cows the heifers growing up to make cows, we find very near the same amount invested in the dairy interests as in the beef-growing interests, and this divides the cattle industry into two distinct interests. Following up the same report we find the gross yearly increase from the dairy to be 350 million dollars. We also find the gross yearly increase of the beef-growing interest to be very near 240 million dollars. These figures prove the fact that the cattle industry of this country pays to the farmers nearly one-half the capital invested in it as a gross yearly increase, besides the fertilizing material that cannot be measured by dollars and cents. It also proves that the dairy interest pays 110 million dollars more than the beef-growing interest, less the amount that should be charged for the extra labor for manufacturing the milk into butter and cheese. The cheap grazing land in the West has caused many States in the East to accept dairying more as a specialty within the last few years. The State of New York, for instance, has two million cow kind against 448 thousand oxen and steers. The State of Massachusetts comes next, Vermont next. Maine is very nearly divided, but all indications seem to point in the direction of more dairying for Maine. Some twelve years ago, when wheat-growing failed in the great State of Iowa, farmers were obliged to accept cattle husbandry. Large butter factories have been established and Iowa creamery butter holds a strong position in the markets of this country to-day. I had the good fortune to meet a gentleman who told me that he kept about 100 cows and sold his cream to a certain butter factory company; he said his cows paid him about $30 per cow per year. And this is a good result for our State. Within a few days I noticed in a western agricultural paper that the average yield of butter per cow per year in Iowa was 71 pounds, and Wisconsin 82 pounds. I do not know the average yield per cow in Maine, but will say if there is a farmer present who owns a cow that will not make more butter than either of these he ought to dispose of her. Why, my nearest neighbor has run a dairy of ten cows this last year, and in twelve months he made 3010 pounds of butter, and told me that if nothing happened his cows would pay him $110 each for this last year.

Of course these are extreme figures, but I hold what can be done in one section of this State can be done in another, and I dare say, in this very town there is another farmer who can claim as good results as this; and so on all through the State of Maine where farmers are paying strict attention to this line of business. Now, according to the best information I can get, it requires, to put it safe, two cows in the State of Iowa to pay as much yearly income as one in Maine; and if we can compete with Iowa we need never fear any other State. With our favorable climate, with our markets at our own doors, by procuring good strains of butter-producing animals and paying strict attention to the business, we can compete with any section of the country in this line of cattle husbandry.

How about the beef-growing interest? If there is any line of cattle husbandry that needs any encouragement at the present time it is the beef-growing interest. The present prices of beef seem to discourage farmers, and there is a stronger friendship prevailing in my part of the State between the farmer and the cow, and the Jersey cow, too. Now, I am very sorry to own this fact, but it is too true. Is it good policy for farmers in accepting the dairy as a specialty to accept this breed? There is one thing certain, if we accept this breed we sacrifice the beef qualities. Perhaps we may be obliged to admit that they are a more reliable butter-producing animal than the Durham or the Holstein. But, suppose we all get established in dairying and accept the Jersey cow, and the prices of butter should fall below a living profit, think what the State of Maine would be obliged to sacrifice in order to get in position to grow beef again.

Well, here we are with these two interests nearly equally divided in the State of Maine. Must we all accept dairying simply because we have got the idea that we cannot compete with the West in growing beef? We will admit that there are some things about dairying that are a little more attractive than beef-growing. For instance, we can dispose of our product every day, week or month, and receive our cash in hand, while in growing beef we want eight months and even a year in order to get our product into cash. It is not my style to square around in order to make things appear in favor of one interest or the other, for certainly we should shape our agricultural interests so as to be of the greatest advantage to us financially; and it would be a true statement to make that the dairy interest is a better paying business at present than the beef-growing interest. But let me ask, do you have the least idea that this state of things will always prevail? Are you and I, Mr. Chairman, going to stand aside and see our neighbor receive $100 income each from his cows and we receive only about one-half that amount upon our steers? Why, certainly not. We will drift into dairying, and so the drift will go on throughout the whole country until these two interests even up in profit. It is the dairy and the sheep interest that pay the best this year. It is liable to be beef and the fruit crop next. Hence, I claim that a variety of productions is the broadest and most reliable road to success in farming in Maine.

Now, this has nothing to do with competing with the West, but it does have something to do with these two interests competing with one another in our State. If I should ask the question, Can the Maine farmer make a good profit at the present prices of beef? the answer would be, No. And if we should ask the western beef grower the same question, his answer would be No, too; and yet we are receiving higher prices for beef than farmers received before the great areas of cheap feeding grounds of the West were utilized for cattle growing. I dare say that there are farmers present to-day that have sold seven-foot cattle for $50 to $75 a pair, and did not grumble at the price received either. Let us consider that it requires 14 bushels of No. 1 wheat in Dakota to be equal to 100 pounds of choice beef in Maine to-day. If we were suffering from the effects of a depression in prices, and the western farmers were growing rich by the sale of their productions, then we might complain. But is this the case?

I recently read an abstract commenting upon large cattle ranches in the Northwest. The gentleman was a ranche owner himself. He quotes that large dividends had ceased, and cattle raising must be managed more carefully and with more economy in the future. He says the Southwest, and Arizona included, is subject to long and continued drouths, and not until a system of irrigation is established can cattle raising be made successful. It is too risky to undertake to winter large herds of cattle in that country without shelter.

When these requirements are met we never need to fear—the beef cannot be shipped into the State of Maine and sold at a mean figure. If it is, it will be at the loss of some one. Some few years ago the cattle business in this country was good. Men with capital saw this, and large amounts of capital were invested in this industry. English capital was brought in and invested; even statesmen who handle the reins of government invested in ranching. Lawyers, orators, theatrical managers, invested in the business. Purchasers were sent into the South and Southwest, and young cattle brought a good price. These cattle were moved North upon the cheap feeding grounds. This made room to raise more in the South, and so the business boomed as no other industry ever did in our country, and the consequences are the business has a little overreached the demand in the East, and prices have fallen below a rich harvest for the western ranchemen; and of course it affects us in Maine in the same ratio, and no more.

Now, I would not be the one to put the argument too strong, for certainly if we cannot compete with other sections of the country, it is high time we knew it. But I will stand behind this statement, that whoever raises good beef and ships it two or three thousand miles into the State of Maine, cannot get very rich at the present prices, after paying the necessary expenses of slaughtering, commission, freight, &c. As I have been engaged in this business all my life and have made it somewhat a study, I feel safe in saying that the prices of beef have reached hard pan, and the next change will be for the better. Of course the prices of beef will vary according to the seasons of the year. The demand will be the best in the spring and early summer. Last spring I sold ten three-year-old steers for nine cents per pound, averaging $80 each after the commission for selling was taken out; and a year ago this fall beef was as low within one cent per pound as it is this fall or winter. In order to steer our agricultural ship into a safe financial harbor, we must keep our eyes upon the points of the compass. I say emphatically that the State of Maine is a good agricultural State, and I think you will bear me out in the statement that we can compete with other sections of the country when we consider that it requires two and a half steers in the State of Texas, of equal weight and quality, to be worth one in Maine. It requires two cows in the State of Iowa, of the same milk and butter producing qualities, to pay as a yearly income as much as one in the State of Maine. It requires three and a half acres of corn raised in the States of Kansas and Nebraska to be equal in money value to one in Maine of the same average yield. It also requires three tons of cultivated hay in the State of Illinois to bring in the markets in cash the same as one in our State; and two acres of land devoted to garden truck, handled by a skillful gardener, will pay as good, yes, a better profit, than one hundred acres of wheat in Dakota this present year. Let us consider that twelve years ago the average yield of wheat in Missouri was thirty bushels per acre; to-day it is less than twelve. Iowa shows about the same decrease. This proves that in some States the productions are falling off; while in the State of Maine we can note an increase in its productions. For instance, let us look at our horse industry—only two States exceed Maine in good horses, and the space between these is fast closing up. The interest is on the increase. The average yield of milk and butter per cow has been increased within the last ten years. Our steers are better fattened and are brought to maturity at a much younger age, and no State in this country can show a team of oxen and steers that could take the blue ribbon from the one exhibited at our State Fair last fall. I visited two western State fairs, and if I am a judge, I saw nothing that could compete with them. The acreage of corn is on the increase, and I trust the day isn't far distant when the farmers in some sections of our State will raise all they need for their own use.

Look for a moment to our fruit crop, especially the apples, and imagine the change that has taken place within the last twenty years. Now, farmers, you can accept or reject my views as your better balanced judgments direct; but I say once more, persistently, that when we deal honestly with the soil, and bring out its latent powers of production by scientific and practical work; and when we consider our numerous industries, scattered as they are throughout our State and bringing our markets home to our doors; and with the diversity of our soil and the variety of crops we can produce; that the active and enterprising farmers of our State never need to fear competing with the farmers of the West or the South. They can get just as good a living and enjoy as many comforts of life as they.

THE BUSINESS HORSE.

By THOMAS DAGGETT, Foxcroft, Member of the Board for Piscataquis County.

I feel that an apology is due from me for appearing before you upon this subject, a subject with which I presume you are all familiar, and which has been talked upon and written about as much and perhaps more than any one subject that interests the farmers of Maine. And, yet, through ignorance of business many are failing to realize any considerable amount of profit, which a thorough knowledge of the details of the business would certainly give those engaged in it. This is a business which is engaging the attention of the farmers of this State more, perhaps, than any one occupation which is being pursued. There is one thing that will recommend this paper and will give you great pleasure and satisfaction, and that is its brevity. I do not purpose at this time to inflict upon you a long and useless eulogy on the horse, his usefulness or his natural or acquired abilities. But what I purpose to do in the little time I shall occupy, is to throw out some practical hints and suggestions (or what appear to me to be practical, after years of hard study and sometimes bitter experiences), for I claim that there is no business, however intelligent or well read a person may be, or how well versed in the scientific principles of that business, or however much they may believe in certain theories and dogmas, in which he may succeed by this knowledge alone. In fact, there is no royal road to success by a mere application of a few theoretical ideas gathered from cranks and speculative schemers.

The only sure way to success, I believe, as applied to agricultural pursuits is by a thorough knowledge of scientific principles combined with practical experience. The business of horse raising is one that is carried on to a large extent all over the State of Maine, and yet it is perplexing to some, annoying to others and a continual drain upon the pockets of many; while to quite a percentage of those engaged in the business it is a pleasure and a source of pecuniary benefit.

The people of this State are taking hold of this industry with renewed energy and with steadily increasing knowledge and understanding of the business, also with increased facilities for intelligently carrying on and conducting an enterprise of such magnitude. Yet, after all, is it not strange that the demand far exceeds the supply;

that the cry comes from all directions for more of Maine's good horses? Why is it that Maine is being drained of her best stock, and why is it that Boston, New York and other markets are continually clamoring for Maine horses? It is simply this, that through the persistent, united, persevering, intelligent and practical efforts of men who are able and willing to carry on the business, they have raised the standard far above that of any other State in the Union. And that is not all. The demand is steadily increasing, and will continue to increase just so long as the intelligent people of this State continue to put forth that zeal and energy that has characterized their efforts in the last quarter of a century.

It is within my recollection that horses that could trot their full mile in three minutes were considered very fast, and the person owning one that could make that time had quite a fortune. Now they would be considered only fair driving horses. In fact, for a first-class gent's driving horse they should be able to trot a mile in about 2.40. *Then* horses that weighed 1000 pounds were considered heavy enough for business on the farm or for lumbering, in fact for all draft purposes, and it mattered little whether they looked like a horse or a mule, provided they had hoofs and hair. Now the weight is taken into consideration, varying from 1100 to 2000 pounds, according to the especial work required of them. They must be symmetrical in form, sound feet and glossy coat of hair. And the disposition is by no means to be overlooked by the purchaser or breeder. It appears to me that horses may be divided into four classes: Trotting or speed horses, gentlemen's driving horses, farm or business horses, and heavy draft horses.

First, the trotting horse is bred, educated and trained especially for the one purpose, speed. It matters very little about his size, his build, his color or his disposition, provided he can make the best time. Persons breeding this class of horses keep this one point in view; and I must say right here, although not personally interested in the business, that there is no class of horses that pays so well to breed as the trotter, provided we have the material to work with. But it takes long years of careful breeding to produce dams or sires that are capable of transmitting their qualities to their progeny with any degree of certainty, and there are few sires, and a less number of dams, in the State of Maine to-day, that will fully come up to the standard, and the person who has them, barring accidents, is reasonably sure of success.

A gentleman's driving horse is different, and should be different in some respects. To be sure, speed is one object in view, and the more he possesses the better. Style, size, color and height are indispensable qualifications. Such a horse can be raised successfully and profitably. The demand is great for them, and the market never will be full.

The farm or business horse comes as near a general purpose horse as any class I know of. What I mean by a general purpose horse is such a one as we use for plowing, harrowing, mowing, raking and in fact all general work—capable of hauling wood or logs, capable of hauling grain to the mill or the produce of the farm to market, or the family to church, capable of being driven on the road at the rate of from six to ten miles per hour with ease, and above all a cheerful and rapid walker. Too much cannot be said upon this one qualification; it has been overlooked in all classes. In the desire to raise trotters it has been overlooked, in the attempt to raise driving horses it has been ignored, and in raising general purpose horses something else has been sought after rather than to increase their ability to walk at the rate of from four to five miles an hour. In this hilly country, where much of the time must be necessarily consumed in walking, it is very important that they should be able to perform that service with ease and rapidity. A horse that is used more than any other class of horses in the cities, on the hacks, 'busses, coaches, cars; used by express companies, fire companies, in fact seventy-five per cent of all the horses used are what I term general purpose horses.

Excuse me, if I relate what I saw at an agricultural fair a few years since. When the officers of the society and committee called up the stallions for raising general purpose horses, and in response to that call appeared such horses as Dr. Franklin, Glenarm, Gen. Withers and others, to say that I was surprised would be expressing my feelings in very feeble terms. I supposed that I was engaged in raising general purpose horses, but when I saw such horses as I have already mentioned come up to the stand for examination, I thought that either I was wrong in my views of a general purpose horse, or else these people were, and I began to look around me and rub my eyes, brush away the fog and try to discover what it all meant; and I came to the conclusion that such horses as I saw there on exhibition were not, in fact, general purpose horses. Since then the same horses have been advertised as speed horses, with their records attached.

The farm or general purpose horse should be in weight from 1000 to 1400 pounds, medium height, blocky made, and of a good disposition. The disposition in this class of horses is indispensable. On the farm they come constantly in contact with the boys and girls, and in many cases are almost regarded as one of the family. In such cases one with a vicious disposition or unruly habits would be entirely worthless. The disposition must be such that they can be educated to perform all kinds of work. The color is a mere matter of fancy; such a color as would be desirable for some would be entirely objectionable to others. When in pursuit of a horse for my own use, if he has all the other qualifications for a good horse, the color is no objection. The best color for me is a good horse.

They must possess certain roading qualities, not such as would be required for a gentleman's driving horse or speed horse, but capable of moving off with ease at the rate of from six to ten miles per hour with a light, elastic step, head well up, with an easy movement, showing by his actions ambition, perseverance and endurance. A horse that has no life, so to speak, no ambition, no elasticity in his movements, no roading qualities, whether he weighs 1000 or 2000 pounds, has no attraction for me.

I have but a word to say in relation to heavy draft horses. There are but few of them raised, and but few used in the State of Maine. The demand for them is limited. Their qualifications are their great weight and ability to walk fast. Weighing from 1600 to 2000 pounds, they, of course, are not expected to possess great roading qualities. They are not driven faster than a walk generally, and should be fast walkers.

I have attempted to give a bird's eye view of what I consider to be the different classes of horses raised in the State of Maine, and the question arises, which of the classes is it most profitable for the farmers of Maine to raise? I am not going to undertake to answer this question for all, for the reason that people must be governed by circumstances. If a man has a brood mare that is capable of producing fast colts by judicious mating, that man should breed fast horses; or if a man has a mare especially adapted to the raising of gentlemen's driving horses, then by judicious mating he can successfully raise that class of horses. But while there is one brood mare capable of producing either of these two classes, there are at least twenty that are better calculated for raising general purpose horses.

Business has brought me in contact with hundreds of men desirous of raising colts, and they almost invariably make the remark that their mare is the best in the country; that she is the best blooded of any in that part of the State; that she possesses wonderful powers of endurance, great roading qualities, and is one of the best workers in the world. In short, a wonderful animal, and if she could only produce a colt her equal it would be worth hundreds of dollars to him. Ask him if she is sound and all right, and in many cases he would say, "Well, no, not exactly; she has a small ringbone, and is a little cockled-jointed, knees slightly sprung, and her wind isn't just right." Upon personal examination I find a poor, old, crippled, broken-down and worthless mare. And yet in his estimation she is a treasure. How absurd the idea to try to raise good horses from such stock!

Frequently the question is asked if colts will inherit the disabilities of their dams. I say no, not necessarily. If the mare has a spavin, ringbone, heaves or anything of the sort, the colt will not necessarily inherit that difficulty, but is very liable to inherit a weakness where its mother is affected. To illustrate: A mare may have what we call the heaves. Now, I never knew a colt up to two or three years old to be troubled with the heaves. In many cases, we all know, the heaves are caused by eating too much dry hay, and the only reason for the colt being troubled in that way is by its liability to inherit that appetite for food which caused the heaves in its dam.

But some will say, "I have a mare that is in some way or other blemished, and I want to raise a colt, and I am not able to purchase a good sound mare. What shall I do?" I say do the best you can under the circumstances and raise a colt; but I will also say, if it is possible breed from sound stock, and thereby obtain the best results. It costs no more to raise a sound colt, one that will command the highest price in the market, it will take no more time to care for him, to educate him, no more food to feed him than it will to raise a colt that will bring fifty per cent less. I have come to this conclusion, that the horses for us to raise as farmers are the general purpose horses, and why? In the first place, by raising a general purpose horse we have one suitable to perform all kinds of work on the farm, and when we have a surplus the market is ready to receive them at a good living price; and, further, we have the satisfaction of knowing that we have sent out into the markets of the world an animal that will do good service to the purchaser and redound to the credit of the old "Pine Tree State." Frequently farmers utterly fail to realize any profit from the business, in the vain attempt to breed fast horses from stock that is capable of producing only general purpose horses. The inducement is held out that you may raise a colt that will sell for a big price, and they take their chances, which is about one in nine hundred and ninety-nine, and the result is, as I have already stated, a failure, and they condemn the business. Whereas, if they had engaged in the business understandingly they would have realized a profit. And another reason I would give for raising general purpose horses is, we have more dams and more sires in this class by a large percentage than in any other, and we are not all able and have not the capital to stock our farms up with a higher priced class of breeding mares. Well, some will say, the business is liable to be overdone, the market will be glutted. One thing is certain, there never was a time since my recollection when a good horse would not sell at a remunerative price. Annually there are hundreds of horses being brought into the State from the West and from the Islands to fill up the vacancy caused from the farmers attempting to raise horses without a thorough knowledge of the business. It is a well-known fact that much of the horse stock in this State is small, and how to increase their size without destroying their symmetrical form or without having them ill-shaped and out of proportion, or without destroying their ability to transmit to their offspring that even temperament which is very essential to the animal in order that it may attain to the highest type of usefulness, is a question asked by many farmers of this State.

The idea is quite prevalent with a large number of farmers that a brood mare of small size mated with a stallion of large size would produce results which would be damaging to the business and detrimental to the interests of the breeder; in fact, would have a tendency to increase the number of ill-shaped and inferior horses which now fill up our barns and stables to too great an extent.

I wish to introduce the testimony of as good authority as is to be found in this country, M. W. Dunham of Illinois, who says: "The success that has attended the crossing of Percheron Norman stallions upon small mares has led to their introduction into the West and Southwest to breed upon the Texas broncos and Indian ponies. The success has been so extraordinary that the United States Interior Department has begun the introduction of Percheron stallions for the use of the Indians to cross upon their ponies, and has bought several stallions of me for that purpose. There is no way that worthless small mares can be made to produce such results as by this cross."

Also a few words from an eminent breeder of horses, and now president of a Percheron horse company, with a million of capital invested and owning a large tract of land and 4500 breeding animals, Mr. J. F. Studebaker of Indiana, who says: "The success of crossing the small western mares with Percheron stallions has been fully demonstrated, and large numbers of people are now employing that means of improving the otherwise worthless horse stock of the plains. My own experience in this special direction, and the great opportunity I have had for observation, has led me to believe, and in fact am thoroughly convinced, that the crossing of mares of small size with stallions of greater weight can be done with perfect safety, and with a decided profit to the breeder. A few years since, when I introduced a larger class of stallions into my county, the people threw up their hands in surprise to think that I should advocate such a radical departure from the old way of doing business. The difference in size was too great in order to produce anything like good results; they must be nearer matched for size. And I will say, as my positive knowledge was limited at the time, I had some misgivings as to the results, and looked forward with much anxiety to the time when my theory should be proved. But when the foals came, instead of weighing, as some had thought, 300 or 400 pounds, or as large as a good-sized yearling, they were rather under-sized. Then of course the people were dissatisfied in another direction, but time soon dispelled their fears in both cases, and there are now no fears entertained as to the propriety of making the cross as indicated above." While the gentlemen referred to have used the Percheron breed to illustrate and prove the feasibility of breeding the small mares to the stallions of large size, I will not undertake to say that other large breeds cannot be crossed with the small mares with equally good results.

I have attempted to discuss this question fairly, and I would not for a moment have you understand that I would discourage the raising of any class of horses. But keep this one idea in view, set your standard high. Whichever class you attempt to breed, be satisfied with nothing but the best. Whatever you attempt to do, strive to do well. And another point keep in view, do not mix the different classes. If you are breeding for speed, do not intermingle that blood with the draft or general purpose horse. If you are breeding for a general purpose horse, do not mix up with the draft or speed horses. It would be absurd to think of mating a Jersey with a Hereford, with a view of producing the best type of working oxen; and yet people entertain just such absurd ideas, and practice just such unreasonable things in the attempt to raise trotting horses.

While I believe in advancing the interests and encouraging the business, and while I believe in the future prosperity of this great and growing industry, I would not encourage any one to engage in this business who is not by nature adapted to it; who has not some natural ability in this direction, for I believe that a person can not attain to the highest degree of success in any business unless they are by nature especially adapted to that kind of work. If a person has a liking for a horse, likes the business of raising them, likes to care for them, to feed them, to educate them, that person will succeed. But if he has no liking for a horse, does not want anything to do with them, prefers to raise cattle, or sheep, or swine, he had better let horse raising entirely alone.

The horse interest of Maine is rapidly increasing, and let us not be caught napping. Let us not be satisfied with raising scrubs. Let us keep right on raising that class of horses which we need on the farm, which we can raise at a profit without going into any speculative operations. I have studiously avoided giving my preferences for the different breeds. They are all good; each has its friends and advocates. We cannot all look at things in the same light, and I think it is well we cannot.

CHEAP CORN.

By Hon. Elbridge Cushman, Lakeville, Massachusetts.

Given at Institutes at Kennebunk and Portland.

Were I this afternoon to tell the story of the recent discovery of some new plant or rare hybrid, the habits and character of which would permit its cultivation and growth on by far the larger portion of our fair land, at the same time furnishing in some form food for almost every variety of animal life, and by its products feeding the armies and navies of the world, and could I but announce the method of cultivating such a plant as the subject of the hour, little fears, indeed, should I have of your most earnest attention or that there would be kindled in you all the most lively interest and enthusiasm.

But when you are told my talk is to be upon the Cheap Cultivation of Indian Corn, methinks I hear a whisper, "How trite, how threadbare!"

To some, perhaps, the lengthy articles of the press and the numerous discussions in farmers' meetings upon this subject may have shorn it of its novelty, if not also of its interest. Nevertheless, we have no doubt there are owners of many acres right here in York County who are not fully decided to-day whether it is cheaper to produce the corn they consume upon their own farms or leave those farms partially neglected and devoting a portion of their time to some other calling and purchase their corn from the fertile plains of the West.

The importance and amount of the corn crop of our country, as well as the consumption and exportation of its products, are told by figures so large as to be almost beyond our comprehension. I shall not weary you with statistics. It is of but little moment to us, to-day, how much our country produces or consumes, or our State or our county even. The great practical question confronting you and me, brother farmers, is, Can we get the corn *we* are consuming and must have any cheaper than at present?

I stand before you firm in the belief that it can be grown from twenty-five to thirty per cent below the present market price, and this not only in my State and my county but also in yours as well. I propose to describe the methods and estimate the cost in detail of the production of a bushel of shelled corn grown in a field of not less than ten acres in extent, nor of not less than fifty bushels yield per acre, and that right here in the Pine Tree State.

And if, perchance, I should not recommend the adoption of all the methods and machinery of which you have heard, you will please not take it for granted they have not been tried upon my farm and discarded for something more economical. You will pardon me if in stating a simple fact, I say it has been my study for a quarter of a century to grow *cheap corn*, and I hope I may not seem to draw too largely from the operations upon my own farm, although the methods I shall describe are the result of many experiments and of long practice. Last harvest I rounded my crib with fifteen hundred baskets of "golden ears," while the autumn before two thousand baskets crowned the labors of the year. I devote much of my attention to this branch of farm husbandry, because my surroundings are adapted to it and it is congenial to my tastes. And there is still another motive, potent everywhere with the Yankee—*it pays.*

We would remark here that much depends upon the man, his soil and the season, but not so much, perhaps, as in the production of many other farm crops. Yet if a man be so sordid and cold that the possessions of broad acres of green leaves and seared tassels waving in the wind, and the long cribs piled high with golden treasures at the "merry husking time" kindles no emotions of gratitude and joy, far be it from me to induce such a one to engage in what no doubt would result in failure and disgust. But I know there are none such here. I see progress stamped upon your farms and your buildings and I feel you are earnest in your calling. But the New England farmer of the present, who would make a success of the production of any crop capable of long transportation, must take into consideration many things of which our fathers never dreamed, among which are cheap transportation and the increased purchasing value of a day's labor.

I well remember in my boyhood, while working in the corn-field with my father upon some of the land that I now own, hearing him contrast those times with his boyhood, when a bushel of corn would bring the price of two faithful days' labor, while at the time of his speaking it would secure but one; and to-day it takes nearly three bushels of corn to pay the price of a day's labor, and often very indifferent labor too. At first this might seem to preclude the possibility of the cultivation of Indian corn in New England; and indeed it would, had not other changes at the same time been going on and keeping pace with those mentioned. I mention this to call attention to the necessity of discarding the old methods and adopting new. If we should still cling to the methods and practices of the fathers, we cannot go back to their times, and failure must be the result.

It must be confessed that we are situated a little too near the northern limit of the great corn belt of our country. Would you trace its northern line you will start from the mouth of the Columbia River coming east, south of the Black Hills and between Lake Superior and Michigan, and cross the St. Lawrence a little above Ottawa, continuing east to the Bay of Fundy. Thus the line would cross your State about one degree north of your county. So it will be seen that if we are to be certain of success we must carry our isothermal lines as far south as possible by selecting our warmest and most congenial soils. It has been most truly said that Indian corn is a "child of the sun."

Having selected a suitable field of sufficient area, it is essential to cheap cultivation that it shall be reasonably free from trees and rocks, and all obstructions to the free use of all improved machinery. Plowing will be the first and perhaps the most essential part of the work, for we learned the truth of the saying in our boyhood, that "a field well plowed is half wed." We should be satisfied with nothing less than a thorough inverting of the sod, without holes or breaks in the furrows. The work should be done with a swivel plow, thus avoiding all dead furrows. From six to eight inches, according to the nature of the soil, will be a sufficient depth. When coarse barn manure is to be applied it should in all cases be plowed in. If asked if this rule should be adhered to in cold and wet land, I should answer such land should never be planted to corn.

After ploughing, the ground is ready for one of the improved patterns of pulverizing harrows. This should be run crosswise and lengthwise of the furrows until the field is like a seed bed. The ground is now ready for such mineral or commercial fertilizers as are to be applied. And here no little amount of skill will be required on the part of the farmer to determine the quantity and the quality of fertilizers to be applied to his fields in order to secure the desired crop with all the conditions favorable. He must not only know something of the nature and composition of the elements in the fertilizer, but he must have a knowledge of the habits and wants of the crops to be grown ; and, still further, he must possess a knowledge of the capacity of the soil. Is the soil wanting in all the essential elements of plant food? In order to grow corn at the cheapest possible rate, we must feed it with just those elements it requires and nothing more. Without doubt this is the most puzzling problem with which the farmer has to contend. But, happily, science has come to our aid and told us there are but three essential elements of plant food wanting in most soils, viz: potash, phosphoric acid and nitrogen. While later developments make it a doubtful policy for the farmer to buy much nitrogen for the production of corn, of all the crops grown upon the farm, none, perhaps, are more greedy or ravenous in their appetites than the corn plants. It occupies the whole season in maturing, and it seems to possess organs for supplying itself with the nitrogenous elements that are required from a variety of sources. More especially where a moderate application of barn manure has been made we never have been able, in the application of any of the nitrates to get an increase in yield commensurate with the expense. But in all cases on our own lands, whether with or without barn manure, we have found an application of potash and phosphoric acid attended with satisfactory results. And on account of the habits of the plant to which allusion has been made, these elements may be applied more cheaply in a raw or crude state than in the form of a superphosphate; and perhaps the common farmer cannot apply these elements in any cheaper or more available form than in pure bone (fine ground) and a high grade muriate of potash. These elements can be very easily and quickly applied by almost any of the fertilizer spreaders in the market in quantities to meet the demands of the soil and circumstances of the farmer. This should be harrowed in lightly with a smoothing harrow, and when the apple trees are in blossom the field will be ready to receive the seed. Before planting we mark in rows three and one-half feet apart each way, and it is quite essential the rows should be straight, otherwise the cost of cultivation will be increased. The marking is done with a quick-walking horse attached to a rude and cheaply constructed gig. An old iron axletree was found that fitted my buggy wheels and we had it cut and welded, allowing the wheels to run the required distance apart. Through this holes were punched and hickory stock and shafts were bolted on. The seat was taken from a horse rake. Truly, we had a gig. It marks two rows at a time and we have only one wheel to keep in line. A fast walking horse will mark ten acres both ways in a day. The corn is planted with the little Automatic Corn Planter, with which a man can readily plant five acres in a day. Immediately after planting the field should be run over with the smoothing harrow, that the birds may not find the corn before it germinates, and crow lines should be strung thickly over the field at sufficient height to admit of a team passing under. As soon as the corn has developed the third leaf we go through the field with the corn planter and plant over all missing hills or where there are not more than two plants, and when it is five or six inches in height, we go through and thin out to four plants in the hill. This should not be done, however, until the cut worm and other enemies of the young plant have suspended operations. The field should be thoroughly harrowed with the smoothing harrow once each week until the corn is five or six inches tall, after which the horse hoe may be introduced and run one way through the field each week, alternating the direction each time. This process should be continued until the corn shades the ground or the haying season occupies the time. Under this system there will be no weeds, as none will get a chance to start, and there will be no demand for hand hoeing.

The field need be visited now only to be admired until stooking time. This will come in those balmy days of our Indian summer, when the kernels on the ear shall have become glazed hard enough to resist the firm pressure of the thumb-nail. This is truly a laborious and expensive part of the work, and it must be well and properly done in order to secure hard and sound ears and bright and sweet stover. We would remark that here, as in many other farm operations, the expense is no greater when the work is well and properly done, than when done in a slovenly and slip-shod manner. Two can work at better advantage than one alone. Five rows should be cut at a time, and when the yield is about fifty bushels per acre, fifteen hills will make a proper sized stook to handle. In cutting, the men will need no "jack" or "horse," or machine of any kind excepting corn cutters. The centre hill should be left and the others cut and placed around it. Before cutting a hill the left hand and arm should be passed around it, gathering all the loose leaves, then cut with the other hand closely to the ground that the stubble may not be in the way. The hill should then be carried to the stook and placed so that each individual stalk will point directly to the top and centre of the stook, thus becoming an element of strength; whereas, if thrown carelessly and allowed to lie crosswise, it becomes an element of weakness, tending to make the stook fall down or "courtesy." In the process of tying two men are also required; one wants a three-quarter inch rope about eight feet long, the other a ball of string. This string is common tarred rope, cut and untwisted, the pieces tied together and wound in a ball of convenient size. The rope is passed around the stook about midway, the ends crossed, each man taking an end and pulling against each other with their might. When compressed as much as possible, the two ends of the rope are passed around to the side of the stook opposite the cross and held by one of the men, while the other passes the string around the stook below the ropes and ties. The same operation is repeated near the top of the stook, and the work is done. And that stook will stand. Rains or snows will neither hurt the grain or the stover. The farmer need be in no undue haste about the harvest, for if properly stooked the

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crop as a rule will keep better before than after housing. Before husking we draw to the barns. The stooks are easily opened or bent over and the centre hill cut. A one horse team with a long wagon and short stakes is the most economical arrangement. The work of husking can be done in a large part by women and children, with stronger hands to crib the corn and mow the stover.

Thus we have hastily gone through with the different processes of cultivation and of harvesting the crop. Now we will review, making estimates of expense by items. I might give you actual figures, results of experiments on my own farm, but they might not be conclusive, as you could not probably obtain the same results on your farm, and very likely I might not again on my own. I would say, however, that the figures I shall give will not vary materially from the cost of production of crops for several years.

The plowing of such land as I have described, and in large fields, may be done for $1.75 per acre, as a man and pair of horses without any driver can easily turn two acres per day. The first harrowing, if sod land, will cost fifty cents ; spreading fertilizer, 35 cents—as with my machine I spread five tons on ten acres with one horse in one day. This includes carting fertilizer to field by another team. Harrowing in fertilizer with smoothing harrow, 25 cents ; marking, 25 cents ; planting, 30 cents ; seed, 20 cents ; harrowing immediately after planting, 25 cents ; expense of crow lines and labor, 20 cents ; planting over, 15 cents ; thinning out, 50 cents ; harrowing four times more, at 25 cents each, $1.00 ; horse hoeing for four weeks, once each week, at 35 cents, $1.40 ; stooking, two men one day, at $1.50, $3.00 ; carting to barn, $1.00 ; husking, cribbing and mowing stover, 10 cents per bushel, for 50 bushels, $5.00. Such an acre of land would be worth, I judge, in your State (it certainly would in mine) $50. Interest on this amount at 5 per cent, $2.50 ; taxes at 1 per cent, 50 cents. Fences you will not need, as you will not want to pasture it, and no one else has any right. Now, I believe we have all the items but the plant food—the exhaustion of the soil. We have said something about the application of certain fertilizers, but what has that to do with the expense of this crop. How are we to tell whether our land is in a better or poorer condition than before we grew the crop? Again, do we know how much plant food has actually been drawn from these applications? and how much from stores left from former applications, and from the natural fertility of the soil? Would it not be a wiser course to charge the crop with just what it has taken from the soil, as near as we can ascertain, rather than what we have put upon the soil, whether plant food or something else?

If we have produced 50 bushels shelled corn and its stover, chemists tell us we have carried off phosphoric acid 31 pounds, and this element is worth in the market 9 cents per pound, $2.79; also 77 pounds potash at 4½ cents, $3.47; and 64 pounds nitrogen at 17 cents, $10.88. That a certain portion of this nitrogen came from the soil, there can be no doubt; also it has been proved that corn, in common with some other plants, draws this element from other sources than the soil. So, just what proportion of this nitrogen has been taken from our acre and must be returned to maintain the fertility, we must confess we are at a loss to tell, and that we may surely be on the safe side we charged the *whole* to the crop, although we repeat that upon our own farm for years no nitrogen, as such, has been applied for the production of corn. It will be observed, however, that, in the application of ground bone and barnyard manure, a certain amount of this element has been added to the soil, which thus far has seemed to meet all demands. Now, as we have given the estimate of expense in detail for the production of fifty bushels of corn on an acre, where large fields are cultivated, and as we believe the most economical methods were pursued, let us recapitulate:

Plowing	$1 75
Harrowing seven times	2 00
Application of fertilizer	35
Marking for planting	25
Planting twice	45
Seed	20
Crow lines and labor	20
Thinning out	50
Horse hoeing four times	1 40
Stooking	3 00
Carting	1 00
Husking	5 00
Interest and taxes	3 00
Fertilizer	17 14
Total expense	$36 04
Cr. by two tons stover at $10	20 00
Total cost per acre	$16 04
Cost per bushel	32

The price of stover will vary in different localities. Such as I have described is worth two-thirds price of good hay. I am selling it at my barn the present month for $12 per ton. As to the amount I have the results of 116 experiments, also I have weighed the stover from a bushel of corn many times myself, and while there is a wide range of difference in different experiments, yet I believe a fair average is one ton of stover for twenty-five bushels of corn.

Thus it will be seen we grow our corn for thirty-two cents per bushel or a little more than one-half the market value. Without doubt, many farmers present own farms of sufficient fertility to produce all the corn they consume without the purchasing of any fertilizer. and if the crop was fed upon the farm your farms would be increasing in fertility by the cultivation. Again, you own your acres and there is no interest to pay, and the taxes are to be paid whether you cultivate them or not. Your own family and farm help could husk many bushels during the late fall and winter months without additional expense. Further, on many farms there would be no necessity for additional teams and very little more farm machinery needed if the corn was raised upon the farm. In such instances, by far the larger part of the cost would be averted, thus bringing the corn at an extremely low figure. Let me say to you, brother farmers, to the young men, there are mines of gold in the fields of Maine. You need not go far away into the western wilds and delve under the mountains for golden treasures. Rather dig for them under the old ancestral trees and by the hearthstone of the fathers.

ANNUAL REPORT

OF THE

MAINE FERTILIZER CONTROL

AND

Agricultural Experiment Station.

1886-7.

THE MAINE FERTILIZER CONTROL

AND

AGRICULTURAL EXPERIMENT STATION.

BOARD OF MANAGERS.

EX-OFFICIO.

PROF. WALTER BALENTINE, Orono,
Professor of Agriculture in the Maine State College.

HON. Z. A. GILBERT, North Greene,
Secretary Maine Board of Agriculture.

APPOINTED BY THE GOVERNOR.

WILLIAM DOWNS, ESQ., Sebec.
BENJAMIN F. PEASE, ESQ., Cornish.
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Officers of the Board.

HON. Z. A. GILBERT, President.
PROF. WALTER BALENTINE, Secretary.
WILLIAM DOWNS, ESQ, Treasurer.

Station Officers.

WHITMAN H. JORDAN, Orono, *Director.*
JAMES M. BARTLETT, Orono, *First Assistant.*
L. H. MERRILL, Orono, *Second Assistant.*
GILBERT M. GOWELL, Orono,
*Supt. Field and Feeding Experiments.**

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*Until April 1st, 1887.

To the Honorable Governor and Council of Maine:

The Board of Managers of the Maine Fertilizer Control and Agricultural Experiment Station herewith submit, according to law, the Annual Report of the Station for the year ending July 1st, 1887.

Z. A. GILBERT, *President.*

WALTER BALENTINE, *Secretary.*

REPORT OF THE TREASURER.

William Downs, in account with the Maine Fertilizer Control and Agricultural Experiment Station,

For the Year Ending December 31, 1886.

RECEIPTS.

Balance in Treasury from 1885	$35 96	
From State Treasurer....................	4965 46	
License fees............................	805 00	
Sale of apparatus and chemicals	21 88	
" Four steers.....	160 00	
" Barley and oats..................	69 00	
" One sheep.......................	4 40	
" Bone black, &c	5 85	
Analyses	132 00	
		$6199 55

EXPENDITURES.

Salaries		$2985 00
Chemicals and chemical apparatus.........		520 95
Field and Feeding Experiments.		
10 steers	$218 00	
4 cows	191 85	
12 pigs..............	57 00	
2 sheep	8 50	
Hay and grain........	387 75	
Labor, field..........	260 74	
Fertilizers	114 90	
Seeds	8 18	
Freight, bags, &c.....	69 01	$1315 93
Collecting fertilizer samples.........		78 25

General Expense.

Rent of office	$30 00		
" Gas machine	12 00		
Type writer	55 00		
Stationery and postage	45 68		
Travelling expenses	20 10		
Printing	12 00		
Discount on notes	5 21		
Sundries	9 32	$189 31	
Travelling expenses of Managers		146 61	
Paid cash into State Treasury		805 00	
			$6041 05
Balance in Treasury			$158 50

WILLIAM DOWNS,

Treasurer.

REPORT OF DIRECTOR.

To the Board of Managers of the Maine Fertilizer Control and Agricultural Experiment Station:

GENTLEMEN:—The report herewith submitted presents the work of the Station for the year beginning July 1st, 1886, and ending June 30th, 1887.

The subject matter of the report embraces the following:

1. FERTILIZERS.
   - (*a*) Inspection of Fertilizers.
   - (*b*) Analyses of Miscellaneous Fertilizing Materials.
   - (*c*) Experiments With Fertilizers— { At the Station. / Among farmers.
   - (*d*) Inquiries Concerning Fertilizers.
2. FOODS.
   - (*a*) Analyses of Cattle Foods.
   - (*b*) Determination of the Digestibility of Various Cattle Foods.
   - (*c*) Feeding Experiments With Various Kinds and Quantities of Foods— { For milk and butter. / For growth.
   - (*d*) Inquiries Concerning Cattle Foods.
3. TESTS OF VARIETIES OF GRAIN AND POTATOES.
4. EXPERIMENTS IN RAISING CREAM.
5. MISCELLANEOUS.
6. ANALYTICAL AND EXPERIMENTAL METHODS.
7. LICENSES ISSUED, AND LAWS.

It is believed that the work undertaken will commend itself to farmers as being practical, and as calculated to throw needed light upon questions that are important in farm practice. Some of the experiments have furnished results that should be directly useful and suggestive to the stock-grower and dairyman, and certainly the figures reached by the inspection of commercial fertilizers for which several hundred thousand dollars are annually expended in the State, have a value that is direct and appreciable.

I desire to acknowledge the kindness of several business houses in presenting the Station with samples of seeds and fertilizers, as follows:

Messrs. Hiram Sibley & Co., Rochester, N. Y., samples of seeds;

Messrs. Jas. M. Thorburn & Co., New York City, samples of seeds;

The Cumberland Bone Co., Portland, Me., samples of fertilizing material;

The Bowker Fertilizer, Boston, Mass., samples of fertilizers and crude materials;

The Mapes Formula and Peruvian Guano Co., New York City, samples of fertilizers and raw products;

Messrs. M. L. Shoemaker & Co., Philadelphia, Pa., samples of fertilizers and crude materials;

Messrs. H. J. Baker & Bro., New York City, samples of fertilizers.

W. H. JORDAN,

Director.

FERTILIZERS.

(*a*) INSPECTION OF FERTILIZERS.*

The inspection of the various brands of fertilizers sold in the State has for its object (1) the comparison of the actual composition of these brands with the guaranteed composition, this being required by law, and (2) the determination of their relative values. In carrying out this inspection the fertilizers must be sampled in the hands of dealers or consumers, analyzed, and their values are then calculated on the basis of ruling commercial prices.

Since the Station was organized in March, 1885, one hundred and seventy-seven samples of fertilizers have been examined, representing forty brands.

Only the analyses made during the present year (1887) appear in this report. There are given below the analyses of seventy-three samples, taken from thirty brands, with such preceding explanations as are deemed necessary for a clear understanding of the main facts pertaining to the composition of commercial fertilizers, and of the real significance that the analyses and valuations have for the consumer.

Valuable Ingredients of Fertilizers. The ingredients of commercial fertilizers upon which both their agricultural and commercial values chiefly depend are nitrogen, phosphoric acid and potash. Besides these more valuable ingredients, sulphuric acid and lime are always present in superphosphates in considerable quantities, being a necessary accompaniment of phosphoric acid as it exists in nearly all manufactured fertilizers.

Nitrogen is the most costly of the three important ingredients mentioned, and adds largely to the commercial value of all the fertilizers sold in Maine, with one or two exceptions. It is found in the markets in quite a variety of substances which are used to supply this ingredient to mixed fertilizers, but which are available for fertilizing purposes when purchased unmixed with anything else.

Nitrate of soda, a compound of nitric acid (aqua fortis) and soda, and sulphate of ammonia, a compound of sulphuric acid (oil of vitriol)

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*The explanations in regard to the compositon and valuation of fertilizers which are made under this head are mainly reprinted from the report for 1885-6, with such changes as are necessary. The apology for quoting so largely from a previous report, is that there are no new facts to be stated, and that to express the old facts in a new form would probably not add anything in value or clearness to the explanations already made.

and ammonia, are two of the most valuable nitrogenous materials which are used to supply nitrogen to the farmer. Their nitrogen is immediately available for use by the plant, the nitric acid of the one and the ammonia of the other being the compounds of nitrogen which largely serve as plant-food. The following materials furnish organic nitrogen to fertilizers:

Dried blood, dried and ground fish, azotin and ammonite (prepared animal matter), fish scrap, meat scrap, cotton-seed meal, castor pomace, horn, hair, wool, leather waste, etc. These substances must decompose and the nitrogen become changed into compounds of nitric acid and ammonia before it is available to plants. There is, therefore, a great difference in the value of organic nitrogen as found in the above-named materials. Dried blood, for instance, decomposes in the soil rapidly, while horn, hair, wool and leather scrap decay very slowly, and the nitrogen which they contain becomes useful only after a long period of time. These latter substances are not only less useful to the farmer than blood, fish and meat, but they are also much less costly, and their presence in a fertilizer supposed to be manufactured of the best materials is good evidence of fraud.

The phosphoric acid of superphosphates is determined in three forms, according to its solubility in various liquids, viz: *soluble*, *reverted*, and *insoluble*.

Soluble phosphoric acid is that which exists in fertilizers in a form freely soluble in water. It is obtained by treating certain phosphatic materials, such as bone and South Carolina rock, with sulphuric acid (oil of vitriol).

In the chemical changes caused by the sulphuric acid, hydrated calcium sulphate (gypsum) is formed if sufficient water be present, which is the same compound as land plaster. The advantage of having the phosphoric acid of fertilizers rendered soluble is not that it remains so in the soil, for it becomes insoluble in water very shortly after application, but in the fact that when the compounds of the soil change it back to an insoluble condition it becomes deposited in particles so minute that they are easily appropriated by the roots of plants.

Reverted phosphoric acid is a term originally signifying phosphoric acid that had once been "soluble," but which from some cause had "reverted" or "gone back" to forms insoluble in water. Now it is used to designate that which is dissolved by a solution of ammonium citrate, and includes not only the truly reverted, but also more or less of phosphoric acid as combined in the original, undissolved phosphatic material. Reverted phosphoric acid, in so far as it comes within the strict meaning of the term, most probably has a value for crop production equal to that of the soluble form, but it is not clear that this holds true of that which would be dissolved by ammonium citrate from finely ground South Carolina rock, for instance, at a temperature of 65° C.

Insoluble phosphoric acid is that which is readily soluble neither in water nor in a solution of ammonium citrate, but which can be dissolved in strong acids. It comes from some of the original phosphatic material that has not been acted upon by sulphuric acid, and depends somewhat for its value upon the kind of material used, whether bone or rock phosphate. In any case it has less value than the soluble or reverted forms.

It should be remembered that the terms "soluble," "reverted," and "insoluble" are merely relative in their significance. There is no compound of phosphoric acid that is not dissolved to a slight extent, at least, by pure water, and to a still greater degree by ammonium citrate, and the extent of the solubility of raw phosphates in these liquids, and in weak acids such as are found in the roots of plants, depends very largely upon their mechanical condition, or the degree of fineness to which they are ground.

The *potash* used in this country for agricultural purposes comes mostly from Germany in the so-called "German potash salts," which include potassium sulphate, potassium chloride (the muriate) and kainite. Except for a few special purposes, potash is equally valuable in all these forms, but costs least in the muriate and in kainite.

The Valuation of Fertilizers.

The law establishing the Station requires that the average of three analyses of each brand of fertilizer sold in the State, with certain exceptions, shall be compared with the guaranteed composition of the fertilizers examined.

This Station, in common with all American experiment stations that stand in an official relation to the fertilizer trade, goes farther than this and applies a schedule of trade values to the goods that it inspects. By means of these trade values there is calculated for each brand what has been designated as the "estimated value" or the "station valuation." As these estimated values are not intended to represent the proper selling price of mixed goods at the point of consumption, and in order to prevent any possible misapprehension as to their real meaning, the following explanations are offered:

1. These trade values represent very closely the prices at which a pound of nitrogen, phosphoric acid and potash, in their various forms, can now be purchased for cash at retail in our large markets. They are based mostly upon the ton prices at which certain classes of goods are offered to actual consumers, and correspond also to "the average wholesale prices for the six months ending March 1st, plus about twenty per cent in the case of those goods for which we have wholesale quotations."

2. These trade values do not include the charges for transportation from the market to the consumer, for storage, mixing, commissions to agents and dealers, selling on long credit, bad debts, etc., etc.

3. They are the prices of nitrogen, phosphoric acid and potash, *ready for use by the farmer*, when these ingredients are purchased under the above-named conditions, singly and not mixed. In ordinary superphosphates we find these three ingredients mixed, but this is not a necessary condition of their use.

An illustration may serve to make clear the above statements. A farmer wishes a ton of fertilizer similar to the well-known brands sold in this State. If he purchases for cash in New York or Boston sixteen hundred (1,600) pounds of dissolved bone black, three hundred (300) pounds of sulphate of ammonia, and one hundred (100) pounds of muriate of potash, and mixes these ingredients together, he will have a complete fertilizer not essentially different from many standard brands of ammoniated superphosphates. The cost of the ton after mixing (if the farmer prefers to mix the ingredients) will be made up as follows:

a. Cost of the materials in the markets.

b. Cost of transportation.

c. Cost of mixing.

The first element entering into the total cost is the only one included in the "estimated value." If there is added to this one element, not only the charges for transportation and mixing, but also the expenses of selling through agents and dealers, long credits, bad debts, etc., we have the factors involved in the cost of our ordinary superphosphates when delivered at or near the place of consumption. As is to be expected, the Station valuations of superphosphates fall below their selling prices. Last year the average difference in this State was $9.96 per ton.

This year it is $8.00 excluding certain brands for which there is evidently a serious overcharge.

4. The Station valuations stand in no direct or necessary relation to the comparative profits which may be derived from the use of the various fertilizers by individual farmers. These values have an almost purely commercial significance, and are not designed to point out to a farmer whether he shall use potash, which is a comparatively cheap ingredient, or nitrogen, which is comparatively costly. If ordinary superphosphates are compared, however, on the basis of commercial valuations it will be found to be true in general that their fertilizing power is in proportion to the money value.

The following schedule of trade values used in this State for 1887 is the one agreed upon by the experiment stations of Massachusetts, Connecticut and New Jersey, after a careful study of prices ruling in the large markets of New England and the Middle States.

For comparison, the trade values used in 1886 are also given:

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS FOR 1887.

	1886. Cts. ℔ lb.	1887. Cts. ℔ lb.
Nitrogen in ammonia salts	18½	17½
" in nitrates	18½	16
Organic nitrogen in dried and fine ground fish	17	17½
" in azotin, ammonite and dried and ground meat	17	17½
Organic nitrogen in cotton seed, linseed meal and in castor pomace	17	17½
Organic nitrogen in dried and fine ground blood		16½
" " in fine ground bone	17	16
" " in fine medium bone	15	14
" " in medium bone	13	12
" " in coarse medium bone	11	10
" " " bone, horn shavings, hair and fish scrap	9	8
Phosphoric acid, soluble in water	8	8
" " " in ammonium citrate (commonly called "reverted")	7½	7½
Phosphoric acid, insoluble, in dry fine ground fish and in fine bone	7	7
Phosphoric acid, insoluble, in fine medium bone	6	6
" " " in medium bone	5	5
" " " in coarse medium bone	4	4
" " " " bone	3	3
" " " in fine ground rock phosphate	2	2
Potash as high grade sulphate	5½	5½
" kainite	4½	4½
" muriate	4½	4½

These values are applied to the valuation of superphosphates and all mixed goods, as follows:

It is assumed that the organic nitrogen of these goods has for its source such materials as dried blood, ground fish, or nitrogenous substances of equally good quality, unless a special examination of some particular brand shows that inferior material like leather has been used. Organic nitrogen in mixed goods will therefore be valued at seventeen and one-half cents per pound.

The insoluble phosphoric acid of mixed fertilizers is considered as coming entirely from bone, and not from South Carolina rock, and is reckoned at three cents per pound.

The potash is valued at the price of that ingredient in kainite and the muriate, unless the chlorine present in the fertilizer is not sufficient to combine with it, in which case the excess of potash is reckoned as the sulphate.

The valuation of a fertilizer is obtained by multiplying the percentages of the several ingredients by twenty (which gives the pounds per ton), and these products by the prices per pound, and the sum of the several final products is the market value of the fertilizing ingredients in one ton.

These estimated values should be studied in the light of the previous explanations. It will probably rarely happen in this State that a mixed fertilizer can be sold near the point of consumption as low as the Station valuation, the excess of cost representing certain expenses previously enumerated. The Station valuations give the consumer a fairly accurate basis for estimating the relative cost of plant-food in the various brands of fertilizers, and will help the farmer to determine whether he can in any way profitably change his methods of buying fertilizing ingredients. A caution should be uttered, however, against making too close an application of the Station valuations, as a difference of a few cents, or even of a dollar, on a ton between two brands may have no real significance, but may be due to unavoidable errors of sampling and analysis, that render it impossible to determine to the utmost exactness the composition of the entire bulk of material that is sold.

The tables which immediately follow give on the left-hand pages the history of the samples taken, and on the opposite right-hand pages the results of the analyses. The selling prices given represent in most instances the rate at which single packages, and not ton lots, are sold. The comparative money values, as calculated by the Station in the manner previously explained, have much more significance than the excess of selling price over valuation, because the selling price varies in some instances according to the quantity of fertilizer sold, conditions of payment, location, &c.

There is one point in connection with the excess of selling price, however, to which attention should be called, which is that the same excess of selling price over valuation in two cases does not necessarily mean that one fertilizer is sold as cheaply as the other. This can be illustrated as follows: A's fertilizer is sold for forty dollars per ton, and values at thirty-two dollars. B's fertilizer sells for twenty-four dollars per ton, and has a valuation of sixteen dollars. The excess of selling price is eight dollars in both cases, but this is only twenty-five per cent of the money value of the ingredients in A's fertilizer, while it is fifty per cent of a similar valuation of B's fertilizer. In other words, B is charging the farmers twice as much as A for handling a given quantity of plant-food.

The figures which show the composition of the various fertilizers analyzed represent the pounds of ingredients found in one hundred pounds of the fertilizer.

Tables giving the History and Analyses of the Samples of Fertilizers Collected in 1887.

FERTILIZERS.

Station Number	Brand.	Manufacturer.	Sampled at	Station Number
198	Americus Ammoniated Superphosphate	Williams & Clark Co., New York, N. Y	Waterville	198
224	" " "	" " " " "	Fryeburg	224
195	Bay State Fertilizer	Clark's Cove Guano Co., New Bedford, Mass	Portland	195
213	" " "	" " " "	New Gloucester	213
217	" " "	" " " "	Fryeburg	217
258	Bay State Superphosphate	J. A. Tucker & Co., Boston, Mass	Augusta	258
262	" " "	" " "	Randolph	262
271	" " "	" " "	Richmond	271

FERTILIZER ANALYSES.

Station Number	Brand.	Moisture.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Soluble.	Phosphoric Acid. Reverted.	Phosphoric Acid. Insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station Valuation of One Ton.	Selling Price.	Selling Price Exceeds Valuation.	Station Number.
198	Americus Ammoniated Superphosphate......	11.32	2.75	.....	8.62	1.87	.36	10.85	.....	10.49	.....	2.51	.....	$29 03	$37 00	$7 97	198
224	" " "	10.97	2.68	.....	8.98	1.35	.45	10.78	.....	10.33	.....	2 48	....	28 57	38 00	9 43	224
	Average	11.14	2.71	2.00 to 3.00	8.80	1.61	.40	10.81	.....	10.41	10.00 to 12.00	2.50	2.00 to 3.00	28 80	37 50	8 70	
195	Bay State Fertilizer........................	11.35	2.76	.....	9.49	1.81	1.74	13.04	....	11.30	.....	2.54	.....	31 09	38 00	6 91	195
213	" " "	9.00	2.63	.....	8.78	2.44	2.06	13.28	.....	11.22	.....	3.00	.....	30 97	38 00	7 03	213
217	" " "	9.31	2.72	.....	8.40	2.07	2.11	12.58	.....	10.47	.....	3.06	.....	30 18	40 00	9 82	217
	Average..........................	9.88	2.70	2.10 to 2.80	8.89	2.11	1.97	12.97	.....	11.00	9.50 to 14.00	2.87	2.00 to 3.00	30 75	38 66	7 92	
258	Bay State Superphosphate.................	17.52	2.87	.....	7.07	1.90	2.10	11.07	.....	8.97	....	2.60	.....	27 67	38 00	10 33	258
262	" " "	16.85	2.95	.....	7.30	.84	2.67	10.81	.....	8.14	.....	2.95	.....	27 37	38 00	10 63	262
271	" " "	18.27	2.87	.....	6.75	.69	2.80	10.24	.....	7.44	....	2.93	.....	26 08	38 00	11 92	271
		17.55	2.90	2.50 to 3.00	7.04	1.14	2.52	10.70	10.00 to 11.00	8.18	9.00 to 9.50	2.83	1.00	27 04	38 00	10 96	

FERTILIZERS.

Station Number	Brand.	Manufacturer.	Sampled at	Station Number
231	Bowker's Ammoniated Dissolved Bone	Bowker Fertilizer Co., Boston, Mass	Auburn	231
256	" " " "	" " "	Fairfield	256
200	Bowker's Hill and Drill Phosphate	" " "	Waterville	200
218	" " " "	" " "	Fryeburg	218
272	" " " "	" " "	Richmond	272
236	B. D. Sea Fowl Guano	Bradley Fertilizer Co., Boston, Mass	Lewiston	236
268	" " " "	" " "	Bowdoinham	268
270	" " " "	" " "	Richmond	270

FERTILIZER ANALYSES.

Station Number.	Brand.	Moisture.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Soluble.	Phosphoric Acid. Reverted.	Phosphoric Acid. Insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station Valuation of One Ton.	Selling Price.	Selling Price Exceeds Valuation.	Station Number.
231	Bowker's Ammoniated Dissolved Bone	18.98	2.42	.....	8.11	2.47	1.58	12.16	.....	10.58	.....	1.39	.....	$27 28	$36 00	$8 72	231
256	" " " "	13.62	2.54	.....	8.46	2.36	1.42	12.22	.....	10.82	.....	1.37	.....	27 98	36 00	8 02	256
	Average	13.80	2.48	1.50 to 2.25	8.28	2.41	1.50	12.19	11.00 to 13.00	10.70	10.00 to 12.00	1.38	1.00 to 2.00	27 63	36 00	8 37	
200	Bowker's Hill and Drill Phosphate	13.15	2.54	.....	8.88	2.46	1.38	12.72	.....	11.34	....	1.29	.....	29 01	40 00	10 99	200
218	" " " "	12.98	3.17	.....	8.41	2.48	1.17	12.06	.....	10.89	.. .	1.51	.....	30 24	38 00	7 76	218
272	" " " "	14.94	2.95	.....	7.54	2.38	.90	10.82	.....	9.92	.....	2.69	... .	28 68	38 00	9 32	272
	Average...........	13.69	2.89	2.50 to 3.25	8.28	2.44	1.15	11.87	.....	10.72	10.00 to 12.00	2.83	2.00 to 3.00	29 31	38 66	9 35	
236	B. D. Sea Fowl Guano..	11.53	2.60	....	8.38	1.64	2.20	12.22	.....	10.02	.....	2.32	.....	28 15	33 00	4 85	236
268	" " " "	13.47	2.60	.. .	7.66	1.96	3.41	13.03	.....	9.62	.....	2.19	.....	28 21	36 00	7 79	268
270	" " " "	11.86	2.46	....	7.84	3.01	3.57	14.42	.....	10.85	....	1.52	.....	29 09	36 00	6 91	270
	Average..........................	12.29	2.55	2.50 to 3.25	7.96	2.20	3.06	13.22	11.00 to 14.00	10.16	9.00 to 11.00	2.01	2.00 to 3.00	28 48	35 00	6 52	

FERTILIZERS.

Station Number	Brand.	Manufacturer.	Sampled at	Station Number
192	Bradley's X. L. Superphosphate	Bradley Fertilizer Co., Boston, Mass	Portland	192
221	" " "	" " "	Fryeburg	221
252	" " "	" " "	Waterville	252
190	Buffalo Ammoniated Superphosphate	Croker Chemical and Fertilizer Co., Buffalo, N. Y	Lewiston	190
212	" " "	" " " "	Orono	212
215	" " "	" " " "	New Gloucester	215
222	Cleveland Superphosphate	Cleveland Dryer Co., Cleveland, Ohio	Fryeburg	222
255	" "	" " "	Fairfield	255

FERTILIZER ANALYSES.

Station Number	Brand.	Moisture.	Nitrogen.		Phosphoric Acid.							Potash.		Station Valuation of One Ton.	Selling Price.	Selling Price Exceeds Valuation	Station Number.
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.				
192	Bradley's X. L. Superphosphate............	14.17	2.74	.....	8.38	1.53	2.28	12.19	.....	9.91	.. .	1.37	....	$28 52	$38 00	$9 48	192
221	" " "	14.93	2.68	.....	7.95	2.28	2.13	12 36	.....	10.23	.....	1.86	.....	28 25	38 00	9 75	221
252	" " "	9.07	2.90	.....	8.11	3.30	1.29	12.70	....	11.41	.....	2.27	.....	30 62	38 00	7 38	252
	Average.	12.72	2.77	2.50 to 3.25	8.15	2.37	1.90	12 42	11.00 to 14.00	10.52	9.00 to 11.00	1.83	2.00 to 3.00	29 13	38 00	8 87	
190	Buffalo Ammoniated Superphosphate.	10.80	3.23	.....	7.78	2.29	1.95	12.02	.....	10.07	.....	1.76	....	29 85	38 00	8 15	190
212	" " "	10.51	3.03	.....	7.60	2.73	1 92	12.25	.....	10.33	.....	1.58	....	29 34	38 00	8 66	212
215	" " "	9.64	2.96	.. .	8.54	2.00	1.50	12.04	....	10.54	.....	1.60	....	29 18	38 00	8 82	215
	Average	10.32	3.07	2.90 to 3.70	7.97	2.34	1.79	12.10		10.31	8.00 to 12.00	1.65	1.00 to 3.00	29 46	38 00	8 54	
222	Cleveland Superphosphate..................	12.95	2.65	.. .	8.61	2.09	2.45	13.15	.....	10.70	.....	1.47	.....	29 22	36 00	6 78	222
255	" "	12.87	2.40	.....	8.66	1.58	2.18	12.42	. .	10.24	.....	2.95	....	28 44	36 00	7 56	255
	Average	12.91	2.52	2.05 to 2.85	8.63	1.84	2.31	12.78	10.00 to 13.00	10.47	8.00 to 10.00	2.21	3.00 to 4.00	28 83	36 00	7 17	

FERTILIZERS.

Station Number	Brand.	Manufacturer.	Sampled at	Station Number
238	Common Sense Fertilizer No. 2	Common Sense Fertilizer Co., Boston, Mass.	East Auburn	238
259	" " " "	" " "	Augusta	259
237	Common Sense Fertilizer Diamond D	Common Sense Fertilizer Co , Boston, Mass.	East Auburn	
194	Cumberland Bone Superphosphate	Cumberland Bone Co., Portland, Me.	Portland.	194
210	" " "	" " "	Monmouth	210
223	" " "	" " "	Fryeburg	223
209	Dirigo Fertilizer	Sagadahoc Fertilizer Co., Bowdoinham, Me.	Monmouth	209
254	" "	" " "	Fairfield	254
265	" "	" " "	Bowdoinham	265

FERTILIZER ANALYSES.

Station Number	Brand.	Moisture.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Soluble.	Phosphoric Acid. Reverted.	Phosphoric Acid. Insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed	Station Valuation of One Ton.	Selling Price.	Selling Price Exceeds Valuation.	Station Number.
238	Common Sense Fertilizer No. 2	8.01	1.85	.....	1.42	2.54	1.74	5.70	.....	3.96	.....	3.92	.....	$16 71	$35 00	$18 29	238
259	" " " "	9.50	1.85	.....	.....	3.63	1.18	4.81	.....	3.63	.....	4.45	.....	16 40	35 00	18 60	259
	Average	8.75	1.85	2.00 to 5.00	.71	3.08	1.46	5.25	4.00 to 6.00	3.79	.....	4.19	3.00 to 5.00	16 56	35 00	18 44	
237	Common Sense Fertilizer Diamond D.........	13.61	1.29	1.00 to 3.00	.21	3.52	1.41	5.14	2.00 to 4.00	3.73	.....	2.47	1.00 to 3.00	13 07	20 00	7 93	237
194	Cumberland Bone Superphosphate	12.55	2.78	.....	6.93	2.04	4.44	13.41	.....	8.97	.....	5.05	.....	31 12	38 00	6 88	194
210	" " "	14.17	2.47	.....	6.46	2.63	4.77	13.86	.....	9.09	....	3.48	.....	28 75	36 00	7 25	210
223	" " "	13.91	2.47	.....	6.62	2.43	4.01	13.06	.....	9.05	.....	4.15	....	28 90	40 00	11 10	223
	Average	13.54	2.57	2.00 to 3.00	6.67	2.37	4.41	13 45	10.00 to 14.00	9.04	9.00 to 11.00	4.22	3.00 to 4.00	29 59	38 00	8 41	
209	Dirigo Fertilizer	4.34	2.51	.....	.....	3.99	7.69	11.68	.....	3.99	.....	2.93	.....	21 86	28 00	6 14	209
254	" "	8.15	1.62	.....	....	7.09	6.32	13.41	.....	7.09	.....	4.84	.....	24 20	28 00	3 80	254
265	" "	10.28	1.55	.....	.....	5.84	7.24	13.08	.....	5.84	.....	3.90	.....	21 83	*26 00	......	265
		7.59	1.89	2.00		5.64	7.08	12.72	12.00	5.64	5.00	3.89	2.00	22 63	28 00	4 97	

* At Factory.

FERTILIZERS.

Station Number	BRAND.	Manufacturer.	Sampled at	Station Number
199	E. Frank Coe's High Grade Amm. Superphosphate	E. Frank Coe, New York, N. Y	Waterville	199
257	" " " " "	" " " "	Skowhegan	257
196	Farmer's Choice	Chemical Amm[illegible]ate and Oil Co., New York, N. Y	Bangor	196
197	Farrar's Superphosphate	F. S Farrar & Co., Bangor, Me	Bangor	197
246	" "	" " "	Foxcroft	246
228	Flamingo Guano	Liebig & Gibbons, Baltimore, Md	Auburn	228
261	" "	" "	Randolph	261
275	" "	" "	Bangor	275
267	Lawn and Garden Dressing	Bowker Fertilizer Co., Boston, Mass.	Bowdoinham	267

FERTILIZER ANALYSES.

Station Number	Brand.	Moisture.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Soluble.	Phosphoric Acid. Reverted.	Phosphoric Acid. Insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash Found.	Potash Guaranteed.	Station Valuation of One Ton.	Selling Price.	Selling Price Exceeds Valuation.	Station Number.
199	E. Frank Coe's High Grade Ammoniated Superphosphate	8.62	2.11	.....	8.14	1.95	2.23	12.32	.....	10.09	.....	2.16	.....	$26 82	$38 00	$11 18	199
257	E. Frank Coe's High Grade Ammoniated Superphosphate	9.02	2.23	.....	8.30	2.29	2.10	12.69	.....	10.59	...	2.58	.....	28 29	38 00	9 71	257
	Average	8.82	2.17	2.00 to 2.50	8.22	2.12	2.17	12.51	.....	10.34	10.00 to 11.00	2.37	1.60 to 2.10	27 56	38 00	10 44	
196	Farmer's Choice	10.67	2.91	....	7.18	2.21	2.36	11.75	.....	9.39	.....	4.20	...	29 97	......	..	196
197	Farrar's Superphosphate	12.20	2.62	...	6.77	4.74	.81	12.32	.....	11.51	.....	3.15	.....	30 26	36 00	5 74	197
246	" "	10.02	3.08	.....	7.33	2.02	1.13	10.48	.....	9.35	.....	6.29	.....	31 57	36 00	4 43	246
	Average	11.11	2.85	.....	7.05	3.38	.97	11.40	.....	10.43	.....	4.72	.....	30 91	36 00	5 09	
228	Flamingo Guano	14.79	.54	.....	.29	5.47	13.39	19.15	.....	5.76	.....	.19	.....	21 41	38 00	16 59	228
261	" "	16.76	.51	.....	.....	6.11	13.61	19.72	.....	6.11	.....	.26	.....	22 05	38 00	15 95	261
275	" "	15.62	.27	.....	.....	3.47	13.41	16.88	.....	3.47	.....	.46	.....	17 22	35 00	17 75	275
	Average	15.72	.44	0.60 to 1.00	.10	5.02	13.47	18.58	.....	5.11	10.00 to 14.00	.30	0.25 to 0.75	20 24	37 00	16 74	
267	Lawn and Garden Dressing	10.57	5.23	5.00 to 6.00	6.35	1.29	.74	8.38	.....	7.64	5 00 to 6.00	3.38	.....	33 70	43 00	9 30	267

FERTILIZERS.

Station Number	Brand.	Manufacturer.	Sampled at	Station Number
214	Liebig's Ammoniated Superphosphate..........	Liebig & Gibbons, Baltimore, Md	New Gloucester.........	214
260	" " "	" "	Augusta	260
276	" " "	" "	Bangor	276
204	Mayo Superphosphate.......................	Atlantic Fertilizer Co., Boston, Mass	Monmouth	204
245	" "	" " "	Foxcroft	245
253	" "	" " "	Waterville	253
191	Potato, Hop, and Tobacco Phosphate	Crocker Chemical and Fertilizer Co., Buffalo, N. Y........	Lewiston	191
216	" " " "	" " " "	New Gloucester.........	216
226	" " " "	" " " "	Baldwin	226

FERTILIZER ANALYSES

Station Number	Brand.	Moisture.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Soluble.	Phosphoric Acid. Reverted.	Phosphoric Acid. Insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station Valuation of One Ton.	Selling Price.	Selling Price Exceeds Valuation.	Station Number.
214	Liebig's Ammoniated Superphosphate	21.40	1.63	....	1.81	5.68	4.56	12.05	.....	7.49	....	2.61	.....	$22 24	$38 00	$15 76	214
260	" " "	21.57	1.71	.....	7.62	.70	4.18	12.50	.....	8.32	.....	2.51	.....	22 39	35 00	13 61	260
276	" " "	22.19	1.60	.....	1.92	6.00	4 27	12.19	.....	7.92	.....	.91	.....	21 00	......	......	276
	Average	21.72	1.65	1.50 to 2.00	3.78	4.13	4.34	12.25	.....	7.91	8.00 to 10.00	2.01	1.00 to 1.50	21 88	36 50	14 68	
204	Mayo Superphosphate......................	16.15	2.34	.....	10.11	.97	.96	12.04	.....	11.08	.....	4.42	.....	30 26	36 00	5 74	204
245	" "	14.27	2.38	.....	9.94	1.61	.53	12.08	.....	11.55	.....	4.83	.....	31 06	38 00	6 94	245
253	" "	15.30	2.42	.....	10.16	1.61	.53	12.30	.....	11.77	.....	4.62	.....	31 39	36 00	4 61	253
	Average...........................	15.24	2.38	2.50 to 3.00	10.07	1.40	.67	12.14	.....	11.47	10.50 to 11.50	4.62	3.00 to 4.00	30 90	36 66	5 76	
191	Potato, Hop and Tobacco Phosphate..........	13.02	2.26	.....	7.94	1.83	.74	10.51	.....	9.77	.....	4.55	.....	27 22	38 00	10 78	191
216	" " " "	11.69	2.42	.....	8.46	1.99	.85	11.30	.....	10.45	.....	4.21	.....	29 08	38 00	8 92	216
226	" " " "	11.91	2.20	.....	7.97	2.24	.67	10.88	.....	10.21	.....	4.37	.....	27 92	38 00	10 08	226
	Average...........................	12.21	2.29	2.00 to 3.00	8.12	2.02	.75	10.89	.....	10.14	10.00	4.38	3.50 to 4.50	28 07	38 00	9 93	

FERTILIZERS.

Station Number	BRAND.	Manufacturer.	Sampled at	Station Number
235	Original Coe's Superphosphate	Bradley Fertilizer Co., Boston, Mass.	Lewiston	235
263	Red Beach Superphosphate	Red Beach Plaster Co., Red Beach, Me	Gardiner	263
266	" "	" " " "	Bowdoinham	266
207	Sagadahoc Superphosphate	Sagadahoc Fertilizer Co., Bowdoinham, Me.	Monmouth	207
264	" "	" " " "	Bowdoinham	264
269	" "	" " " "	So. Litchfield	269
274	Seeding Down Fertilizer	Cumberland Bone Co., Portland, Me	Bangor	274

FERTILIZER ANALYSES.

Station Number	Brand.	Moisture.	Nitrogen.		Phosphoric Acid.							Potash.		Station Valuation of One Ton.	Selling Price.	Selling Price Exceeds Valuation.	Station Number
								Total.		Available.							
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.				
235	Original Coe's Superphosphate..	11.40	2.35	2.05 to 2.85	8.29	1.81	3.12	13.22	10.00 to 13.00	10.10	8.00 to 10.00	2.12	1.00 to 2.00	$27 86	$33 00	$5 14	235
263	Red Beach Superphosphate..................	12.75	2.28	.....	2.08	7.39	2.51	11.98	.....	9.47	.....	2.31	.....	25 86	36 00	10 14	263
266	" " "	12.57	2.14	.....	8.13	1.20	1.97	11.30	.....	9.33	.....	2.19	.....	25 34	36 00	10 66	266
		12.66	2.21	2.50	5.11	4.29	2.24	11.64	.....	9.40	8.00	2.25	2.26	25 60	36 00	10 40	
207	Sagadahoc Superphosphate..................	21.28	2.91	.....	5.07	2.12	2.11	9.30	.....	7.19	.....	2.96	.....	25 26	33 00	5 74	207
264	" "	21.22	2.90	.....	3.62	4.11	2.14	9.87	.....	7.73	.....	3.41	.....	26 18	30 00	.....	264
269	" "	21.35	3.01	.....	4.42	3.24	1.74	9.40	.....	7.66	.....	2.95	.....	26 06	32 00	5 94	269
		21.28	2.94	2.00 to 3.00	4.37	3.16	1.99	9.52	13.00	7.53	9.50 to 12.50	3.11	2.00 to 3.00	25 83	32 50	5 84	
274	Seeding Down Fertilizer..................	11.13	1.45	1.50	3.20	4.43	15.77	23.40	18.00 to 20.00	7.63	.....	.97	1.00	30 27	28 00	-2 27	274

FERTILIZERS.

Station Number	Brand.	Manufacturer.	Sampled at	Station Number
193	Soluble Pacific Guano	Glidden & Curtis, Gen'l Ag'ts, Boston, Mass	Portland	193
203	" " "	" " "	Waterville	203
205	" " "	" " "	Monmouth	205
211	Standard Superphosphate	Standard Fertilizer Co , Boston, Mass	Bangor	211
225	" "	" " "	Cornish	225
229	" "	" " "	Auburn	229
202	Stockbridge's Corn Fertilizer	Bowker Fertilizer Co., Boston, Mass	Waterville	202
219	" "	" " "	Fryeburg	219
233	" "	" " "	Auburn	233

FERTILIZER ANALYSES.

Station Number	Brand.	Moisture.	Nitrogen.		Phosphoric Acid.							Potash.		Station Valuation of One Ton.	Selling Price	Selling Price Exceeds Valuation.	Station Number
			Found.	Guaranteed.	Soluble.	Reverted.	Insoluble	Total. Found.	Total. Guaranteed	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.				
193	Soluble Pacific Guano	11.90	2.50	.....	6.48	2.57	3.37	12.42	.....	9.05	.....	2.55	.....	$27 16	$38 00	$10 84	193
203	" " "	12.05	2.50	.....	6.53	3.19	3.40	13.12	.....	9.72	.....	2.58	.....	28 21	36 00	7 79	203
205	" " "	11.49	2.46	.....	6.11	3.11	3.43	12.65	.....	9.22	.....	2.52	.....	27 25	35 00	7 75	205
		11.81	2.49	2.00 to 3.00	6.37	2.96	3.40	12.73	12.00 to 14.00	9.33	8.00 to 11.00	2.55	2.00 to 3.50	27 54	36 33	8 79	
211	Standard Superphosphate	12.06	2.65	.....	7.54	2.42	2.82	12.78	.....	9.96	.....	2.66	.....	28 91	38 00	9 09	211
225	" "	12.90	2.67	.....	7.34	2.46	2.35	12.15	.....	9.80	.....	2.34	.....	28 17	38 00	9 83	225
229	" "	11.17	2.65	.....	7.70	2.56	2.51	12.77	.....	10.26	.....	2.63	.....	29 17	38 00	8 83	229
		12.04	2.66	2.50 to 3.50	7.53	2.48	2.56	12.57	11.00 to 16.00	10.01	9.00 to 13.00	2.54	2.00 to 4.00	28 75	38 00	9 25	
202	Stockbridge's Corn Fertilizer	11.42	3.02	.....	8.08	2.35	1.22	11.65	.....	10.43	.....	2.99	.....	30 21	42 00	11 79	202
219	" " "	14.25	2.79	.....	8.24	2.05	1.39	11.68	.....	10.29	.....	2.98	.....	29 37	40 00	10 63	219
233	" " "	11.10	3.36	.....	7.79	2.48	.83	11.10	.....	10.27	.....	5.05	.....	32 71	43 00	10 29	233
		12.26	3.06	3.25 to 4.25	8.04	2.29	1.15	11.48	7.00 to 9.00	10.33	6.00 to 7.00	3.67	4.00 to 5.00	30 76	41 66	10 90	

FERTILIZERS.

Station Number	Brand.	Manufacturer.	Sampled at	Station Number
273	Stockbridge's Pea and Bean Fertilizer	Bowker Fertilizer Co., Boston, Mass	Richmond	273
201	Stockbridge's Potato Fertilizer	Bowker Fertilizer Co., Boston, Mass	Waterville	201
220	" "	" " "	Fryeburg	220
230	" "	" " "	Auburn	230

FERTILIZER ANALYSES.

Station Number	Brand.	Moisture.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Soluble.	Phosphoric Acid. Reverted.	Phosphoric Acid. Insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station Valuation of One Ton.	Selling Price.	Selling Price Exceeds Valuation.	Station Number
273	Stockbridge's Pea and Bean Fertilizer..	10.18	3.41	.....	5.42	5.25	1.87	12.54	.....	10.67	.....	2.93	.....	$32 08	$43 00	$10 92	273
201	Stockbridge's Potato Fertilizer	11.57	3.47	.....	7.46	2.54	1.12	11.12	.....	10.00	.....	3.14	.....	31 23	42 00	10 77	201
220	" " "	12.37	3.14	.....	7.33	2.21	1.34	10.88	.....	9.54	.....	3.83	.....	30 08	40 00	9 92	220
230	" " "	11.32	3.77	.....	7.94	1.90	1.02	10.86	.....	9.84	.....	3.46	.....	32 29	43 00	10 71	230
		11.75	3.46	3.25 to 4.25	7.58	2.22	1.16	10.96	10.00 to 12.00	9.80	8.00 to 10.00	3.48	5.00 to 6.00	31 20	41 66	10 46	

For convenience of reference a somewhat abridged summary of the averages in the previous tables has been arranged, which follows. In the last column can be seen the relation of the excess of selling price to the money valuation. In order to see clearly the significance of the figures of this column it should be remembered that the Station valuation is the sum of money for which the ingredients of a ton of fertilizer can be bought at retail in our large markets for cash, *in a condition ready for use*, when sold singly and not mixed. The selling price is the sum of money which a farmer pays for the ingredients of a ton of fertilizer, mixed and delivered at his door, or in his immediate vicinity.

The difference between the Station valuation and the selling price is really the sum of money which it costs the farmer to have the ingredients of a ton of fertilizer mixed, transported and sold. The last column of figures shows what percentage this difference is of the money valuation, or the relative cost of mixing, transporting and selling the same amount of plant food in each fertilizer. As a rule, the quantity of fertilizing ingredients which costs $1.00 in our large markets is sold to Maine farmers at from 20 to 35 cents advance. In four cases the increase in cost is over 60 cents on the dollar, and in one instance is 111 cents.

It may be true that every brand of commercial fertilizers represented in these analyses is offered to Maine farmers at the lowest price consistent with fair profits. Whether this be so or not, the fact is very evident that the prices of a few brands are out of proportion to the cost of a larger part of the fertilizers in our markets, and it is not to be expected that such goods can successfully compete with those offered at prices much lower in proportion to their real value. It is claimed by some interested parties that chemical analysis is incompetent to determine even the relative values of fertilizers, and that, this being true, the analyses and money valuations of experiment stations are not a reliable guide for the farmer. The insincerity of this argument is shown by the fact that dealers in the materials used in the manufacture of commercial fertilizers buy and sell wholly on what they learn of the goods from chemical analysis. That which has value to the dealer and the manufacturer is that which has value to the farmer, and it is absurd to suppose that chemical methods are reliable in the one case and not in the other.

Table Showing Average Composition of Fertilizers Analyzed in 1887.

Brand.	No. of Samples Analyzed.	Moisture.	Nitrogen.	Phosphoric Acid. Total.	Phosphoric Acid. Available.	Phosphoric Acid. Insoluble.	Potash.	Station Valuation of One Ton.	Selling Price Exceeds Valuation.	Excess of Selling Price in Percentage of Valuation.
Americus Ammoniated Superphosphate	2	11.14	2.71	10.81	10.41	.40	2.50	$28 80	$8 70	30 20
Bay State Fertilizer	3	9.84	2.70	12.97	11.00	1.97	2.87	30 75	7 92	25 75
Bay State Superphosphate	3	17.55	2.90	10.70	8.18	2.52	2.83	27 04	10 96	40 50
Bowker's Ammoniated Dissolved Bone	2	13.80	2.48	12.19	10.70	1.50	1.38	27 63	8 37	30 30
Bowker's Hill and Drill Phosphate	3	13.69	2.89	11.87	10.72	1.15	2.83	29 31	9 35	31 90
B. D. Sea Fowl Guano	3	12.29	2.55	13.22	10.16	3.06	2.01	28 48	6 52	22 90
Bradley's X L Superphosphate	3	12.72	2.77	12.42	10.52	1.90	1.83	29 44	8 87	30 10
Buffalo Ammoniated Superphosphate	3	10.32	3.07	12.10	10.31	1.79	1.65	29 46	8 54	29 00
Cleveland's Superphosphate	2	12.91	2.52	12.78	10.47	2.31	2.21	28 83	7 17	24 90
Common Sense Fertilizer No. 2	2	8.75	1.85	5.25	3.79	1.46	4.19	16 56	18 44	111 30
Common Sense Fertilizer, Diamond D	1	13.61	1.29	5.14	3.73	1.41	2.47	13 07	7 93	60 60
Cumberland Bone Superphosphate	3	13.54	2.57	13.45	9.04	4.41	4.22	29 59	8 41	28 40
Dirigo Fertilizer	3	7.59	1.89	12.72	5.64	7.08	3.89	22 63	4 97	21 90
E. Frank Coe's High Grade Amm. Superphosphate	2	8.82	2.17	12.51	10.34	2.17	2.37	27 56	10 44	37 90
Farmer's Choice	1	10.67	2.91	11.75	9 39	2.36	4.20	29 97		

Table Showing Average Composition of Fertilizers Analyzed in 1887.

Brand.	No. of Samples Analyzed.	Moisture.	Nitrogen.	Phosphoric Acid.			Potash.	Station Valuation of One Ton.	Selling Price Exceeds Valuation.	Excess of Selling Price in Percentage of Valuation.
				Found.	Available.	Insoluble.				
Farrar's Superphosphate	2	11.11	2.85	11.40	10.43	.97	4.72	$30 91	$ 5 09	16 50
Flamingo Guano	3	15.72	.44	18.58	5.11	13.47	.30	20 21	16 74	82 70
Lawn and Garden Dressing	1	10.57	5.23	8.38	7.64	.74	3.38	33 70	9 30	27 60
Liebig's Ammoniated Superphosphate	3	21.72	1 65	12.25	7.91	4.34	2.01	21 88	14 68	67 10
Mayo Superphosphate	3	15.24	2.38	12.14	11.47	.67	4.62	30 90	5 76	18 60
Potato, Hop and Tobacco Phosphate	3	12.21	2.29	10.89	10.14	.75	4.38	28 07	9 93	35 40
Original Coe's Superphosphate	1	11.40	2.35	13.22	10.10	3.12	2.12	27 86	5 14	18 40
Red Beach Superphosphate	2	12.66	2.21	11.64	9.40	2.24	2.25	25 60	10 40	40 70
Sagadahoc Superphosphate	3	21.28	2.94	9.52	7.53	1.99	3.11	25 83	5 84	22 60
Seeding Down Fertilizer	1	11.13	1.45	23.40	7.63	15.77	.97	30 27	—2 27	
Soluble Pacific Guano	3	11.81	2.49	12.73	9.33	3.40	2.55	27 54	8 79	31 90
Standard Superphosphate	3	12.04	2.66	12.57	10.01	2.56	2.54	28 75	9 25	32 20
Stockbridge's Corn Fertilizer	3	12.26	3.06	11.48	10.33	1.15	3.67	30 76	10 90	35 40
Stockbridge's Pea and Bean Fertilizer	1	10.18	3.41	12.54	10.67	1.87	2.93	32 08	10 92	34 00
Stockbridge's Potato Fertilizer	3	11.75	3.46	10.96	9.80	1.16	3.48	31 20	10 46	33 50

(*b*) ANALYSES OF MISCELLANEOUS FERTILIZERS.

Analyses have been made of quite a number of fertilizing materials, including those used in the field experiments conducted by the Station, and also fertilizers sent to the Station by farmers with a request that they be submitted to examination.

The following list includes nearly all these materials of a miscellaneous character.

Miscellaneous Fertilizers.

Station No.

239 Ground South Carolina rock, sent to Station by Chas. G. Atkins, Esq., Bucksport.

240 Ground South Carolina rock, used in the Station field experiments.

188 Bone meal, sent to Station by E. H. Libbey, Esq., in behalf of Androscoggin County Grange.

242 Ground bone, used in the Station field experiments.

241 Dissolved bone black, used in the Station field experiments.

244 Sulphate of ammonia, used in the Station field experiments.

243 Muriate of potash, used in the Station field experiments.

249 "Muriate of potash," sent to the Station by Chas. G. Atkins, Esq., Bucksport.

Station Number		Nitrogen.	Phosphoric Acid.			Potash.
			Soluble.	Reverted.	Insoluble.	
		%	%	%	%	%
239	Ground S. C. rock	......	......	......	27.30	
240	" " "	.....	......	......	26.37	
188	Bone meal	4.02	.....	......	19.63	
242	Ground bone	3.75	......	......	22.22	
241	Dissolved bone black	......	16.16	1.04	.26	
244	Sulphate of ammonia	20.98				
243	Muriate of potash	......	......	......	......	50.44
249	" " "	.....	......	......	......	12.19

The sample of bone meal, No. 188, was sent to the Station because it was thought that its appearance gave indications of adulteration.

A portion of the reply sent to Mr. Libbey was in substance as follows:

"The average of a large number of analyses of ground bone (bone meal) gives these figures:

Phosphoric acid	21.7 per cent.
Nitrogen	3.3 "

Although the sample you sent contains less phosphoric acid and more nitrogen than the average, the composition is not unusual, and the analysis gives no indication of adulteration."

Sample No. 249 came from Mr. Atkins marked "Muriate of Potash," but evidently it is kanite. Muriate of potash should contain at least 50 per cent of potash (potassium oxide), whereas this was found to contain only 12.19 per cent, which is below the percentage often found in kanite. If this material was sold for muriate of potash, of the grade now found in the market, a deception was practiced.

Clam Shells.

Samples of clam shells, whole and ground to different degrees of fineness, were furnished to the Station by Hon. Z. A. Gilbert, which were obtained through the kindness of the manufacturers, the Damariscotta Shell and Fertilizer Co.

It is not known to what extent this material is offered to farmers for use as a fertilizer, but it is assumed that the composition of all classes of substances that are in the market under the head of fertilizing material is a matter of public interest.

The character of the four samples was as follows:

Station No.	
184	Whole shells.
185	Shells broken in coarse pieces.
186	Shells ground quite fine.
187	Shells ground very fine.

As would be expected, these different grades have very nearly the same composition. The analyses are given below:

	184.	185.	186.	187.
	%	%	%	%
Carbonate of lime	96.59	96.09	91.36	93.09
Sulphate of lime (hydrated)	1.11	.99	1.20	1.47
Phosphoric acid	trace	trace	trace	trace
Oxide of iron	"	"	"	"
Magnesia	"	"	"	"
Organic matter	1.69	1.07	1.33	1.14
Insoluble material (silica, etc.)	.40	.24	3.02	1.96
Water	.27	.19	.51	.82

The chief ingredient of clam shells, as these and many other analyses show, is carbonate of lime, and they do not contain an appreciable amount of any of the more costly ingredients of plant food. Like lime, these shells are not a fertilizer in the sense that barn manure or a superphoshate is, and their effect would be indirect. In fact their effect, when finely ground, would be similar to that of lime, only less vigorous. Fifty-six pounds of well-burned lime would add to the soil all that is of value in a hundred pounds of clam shells, and would, when thoroughly air slaked have an equal or greater effect on crop production.

Hen Manure.

A communication was received from E. F. Roundy, Esq., No. Hermon, asking in regard to the expense of procuring the analysis at the Station of a sample of hen manure. The reply was made that if Mr. Roundy would carefully select a sample, and weigh a barrelful of the manure from which the sample was taken, the analysis would be performed free of charge.

Two samples of hen manure were received, accompanied by the following letter:

May 9, 1887.

Dear Sir:—

"I send you *two* samples of hen manure by Express. Sample A is the droppings as taken from the platform under the roosts, and not dried.

A common flour barrel filled and well firmed in weighs 200 pounds net.

The hens which made the above were fed principally on oats and wheat bran with *some corn meal and corn.*

Sample B is hen manure in which there were put a very few ashes and about 20 pounds of plaster per barrel. About four weeks ago it was piled in the barn floor and has been worked over several times since. It weighs at present time 175 pounds per barrel, net, well chopped in.

Please state the amount of the several constituents and their value. Some think a barrel of hen manure as good as a barrel of phosphate. Acting upon *that* idea, I, last year, planted a few rows, using the manure in about the same quantity as I did of phosphate on other corn.

The corn under which the manure was put did not amount to much, while the other was good."

The samples of manure were analyzed, and the results are given in the reply sent to Mr. Roundy.

Dear Sir:

"We have completed the analyses of the samples of hen manure which you sent to the Station, with the following results: I give first the percentages and valuable ingredients in the two samples as received.

Sample.	Phos. Acid.	Potash.	Nitrogen.
A	.91	.69	1.10
B	1.29	1.02	1.47

From these percentages I have calculated the pounds of each of these valuable ingredients in a barrel of each kind of manure, wet and dry; and also the commercial value of these quantities in forms equally useful to the farmer.

Sample	Phos. Acid.	Potash.	Nitrogen.	Value per Barrel.
A	1.8 lbs.	1.38 lbs.	2.2 lbs.	$0.65
B	2.25 "	1.78 "	2.58 "	0.78

The phosphoric acid is reckoned at 8 cents per pound, the potash at 5 cents, and the nitrogen at 20 cents. You cannot get something out of nothing, so you cannot expect that the manure of hens will contain more fertilizing material than is furnished by their food."

Relative Manure Value of Cotton-Seed Meal and Linseed Meal.

The manurial value of purchased cattle foods is a matter of importance. This value is determined by the amounts of nitrogen, phosphoric acid and potash that the foods contain, as these ingredients appear in the manure in proportion to the quantities found in the food.

As a source of plant food cotton-seed meal is superior to linseed.

Analyses of two samples of each of these foods collected in Maine in the fall of 1886 showed them to contain the following quantities of nitrogen, phosphoric acid and potash:

	Nitrogen.		Phosphoric Acid.		Potash.	
	Per Cent.	Pounds in a Ton.	Per Cent.	Pounds in a Ton.	Per Cent	Pounds in a Ton.
Cotton-seed meal, xxviii.....	7.03	140.6	3.28	65.6	1.88	37.6
Cotton-seed meal, xxxv......	7.38	147.6	3.08	61.6	2.03	40.6
Average...............	7.20	144.0	3.18	63.6	1.96	39.1
Linseed meal, xxix.	4.92	98.4	1.98	39.6	1.14	22.8
Linseed meal, xxxiv.........	5.65	113.0	1.80	36.0	1.11	22.2
Average...............	5.29	105.8	1.89	37.8	1.13	22.5

The cost in 1887 of the same quantities of equally valuable nitrogen, phosphoric acid and potash that are found in the above average for cotton-seed meal was $31.31, while the market value of these ingredients in the average linseed meal was only $22.12.

About four-fifths of this market value pertains to the nitrogen that these two foods contain, this being the most costly ingredient of the three mentioned.

It is not asserted therefore, that a farmer can afford to pay the above sum of money for a ton of cotton-seed meal or linseed meal to use as a fertilizer, unless it is for the purpose of mixing these materials with some purely phosphatic fertilizer. The cases are rare in Maine where it is profitable to apply alone a fertilizer containing so large a quantity of nitrogen, in proportion to the amounts of phosphoric acid and potash, as is found to be the case with cotton-seed and linseed meals.

The fact is plain, however, that these two feeding stuffs bring to the farm the quantities of valuable manurial ingredients shown by the analyses, and that these quantities would cost, when purchased in commercial fertilizers, the sums of money stated. No other fact is needed to make evident the value to the farm of purchased foods of this character, as a source of fertility.

(c) EXPERIMENTS WITH FERTILIZERS.

Field Experiments with Fertilizers at the Station.

The field experiments with fertilizers now being conducted at the Station are planned with reference to gaining information on four points in farm practice, viz.:

(1). The comparative worth of phosphoric acid (phosphates) in the various forms available for use.

(2). The use of a partial as compared with a complete fertilizer.

(3). The relative profits resulting from the use of different quantities of fertilizers.

(4). The comparative results from the use of farm manures (excrement of animals) and of commercial manures.

The soil of the experimental field is a clayey loam, well adapted to grass and grain, which at the beginning of the experiments was in condition to produce a fairly good crop without the aid of manure.

The field, which is quite uniform in character, is divided into thirty-six (36) plots, eight rods long and one rod wide, containing one-twentieth of an acre each. The plots are separated by a strip of land eight feet wide, in which runs a ditch deep enough to ensure a prompt removal of all surplus water from the surface soil.

Before the sod was broken for the plots in 1885, the field had borne three heavy crops of grass, previous to which the land received a liberal application of manure and unleached ashes.

In 1885 the plots produced a crop of barley with no manure, the treatment of the plots being uniform throughout.

The plots extend east and west, and are arranged in two tiers which run north and south, and which are separated by a narrow road. The corners of the plots are marked by seasoned maple stakes, which are driven so deep that they will remain permanently.

It is intended to continue these experiments on the same plots for a series of years. It is only by testing the effect of continuing a method of manuring for a long time that we are able to arrive at conclusions which can be safely followed in farm practice.

It is proposed, therefore, to devote these plots to a rotation of crops, making an application of fertilizers at stated periods, and keeping a careful record of the crops produced and such other facts as seem to be of interest.

It is well known that the field experiments of this sort may involve errors of considerable magnitude, the main source of error being lack of uniformity in the productiveness of the various plots.

In these experiments an effort will be made to eliminate errors due to this cause, by (1) having three plots in different parts of the fields treated in the same way, and by (2) continuing the experiments for a long time.

If the average results thus obtained show no marked difference between the effect of two methods of manuring after ten years, it can be safely concluded that so far as immediate profit is concerned it will make very little difference which method a farmer chooses. It should be recognized, therefore, that the results obtained from the work of any one year have a value somewhat in proportion to the number of years the experiments have been continued, consequently the yields of the plots for 1866 are given only as a report of progress.

Each tier of eighteen plots is divided into three sets of six plots each. In each set there is one plot which receives no manure, and the other five plots all receive fertilizers of some kind, which are not alike in all respects on any two plots in the same set. Each plot of one set, however, is treated exactly like a corresponding plot in both the other sets, so that each method of manuring is carried out on three plots. The average yield of the three plots treated alike is taken as representing the yield from the method of manuring used on those plots.

The Comparative Production from Different Forms of Phosphoric Acid.

A very large part of the phosphoric acid that is applied to the soil in commercial fertilizers does not exist in the fertilizers in the forms in which it is found in nature.

The larger portion of the bone, and about all the phosphatic guanos and mineral phosphates used, are treated with sulphuric acid before going to the farm. This is done in order to make the phosphoric acid available to plants, and the cost of this ingredient of fertilizers is thus greatly increased.

The question is now raised whether the increased cost caused by the use of sulphuric acid is profitable in all cases. It is well known that a soluble phosphate does not remain in solution in the soil, but that immediately after the application of a fertilizer to moist earth the soluble phosphoric acid becomes combined in insoluble phosphates, which are deposited in minute particles. The particles are so finely divided that the roots of plants easily secure plant food from them. It seems from the knowledge at present available, therefore, that the ultimate and valuable result of treating a phosphate with sulphuric acid is its distribution through the soil in a mechanical condition so fine that it is readily available to plants.

The query very naturally follows whether practically the same result cannot be reached by the use of very finely ground *undissolved* phosphates, and thus lessen the expense of crop production, especially of grain and grass. This is one of the points involved in the field experiments undertaken by the Station.

Three forms of phosphatic material are being used in this experiment, viz.: Dissolved bone black, in which the phosphoric acid has been rendered largely soluble by the action of sulphuric acid; finely ground bone, undissolved; and finely ground South Carolina rock, undissolved.

In every case other necessary ingredients of plant food besides phosphoric acid are supplied so abundantly by the use of muriate of potash and sulphate of ammonia that a failure of the crop to grow could only be ascribed to a lack of available phosphoric acid.

The quantity of phosphatic material applied is sufficient in every case to furnish the same amount of phosphoric acid per acre throughout. The cost of the phosphoric acid varies greatly, however, in the three cases, that furnished by the ground S. C. rock costing not over a third of the market value of the same amount in the other two forms.

The following table gives the kinds and quantities of fertilizers used, and the yields of grain and straw on each plot.

The crop grown was oats. The seed was sown May 15th, and the crop was cut August 13th.

This experiment involves the first series of eighteen plots.

METHOD OF MANURING.

	Nothing.		Dissolved Bone Black 400 lbs., Muriate of Potash 100 lbs., Sulphate of Ammonia 200 lbs.		Fine Ground Bone 360 lbs, Muriate of Potash 100 lbs, Sulphate of Ammonia 140 lbs.		Fine Ground South Carolina Rock 300 lbs., Muriate of Potash 100 lbs., Sulphate of Ammonia 200 lbs.		Muriate of Potash 100 lbs., Sulphate of Ammonia 200 lbs.		Stable Manure 40,000 lbs.	
	Yield, Plot.		Yield, Plot.		Yield, Plot.		Yield, Plot.		Yield, Plot.		Yield, Plot.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Plot 1...	96½	119½										
" 7...	79	103										
" 13...	75	75										
Plot 2...	.....	.....	126	184								
" 8...	.....	.....	134½	180½								
" 14...	.....	.....	112½	147½								
Plot 3...	.....	.....	.....	.....	117	153						
" 9...	.....	.....	.....	.....	122	173						
" 15...	.....	.....	.....	.....	106	144						
Plot 4...	.....	.....	.....	.....	.....	.....	107½	137½				
" 10...	.....	.....	.....	.....	.....	.....	124½	173½				
" 16..	.....	.....	.....	.....	.....	.....	93	122				
Plot 5...	.....	.....	.....	.....	.....	.....	.....	.....	90	135		
" 11...	.....	.....	.....	.....	.....	.....	.....	.....	112	133		
" 17...	.....	.....	.....	.....	.....	.....	.....	.....	88½	116½		
Plot 6...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	124½	190½
" 12...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	126½	138¼
" 18...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	81½	128½
Average..	83.5	99.2	124.3	170.7	114.3	156.7	108.3	144.3	96.8	128.2	110.8	152.5

In the next table can be seen the average rate of yield per acre with the various kinds of fertilizers used, and with no fertilizer.

Kind of Fertilizer.	Quantity of Fertilizer Per Acre	Yield Per Acre. Average of Three Plots.		Gain Over Plots Receiving no Fertilizer.	
		Grain. bush.	Straw. lbs.	Grain. bush.	Straw. lbs.
Nothing	....	55.7	1,984		
Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 200	82.9	3,414	27.2	1,430
Fine ground bone Muriate of potash Sulphate of ammonia	360 100 140	76.2	3,134	20.5	1,150
Fine ground S. C. rock Muriate of potash Sulphate of ammonia	300 100 200	72.2	2,884	16.5	900
Muriate of potash Sulphate of ammonia	100 200	64.5	2,564	8.8	580
Stable manure	40,000	73.9	3,050	18.2	1,066

The yield of the plots receiving no fertilizer shows that the land was capable of producing a good crop without the aid of manure, and so it should not be expected that the fertilizers would cause a marked increase of crop. Nevertheless, the increase was quite large in some cases.

The following brief comments may serve to point out the important facts indicated by the above table:

(1). The largest increase of crop was produced by the use of soluble phosphoric acid, in the case of the dissolved bone black. Experience has shown that this would probably be the case for the first year. Will it continue to be the case for several years?

(2). The undissolved phosphates, viz: the fine ground bone and fine ground rock, were undoubtedly used by the crop to a considerable extent, as can be seen by comparing the yield where these fertilizers were applied with the yield where the muriate of potash and sulphate of ammonia were used without phosphatic material.

(3). For the first year's crop the yard manure proved inferior to the best complete commercial fertilizer.

Partial and Complete Fertilizer—The Profitable Quantity of Commercial Fertilizer to Use.

The two questions to which the second series is devoted are the following:

(1). The use of partial as compared with complete fertilizers.

(2). The relative profits resulting from the use of different quantities of fertilizers.

Both of these questions are of great importance in farm practice. If a failure to supply in commercial manures *all* the most important elements of plant food is to prove disastrous to the profits of farming, either immediately or after a period of years, it is important that the fact should be shown by good evidence.

The second question is equally important in farm economy. It is well known that no arable soil is so poor that it will not furnish a portion of the food necessary for the production of a crop. That which the soil cannot supply the farmer must, but it is good economy not to increase the artificial supply out of proportion to the demand. There is abundant evidence that from our good soils the natural supply is an important factor in crop production.

As in the first series, three plots are devoted to the same method of treatment, and the yields given are the averages of three plots in each case.

The table below gives the kinds and quantities of manures used, and the yields of grain and straw from each method of treatment. The seed (oats) was sown and the crop was harvested at the same time as in the first series of plots.

METHOD OF MANURING.

	Nothing.		Dissolved Bone Black 400 lbs. (per acre).		Dissolved Bone Black 400 lbs., Muriate of Potash 100 lbs. (per acre).		Dissolved Bone Black 200 lbs., Muriate of Potash 50 lbs., Sulphate of Ammonia 60 lbs. (total 310 lbs., per acre).		Dissolved Bone Black 300 lbs., Muriate of Potash 100 lbs., Sulphate of Ammonia 120 lbs (total 520 lbs., per acre).		Dissolved Bone Black 400 lbs, Muriate of Potash 150 lbs., Sulphate of Ammonia 180 lbs. (total 730 lbs., per acre).	
	Yield, Plot.		Yield, Plot.		Yield, Plot.		Yield, Plot.		Yield, Plot.		Yield, Plot.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Plot 19,	92½	127½										
" 25,	68	137										
" 31,	75½	94½										
Plot 20,	....	....	84½	127½								
" 26,	....	....	86	179								
" 32,	....	....	78	122								
Plot 21,	....	....	....	....	82	143						
" 27,	....	....	....	....	87	203						
" 33,	....	....	....	....	74½	145½						
Plot 22,	....	....	....	....	....	....	89	156				
" 28,	....	....	....	....	....	....	87½	182½				
" 34,	....	....	....	....	....	....	82½	112½				
Plot 23,	....	....	....	....	....	....	....	....	98	198		
" 29,	....	....	....	....	....	....	....	....	100	160		
" 35,	....	....	....	....	....	....	....	....	112½	177½		
Plot 24,	....	....	....	....	....	....	....	....	....	....	90	230
" 30,	....	....	....	....	....	....	....	....	....	....	94½	195½
" 36,	....	....	....	....	....	....	....	....	....	....	121½	173½
Average	78.7	119.7	82.8	142.8	81.5	163.8	86.3	150.3	103.5	178.5	102	199.7

As before, the average rate of yield of the plots per acre is calculated. The results follow.

Kind of Fertilizer.	Quantity of Fertilizer Per Acre.	Yield Per Acre. Average of Three Plots.		Gain Over Plots Receiving no Fertilizer.	
		Grain. bush.	Straw. lbs	Grain. bush.	Straw. lbs.
Nothing	......	52.5	2,394		
Dissolved bone black	400	55.2	2,856	2.7	462
Dissolved bone black Muriate of potash	400 100	54.3	3,276	1.8	882
Dissolved bone black Muriate of potash Sulphate of ammonia	200 50 60	57.5	3,006	5.0	612
Dissolved bone black Muriate of potash Sulphate of ammonia	300 100 120	69.	3,570	16.8	1,176
Dissolved bone black Muriate of potash Sulphate of ammonia	400 150 180	68.	3,994	15.8	1,600

(1). The complete fertilizer gives the largest yield, so also does the largest quantity of the complete fertilizer. The increase in yield is not in proportion, however, to the increase in the quantity of fertilizer.

Field Experiments with Fertilizers by Farmers.

In the spring of 1886, the Station sent to farmers located in different parts of the State experimental sets of fertilizers, which were to be used according to certain directions given by the Station, the results of the experiments to be reported to the Station.

The objects in view in coöperating with farmers in this sort of experimental work were the following:

(1). To stimulate habits of inquiry and observation.

(2). To render farmers more familiar with the composition of fertilizers.

(3). To add something, if possible, to our stock of knowledge in regard to the profitable use of commercial fertilizers.

It was hoped to secure these results not only through the observations and experience of the farmers conducting the experiments, but also through the interest that the experiments might excite among other farmers in the localities to which the experimental sets of fertilizers were sent.

Fourteen farmers undertook experiments. With six of these the work resulted in utter failure, in most cases due to a drouth, which either prevented the proper germination of the seed or so dwarfed the crop from lack of water as to prevent any beneficial effect the fertilizers might otherwise have had.

The names and location of the eight farmers whose results are here reported are given below:

H. C. Burleigh, Vassalboro'.
J. M. Deering, Saco.
D. B. Johnson, Freedom.
H. L. & W. E. Leland, East Sangerville.
A. L. Moore, Limerick.
A. P. Starrett, Warren.
A. J. Tolman, Rockland.
E. P. & A. C. True, South Litchfield.

The following is a copy of the directions sent to each farmer that conducted an experiment:

Directions for Field Experiments with Fertilizers.

1. Select land that is as uniform in character as possible, and which has received no manure for several years (run-out land if you have it.)

2. The required dimensions of the whole piece are 8x11 1-8 rods, or 132x183 feet.

3. Before the plots are laid out, plow the whole piece, and pulverize thoroughly.

4. Make the size of each plot one-twentieth of an acre, and the dimensions one rod wide and eight rods long.

5. Measure off the plots, and drive a stake at each corner, leaving a strip of land two feet wide between the plots. If the land is inclined, the length of the plots should be up and down the slope.

6. Number the plots 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10.

7. Put *no* fertilizer on plots 1 and 6, and no fertilizer on any plot except that contained in the bags.

8. Put the fertilizers on the plots numbered to correspond to the numbers on the bags. Put Bag No. 2 on Plot No. 2, etc., etc.

9. Apply the fertilizers in the manner which you have practiced, only be careful that no fertilizer comes in contact with the seed.

10. Make the same number of rows on each plot, with the same number of hills in each row. This can be easily done by cross marking.

11. Put the same amount of the same kind of seed on each plot.

12. Plant the seed (or sow) on the same day on all the plots.

13. Cultivate the plots while the crop is growing, as nearly at the same time as possible.

14. Weigh the crop carefully on each plot, both grain and straw if grain is sown, both corn and fodder if corn is planted, that is, find weight of grain and straw separately.

15. Carefully report any misfortune to the crop on any plot, and keep a record of the appearance of each plot.

It is gratifying to be able to state that the experimenters were painstaking in their efforts to follow the above directions, and that where the experiments escaped unavoidable misfortunes the results were satisfactory, in some cases highly so.

The sets of fertilizers were alike in all respects. Each set consisted of eight bags, containing the materials stated below.

Bag 2.	Dissolved bone black,	20 lbs.
Bag 3.	Dissolved bone black,	20 lbs.
	Muriate of potash,	5 "
Bag 4.*	Dissolved bone black,	20 lbs.
	Muriate of potash,	5 "
	Sulphate of bone,	5 "
Bag 5.	Fine ground bone,	20 lbs.
Bag 7.	Same as Bag 2.	
Bag 8.	Same as Bag 3.	
Bag 9.	Same as Bag 4.	
Bag 10.	Same as Bag 5.	

* Complete fertilizer.

The cost per acre of these fertilizers is given for the benefit of those who wish to study the results of the following experiments from a financial point of view. These figures include only the cost of the materials delivered in Orono, the small expense of mixing and the freight paid for re-shipping to the various experimenters not being taken into account. The prices which the Station paid for these materials are lower than the retail prices quoted for small lots, but are applicable to lots of several tons.

Bag 2	$6,50	per acre.
Bag 3	9.00	"
Bag 4	13.00	"
Bag 5	7.60	"

H. C. Burleigh, Vassalboro'.

Crop, *oats*. The land was broken in 1881, manured with one-half ton coarse bone per acre, and seeded to winter wheat and Timothy. In grass since, with no fertilizer. Seed sown at rate of 2½ bushels per acre.

Plot.	Fertilizer Applied.	Amount of Fertilizer per Acre.	Total Crop Per Acre.	Yield Per Acre. Grain.	Yield Per Acre. Straw.
		lbs.	lbs.	bush.	lbs.
1	No fertilizer	....	2,540	28.	1,700
2	Dissolved bone black	400	2,420	20.7	1,800
3	Dissolved bone black Muriate of potash	400 100	2,800	37.3	1,680
4	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	3,180	45.3	1,820
5	Fine ground bone	400	2,550	30.3	1,640
6	No fertilizer	....	2,730	31.7	1,780
7	Dissolved bone black	400	2,680	32.0	1,720
8	Dissolved bone black Muriate of potash	400 100	2,910	39.	1,740
9	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	3,850	49.7	2,360
10	Fine ground bone	400	2,920	37.	1,810

Average.

		Total Crop per Acre.	Yield per Acre. Grain.	Yield per Acre. Straw.	Increase over plots receiving no Fertilizer. Grain.	Increase over plots receiving no Fertilizer. Straw.
		lbs.	bush.	lbs.	bush.	lbs.
No fertilizer		2635	29.9	1740		
Dissolved bone black, containing phosphoric acid		2550	26.3	1760	-3.6	20
Dissolved bone black, Muriate of potash	Containing phosphoric acid and potash.	2855	38.1	1710	8.2	-30
Dissolved bone black, Muriate of potash, Sulphate of ammonia.	Containing phosphoric acid, potash and nitrogen.	3515	47.5	2090	17.6	350
Fine ground bone	Containing phosphoric acid and nitrogen.	2735	33.6	1725	3.7	-15

Comments. The fertilizers produced a small increase of yield, that with the complete fertilizer being much larger than in any other case.

J. M. DEERING, Saco.

Crop, *corn.* Soil, moist, interval land, in grass for seven years, yielding rather more than one ton of hay per acre when plowed.

Plot.	Fertilizer Applied.	Amount of Fertilizer Per Acre.	Total Crop Per Acre.	Yield Per Acre.	
				Grain.	Fodder.
		lbs.	lbs.	bush.	lbs.
1	No fertilizer	....	8,480	40.	5,480
2	Dissolved bone black	400	8,400	40.	5,400
3	Dissolved bone black Muriate of potash	400 100	10,200	53.3	6,200
4	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	9,800	48.	6,200
5	Fine ground bone	400	9,600	50.7	5,800
6	No fertilizer	....	8,000	37.3	5,200
7	Dissolved bone black	400	8,840	43.2	5,600
8	Dissolved bone black Muriate of potash	400 100	10,600	56.0	6,400
9	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	10,200	50.7	6,400
10	Fine ground bone	400	9,800	50.7	6,000

AVERAGE.

		Total Crop per Acre.	Yield per Acre.		Increase of yield over plots with no Fertilizer.	
			Grain.	Straw.	Grain.	Fodder.
		lbs.	bush.	lbs	bush.	lbs.
No fertilizer		8,240	38.7	5340		
Dissolved bone black, containing phosphoric acid,		8,620	41.6	5500	2.9	160
Dissolved bone black, Muriate of potash.	Containing phosphoric acid and potash.	10,400	54.6	6300	15.9	960
Dissolved bone black. Muriate of potash, Sulphate of ammonia.	Containing phosphoric acid, potash and nitrogen.	10,000	49.3	6300	10.6	960
Fine ground bone....	Containing phosphoric acid and nitrogen	9,700	50.7	5900	12.0	560

In this experiment Mr. Deering separated the sound corn from the soft and weighed each kind. The amount of sound corn was not in proportion to the total weight of ears, but was greatest on the plots to which the ground bone was applied, the next largest amount being found in the plots receiving the bone black and muriate of potash. The following were the average weights of sound shelled corn grown with the various fertilizers:

No fertilizer, 29.3 bushels; dissolved bone black, 33.3 bushels; dissolved bone black and muriate of potash, 42.6 bushels; dissolved bone black, muriate of potash and sulphate of ammonia, 37.3 bushels; ground bone, 46.6 bushels.

Mr. Deering's observation was that while the growth was luxuriant where the complete fertilizer was applied, the ammonia salt seemed to retard the ripening of the crop.

It should be noted that this experiment was performed on land capable of feeding a good crop without the aid of manure, so that the application of the fertilizers caused but small increased growth.

D. B. Johnson, Freedom.

Crop, *beans*. The experimental field had been in grass for eight years. Soil very uniform.

Plot.	Fertilizer Applied.	Amount of Fertilizer per Acre.	Total Crop per Acre.	Yield per Acre.	
				Beans.	Vines.
		lbs.	lbs.	bush.	lbs.
1	No fertilizer	....	740	5.8	390
2	Dissolved bone black	400	920	7.7	460
3	Dissolved bone black Muriate of potash	400 100	1,300	12.0	580
4	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	1,840	14.7	960
5	Fine ground bone	400	1,120	9.3	540
6	No fertilizer	....	920	10.	320
7	Dissolved bone black	400	980	7.7	520
8	Dissolved bone black Muriate of potash	400 100	1,280	11.5	590
9	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	1,380	10.3	740
10	Fine ground bone	400	960	8.3	460

Average.

Fertilizer Applied.		Total Crop Per Acre.	Yield Per Acre.		Increase of yield over plots with no Fertilizer.	
			Beans.	Vines.	Beans.	Vines.
		lbs.	bush.	lbs.	bush.	lbs.
No fertilizer		830	7.9	355		
Dissolved bone black, containing phosphoric acid,		960	7.7	490	......	135
Dissolved bone black, Muriate of potash,	Containing phosphoric acid and potash,	1,290	11.7	585	3.8	230
Dissolved bone black, Muriate of potash, Sulphate of ammonia,	Containing phosphoric acid, potash and nitrogen,	1,610	12.5	850	4.6	495
Fine ground bone		1,040	8.8	500	.9	145

On plots 4 and 9 in this experiment the seed in some hills (48 and 76 respectively) failed to germinate, and in plot 10 the crows pulled 35 hills. Each plot contained 480 hills, and the yield of each plot is calculated on the basis of this number.

The increased growth due to the complete fertilizer especially is seen to be enough to nearly double the weight of the total crop, the increased production of beans being nearly as large where the phosphoric acid and potash were applied without the nitrogen. Mr. Johnson writes that the plants with the complete fertilizer appeared to be the rankest in growth.

H. L. & W. E. Leland, East Sangerville.

Crop, *corn*. Soil, a light loam of fine texture, which had not been ploughed for several years. Produced the season before plowing at the rate of a ton of hay to the acre.

Plot.	Fertilizer Applied.	Amount of Fertilizer Per Acre.	Total Crop Per Acre.	Yield Per Acre.	
				Grain.	Fodder.
			lbs.	bush.	lbs.
1	No fertilizer	....	3,770	20.	2,280
2	Dissolved bone black	400	7,520	45.3	4,120
3	Dissolved bone black Muriate of potash	400 100	6,910	37.	4,140
4	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	8,550	42.6	5,360
5	Fine ground bone	400	4,560	30.	2,320
6	No fertilizer	....	3,120	12.3	2,200
7	Dissolved bone black	400	4,980	26.0	3,040
8	Dissolved bone black Muriate of potash	400 100	5,800	30.	3,520
9	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	8,600	40.5	5,560
10	Fine ground bone	400	4,320	25.3	2,420

AVERAGE.

		Total Crop Per Acre.	Yield Per Acre.		Increase of yield over plots with no Fertilizer.	
			Grain.	Fodder.	Grain.	Fodder.
		lbs.	bush.	lbs.	bush.	lbs.
No fertilizer		3445	16.1	2240		
Dissolved bone black,	Containing phosphoric acid.	6250	35.6	3580	19.5	1340
Dissolved bone black, Muriate of potash.	Containing phosphoric acid and potash.	6355	33.5	3830	17.4	1590
Dissolved bone black, Muriate of potash, Sulphate of ammonia.	Containing phosphoric acid, potash and nitrogen.	8575	41.5	5460	25.4	3220
Fine ground bone	Containing phosphoric acid and nitrogen.	4440	27.6	2370	11.5	130

In this experiment the increase of crop was not only considerable on nearly all of the plots, but, considering both fodder and corn, was especially large on those plots receiving the complete fertilizer. This is in accordance with the general effect of nitrogenous manures in increasing the proportion of straw or fodder to grain.

A. L. Moore, Limerick.

Crop, *potatoes*. The soil was a gravelly loam, in grass ten years, until 1885, when a crop of oats was grown on it after an application of 400 pounds of superphosphate per acre.

Plot.	Fertilizer Applied.	Amount of Fertilizer Per Acre.	Weight of Crop Per Acre, tubers.	Yield Per Acre, tubers.
		lbs.	lbs.	bush.
1	No fertilizer....................	....	7,400	123.3
2	Dissolved bone black................	400	8,100	135.
3	Dissolved bone black............ Muriate of potash	400 100	11,400	190.
4	Dissolved bone black............ Muriate of potash .... Sulphate of ammonia............	400 100 100	12,900	215.
5	Fine ground bone..................	400	9,600	160.
6	No fertilizer....................	....	5,200	86.6
7	Dissolved bone black	400	8,900	148.3
8	Dissolved bone black............ Muriate of potash	400 100	11,340	189.
9	Dissolved bone black............ Muriate of potash............... Sulphate of ammonia............	400 100 100	11,900	198.3
10	Fine ground bone................	400	8,120	135.3

AVERAGE.

		Weight of Crop Per Acre, tubers.	Yield Per Acre, tubers.	Increase of yield over plots with no Fertilizer.
		lbs.	bush.	bush.
No fertilizer................................		6,300	104.8	
Dissolved bone black, containing phosphoric acid,		8,500	141.6	38.8
Dissolved bone black, Muriate of potash.	Containing phosphoric acid and potash.	11,370	189.5	84.7
Dissolved bone black, Muriate of potash, Sulphate of ammonia.	Containing phosphoric acid, potash and nitrogen.	12,400	206.6	101.8
Fine ground bone....	Containing phosphoric acid and nitrogen.	8,860	147.6	42.8

Mr. Moore's experiment furnishes a good illustration of the profitable use of commercial fertilizers. As can be seen by calculating the cost of the fertilizers, this cost was not over half the value of the increase of crop in any case. The largest growth, though not the most profitable, was from the complete fertilizer.

A. P. Starrett, Warren.

Crop, *corn*. Soil, clay loam, a portion of an old, run-out mowing field.

Plot.	Fertilizer Applied.	Amount of Fertilizer Per Acre.	Total Crop Per Acre.	Yield Per Acre.	
				Grain.	Fodder.
		lbs.	lbs.	bush.	lbs.
1	No fertilizer	....	2,085	11.9	1,190
2	Dissolved bone black	400	2,805	17.3	1,510
3	Dissolved bone black Muriate of potash	400 100	11,015	73.9	5,575
4	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	9,245	54.	5,245
5	Fine ground bone	400	1,185	7.4	630
6	No fertilizer	....	1,165	6.5	680
7	Dissolved bone black	400	1,725	10.3	945
8	Dissolved bone black Muriate of potash	400 100	13,120	78.	7,270
9	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	13,740	75.4	8,085
10	Fine ground bone	400	2,665	15.1	1,530

AVERAGE.

		Total Crop Per Acre.	Yield Per Acre.		Increase of yield over plots with no Fertilizer.	
			Grain.	Fodder.	Grain.	Fodder.
		lbs	bush	lbs.	bush.	lbs.
No fertilizer		1,625	9.2	935		
Dissolved bone black,	Containing phosphoric acid.	2,265	13.8	1227	4.6	292
Dissolved bone black, Muriate of potash.	Containing phosphoric acid and potash.	12,067	75.9	6422	66.7	5487
Dissolved bone black, Muriate of potash, Sulphate of ammonia,	Containing phosphoric acid, potash and nitrogen.	11,492	64.7	6665	55.5	5730
Fine ground bone....	Containing phosphoric acid and nitrogen.	1,925	11.2	1080	2.0	145

The results of Mr. Starrett's experiment are the most striking of any secured. They show how the application of a small quantity of a particular kind of plant food may cause abundant and profitable growth where otherwise the crop would be very nearly worthless. These results also point in a marked manner to the necessity of applying such ingredients to plant food as make good the deficiencies of the soil. When the bone black was used alone the crop was but little better than when no fertilizer was applied, but when this was combined with muriate of potash the crop increased eight-fold. Again, the further addition of a nitrogenous fertilizer to the mixture added nothing to the growth of the corn.

A. J. Tolman, Rockland.

Crop, *oats*. The experimental field had received no manure for several years. Soil, a dark loam.

Plot.	Fertilizers Applied.	Amount of Fertilizer Per Acre	Total Crop Per Acre.
		lbs.	lbs.
1	No fertilizer	....	1,040
2	Dissolved bone black	400	1,180
3	Dissolved bone black Muriate of potash	400 100	1,400
4	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	1,820
5	Fine ground bone	400	1,240
6	No fertilizer	....	860
7	Dissolved bone black	400	1,160
8	Dissolved bone black Muriate of potash	400 100	980
9	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	1,680
10	Fine ground bone	400	1,220

Average.

		Total Crop Per Acre.	Increase of yield over plots with no Fertilizer.
		lbs.	lbs.
No fertilizer		950	
Dissolved bone black, containing phosphoric acid		1170	220
Dissolved bone black, Muriate of potash,	Containing phosphoric acid and potash.	1190	240
Dissolved bone black, Muriate of potash, Sulphate of ammonia,	Containing phosphoric acid, potash and nitrogen.	1750	800
Fine ground bone, containing phosphoric acid and nitrogen		1230	280

Unfortunately in this experiment the weights of grain and straw were not obtained separately, only the total weight of crop being given, so that the production of grain on the several plots cannot be stated. Here, as in most other cases, the complete fertilizer was the most efficient.

E. P. and A. C. TRUE, So. Litchfield.

Crop, *corn and potatoes.* Soil of experimental field well adapted to corn raising. Had received no fertilizer for thirty-five years.

Plot.	Fertilizer Applied.	Amount of Fertilizer Per Acre.	Total Crop Per Acre, Tubers.	Yield Per Acre.	
				Tubers.	
		lbs.	lbs	bush.	
1	No fertilizer	....	5,250	87.5	
2	Dissolved bone black	400	8,400	140.	
3	Dissolved bone black Muriate of potash	400 100	6,825	113.7	
4	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	8,400	140.	
5	Fine ground bone	400	6,055	100.9	
			Corn, lbs.	Grain, bush.	Fodder, lbs.
6	No fertilizer	....	7,630	57.5	3,320
7	Dissolved bone black	400	8,990	67.5	3,920
8	Dissolved bone black Muriate of potash	400 100	14,060	93.7	7,030
9	Dissolved bone black Muriate of potash Sulphate of ammonia	400 100 100	13,050	93.7	5,980
10	Fine ground bone	400	9,870	64.	5,070

The results of the Messrs. True's work are not so valuable as they would have been had all the plots been planted with the same crops. Nevertheless, the results show plainly that neither the corn nor potatoes secured any larger crop from the application of a complete fertilizer than from the use of the mixture of bone black and potash salt.

In the next table the results of the several experimenters are brought together for convenience of reference and comparison.

Table Showing Results of Field Experiments with Fertilizers.

Experimenter.	Kind of Crop.	Increased Yield Over Plots Receiving No Fertilizer. From Phosphatic Manure Alone. Total Crop.	From Phosphatic Manure Alone. Grain or Tubers.	From Phosphatic Manure Alone. Straw or Fodder.	From Mixture of Phosphatic and Potash Manures. Total Crop	From Mixture of Phosphatic and Potash Manures. Grain or Tubers.	From Mixture of Phosphatic and Potash Manures. Straw or Fodder.	From Mixture of Phosphatic, Potash and Nitrogenous Manures. Total Crop.	From Mixture of Phosphatic, Potash and Nitrogenous Manures. Grain or Tubers.	From Mixture of Phosphatic, Potash and Nitrogenous Manures. Straw or Fodder.	From Ground Bone Containing Phosphoric Acid and Nitrogen. Total Crop.	From Ground Bone Containing Phosphoric Acid and Nitrogen. Grain or Tubers.	From Ground Bone Containing Phosphoric Acid and Nitrogen. Straw or Fodder.
		lbs	bush.	lbs.	lbs.	bush.	lbs	lbs.	bush.	lbs.	lbs.	bush.	lbs.
H. C. Burleigh, Vassalboro'........	Oats.....	—85	—3.6	20	220	8.2	—30	880	17.6	350	100	3.7	—15
A. J. Tolman, Rockland...........	"	220	......	....	240	....	....	800	....	....	280		
J. M. Deering, Saco..............	Corn ...	380	2.9	160	2,160	15.9	960	1,760	10.6	960	1,460	12.	560
H. L. & W. E. Leland, E. Sangerville	"	2,805	19.5	1,340	2,905	17.4	1,540	5,130	25.4	3,220	1,000	11.5	130
A. P. Starrett, Warren	"	640	4.6	292	10,442	66.7	5,487	9,867	55.5	5,730	300	2.0	145
E. P. & A. C. True, So. Litchfield..	"	1,360	10.0	600	6,430	38.2	3,710	5,420	38.2	2,660	2,240	6.5	1,750
A. L. Moore, Limerick	Potatoes,	2,200	38.8	....	5,070	84.7	....	6,100	101.8	....	2,560	42.8	.
E. P. & A. C. True, So. Litchfield..	"	3,150	52.5	....	1,575	26.2	....	3,150	52.5	....	805	13.4	
D. B. Johnson, Freedom	Beans....	130	......	135	460	3.8	230	780	4.6	495	210	.9	145

Comments on Fertilizer Experiments.

The results of fertilizer experiments for a single year admit of scarcely any general conclusions, yet on some points these experiments by farmers strongly corroborate the testimony of practice.

(1) A moderate quantity of a commercial fertilizer does in some instances produce a large increase of crop.

(2) This increase of crop for a single season varies greatly with the locality.

(3) A complete fertilizer, *i. e.*, one consisting of a mixture of nitrogenous, phosphatic and potash fertilizers, is the safest manure with which to insure a crop, but is often much less profitable than a fertilizer not containing one or two of the three valuable ingredients. This fact is illustrated in a striking manner by the results of Mr. Starrett's experiment, where the crop was increased nearly eight-fold by the use of a mixture of phosphatic and potash manures, no further increase being secured by the addition of sulphate of ammonia to this mixture.

(4) Except in the case of Mr. Deering's experiment, where the land was in excellent condition, the ground bone failed to furnish plant food as readily as the other materials used.

FOODS.

(*a*) ANALYSES OF FEEDING STUFFS.

The following is a list of the feeding stuffs analyzed by the Station within the year:

2	samples	Timothy hay,
2	"	Clover "
1	"	Oat straw,
2	"	Potatoes,
2	"	Cotton-seed meal,
2	"	Linseed meal,
1	"	Patent cattle food,
1	"	Beef scraps,
1	"	Pork scraps,
1	"	Dried blood.

The most of these feeding stuffs are those used in the digestion and feeding experiments reported farther on.

Explanations. *The analysis of any plant or animal substance with reference to its use as a cattle food does not go so far as to determine the percentage of every single ingredient in the material analyzed, but only aims to learn the percentages of certain classes of compounds, the members of each class having a close resemblance in composition and in nutritive effect. Thus we have in all fodder tables several columns of figures headed by the following terms: Water, Ash, Protein, Crude Fiber, Nitrogen-free Extractive Matter, and Fats. As these terms are in constant use, not only in this report but in all agricultural literature, they are made the subject of such explanations as seem necessary in order to show their relation to animal nutrition.

The *water* or *moisture* of cattle foods, of which all contain more or less, is measured by the loss of weight which takes place when the substance is dried for some time at the temperature of boiling water, or 212° Fahrenheit. The percentage of water is very large in green crops, and comparatively small in all dried materials. In all feeding stuffs which exist in the air-dry condition, the percentage of moisture varies greatly according to the state of the atmosphere, so that in rainy or moist weather a given quantity of hay or grain that is at all exposed to the air will weigh considerable more than during a time of dryness. Freshly cured hay and newly harvested grain contain much more water than old hay and grain, the difference being an important consideration in buying or selling by weight. While the water in cattle foods has no nutritive value above water that an animal drinks, its presence or absence often has a marked influence upon the palatableness of feeding stuffs.

The *ash*, or mineral part of any food stuff, is that which is left after the combustible portion is burned away, and includes quite a number of compounds. The amount of ash in plants is influenced in a marked manner by their age, and conditions of growth, such as locality, kind of manuring, &c. The mineral compounds of cattle foods fill an important place in furnishing the material for building up the bony framework of the animal.

Protein (or *albuminoids*) is a collective term that includes quite a variety of compounds, which are distinguished from the members of

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*These explanations are quoted from the last report for the same reasons that seemed to justify the repetition of the explanations in regard to fertilizers.

the other important classes of substances in feeding stuffs by the fact that they contain nitrogen.

Such compounds as egg albumen, the muscular tissue of animals and the caseine of milk are albuminoids, and to these animal substances the albuminoids of plants bear a close resemblance both in chemical properties and in food value. The protein of feeding stuffs cannot be directly determined with accuracy. The estimation is an indirect one, and is based upon the fact that all albuminoids contain approximately 16 per cent of nitrogen. If, therefore, the percentage of nitrogen in any feeding stuff be multiplied by 6.25, the percentage of albuminoids is obtained with sufficient accuracy for all practical purposes. The important and peculiar office which albuminoids fill in serving the uses of the animal kingdom is that they constitute the only source of material for the formation of muscular tissue, hair, horn, caseine, etc., etc.

Plants contain other nitrogenous compounds called *amides* that occur most abundantly in fodder and root crops, the amount varying in the former at different periods of growth, while in the grains the nitrogen exists almost wholly in the form of albuminoids. Fodder tables generally give as the percentage of protein the product of the total percentage of nitrogen by 6.25.

A given amount of protein as stated for hay in tables of fodder analyses is not quite the same thing, therefore, as the same amount occurring in the grains, because in the former case much more of the nitrogen belongs to the non-albuminoid, or amide form.

The true value of amides in animal nutrition is not well defined. That they are wholly like albuminoids in office seems hardly probable, at least previous investigations do not show this.

Crude fiber is the woody part of plants, and is that which remains undissolved after treating vegetable substance with weak acids and alkalies. Paper and cotton fiber are good examples of nearly pure crude fiber.

The *nitrogen-free extractive matter* includes all the non-nitrogenous compounds of feeding stuffs, excepting crude fiber and the fats, the most important and abundant members of this class being starch and sugar.

The *fats* or vegetable oils are extracted from plant substance by ether, which also takes out more or less chlorophyl, wax, etc., especially in the case of hays and coarse fodders. Olive, linseed and cotton-seed oils are good examples of vegetable fats.

The starch, sugar and fats can play no part in the formation of flesh or the caseine of milk, but are alike in being a source of animal fat and heat.

Digestibility of feeding stuffs. The composition alone of any feeding stuff is a very imperfect standard by which to judge its food value. Of the food consumed by an animal, only that portion which is digested, *i. e.*, that which is dissolved by the several digestive fluids and passes into the blood, can serve to maintain the vital functions, or to produce growth. Consequently, certain cattle foods, by being much more digestible than others, are much more completely utilized. The main facts pertaining to digestibility are presented farther on under the head of "Digestion Experiments," and the method of applying a knowledge of the composition and digestibility of feeding stuffs is shown in discussing the feeding experiments.

XXIII. Timothy hay, from grass grown in Orono, two weeks past bloom, used in digestion and feeding experiments.

XXXIII. Timothy hay, same lot as XXIII.

XXIV. Clover hay, alsike clover, grown in Orono, mixed with a Timothy, cut when partly out of full bloom; used in digestion and feeding experiments.

XXXVII. Clover hay, same lot as XXIV.

XXVII. Oat straw, from College farm, used in digestion and feeding experiments.

XXX. Potatoes, purchased in the market, used in digestion and feeding experiments.

XXXII Potatoes, same lot as XXX, analyzed after boiling, used in same way.

XXVIII. Cotton-seed meal, sampled in Lewiston and sent to Station by A. C. Chandler, New Gloucester.

XXXV. Cotton-seed meal, purchased in Bangor for use in feeding experiments.

XXIX. Linseed meal, sampled at Lewiston and sent to Station by A. C. Chandler, New Gloucester.

XXXIV. Linseed meal, purchased in Bangor for use in feeding experiments.

XXV. Beef scrap, residue after extraction of the fat by heat and pressure, used in feeding experiments.

XXVI. Pork scrap, residue after extraction of the fat by heat and pressure, used in feeding experiments.

XXXVI. Dried blood, a fine specimen, used in feeding experiments.

The samples of hay and straw were obtained by chopping very fine from fifty to seventy-five pounds of the material with a hand cutter, mixing the whole thoroughly, and then selecting the portion to be ground for analysis.

Laboratory Number.		Water.	Ash.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.	In 100 parts water-free Substance				
								Ash.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.
		%	%	%	%	%	%	%	%	%	%	%
XXIII......	Timothy hay............	11.34	3.75	5.94	28.89	47.41	2.67	4.23	6.70	32.58	53.48	3.01
XXXIII.....	Timothy hay............	9.35	3.48	5.19	28.60	50.51	2.87	3.84	5.72	31.55	55.73	3.16
XXIV	Clover hay......	11.10	6.27	10.06	30.36	39.24	2.97	7.05	11.31	34.15	44.15	3.34
XXXVII ...	Clover hay.............	10.18	6.36	10.00	30.15	40.36	2.95	7.08	11.13	33.57	44.93	3.29
XXVII......	Oat straw..............	10.00	3.67	3.56	37.77	41.96	3.04	4.08	3.95	41.96	46.67	3.40
XXX	Potatoes,—raw	75.90	.82	2.62	.55	19.98	.13	3.40	10.91	2.30	82.85	.54
XXXII......	Potatoes,—boiled.........	75.37	.88	2.63	.68	20.37	.07	3.57	10.70	2.78	82.67	.28
XXVIII.....	Cotton-seed meal.........	8.90	7.27	43.94	9.62	19.40	10.88	7.98	48.23	10.56	21.29	11.94
XXXV......	Cotton-seed meal.........	7.87	6.94	46.12	6.79	21.00	11.28	7.53	50.06	7.37	22.80	12.24
XXIX	Linseed meal............	8.02	7 26	30.34	13.25	30.82	9.89	7.90	32.80	14.30	33.50	10.50
XXXIV.....	Linseed meal.......... .	9.85	5.14	35.31	7.89	32.81	9 80	5.70	39.16	8.75	35.52	10.87
XXV	Beef scrap	1.33	8.03	57.69	–	–	32.95	8.14	58.46	–	–	33.40
XXVI	Pork scrap.............	.81	2.24	57.35	–	–	39.60	2.26	57.80	–	–	39.94
XXXVI....	Dried blood	6.69	6.64	65.12	–	5.32	16.23	7.12	69.79	–	5.70	17.39
XXXVII....	Royal stock food.........	8.36	5.20	26.19	5.76	48.32	6.17	5.67	28.58	6.28	52.74	6.73

Notes on the Above Analyses.

(1) The somewhat low percentage of protein in the case of all the hays is explained by the ripeness of the grass before cutting.

(2) The cooking (steaming) of potatoes did not affect materially either their weight or composition. Samples XXX and XXXII are from the same lot of potatoes, the former being analyzed before boiling and the latter after. The quantity of potatoes cooked by "steaming" them was 1000 grams, which after cooking and while hot weighed 1022 grams, and after cooling 995 grams, the loss being due to evaporation of water while cooling. The composition of the dry substance of the raw and boiled potatoes is seen to be practically the same.

(3) A number of inquiries have been received as to the relative value of cotton-seed meal and linseed meal, as now found in Maine markets, for feeding purposes. With a view to answering these inquiries several samples of these two cattle foods were collected from lots offered for sale in the State, the analyses of which are given above.

These analyses indicate that these two feeding stuffs as now sold in this State are of good quality. The linseed meal is evidently "old process" in which quite a percentage of oil still remains.

The two meals differ chiefly in the amount of protein or nitrogenous material which they contain, the cotton-seed meal having an average in these cases of twelve (12) per cent more than the linseed meal. The fat is about the same in both, but the linseed meal contains more carbohydrate material (starch, sugar, etc.,) this largely taking the place of the excess of protein in the cotton-seed meal. Nevertheless, both foods are highly nitrogenous, and take practically the same place in the ration. Both are valuable as a supplement to the home raised foods that are poor in protein, such as straw, poor hay, corn fodder, etc., the cotton-seed meal having some advantage over the linseed in this respect.

(4) The beef and pork scraps are seen to be highly nitrogenous, *i. e.*, they contain about 57 per cent of albuminoids. Such waste products are valuable as a poultry food and at the price paid for the lots from which these samples were taken, viz., 2½ cents per pound, they can be purchased with profit.

(5) The Royal stock food cattle cake was sent to the Station for analysis by Messrs. E. W. Blatchford & Co., Chicago, Ill. This cake appears to be a sweet, clean food, prepared by mixing several

waste products that are valuable as concentrated cattle food. So far as analysis can determine, the cake ranks in value with linseed meal containing the minimum percentages of protein and fat.

SKIMMED MILK AND BUTTERMILK *vs.* CORN MEAL, BRAN, &C.

The following is a record of correspondence with A. C. Chandler, Esq., of New Gloucester, in regard to the relative feeding value of several feeding stuffs. Mr. Chandler wrote as follows:

NEW GLOUCESTER, MAINE, October 21, 1886.

Will you please give me the component parts of skimmed milk and of buttermilk? Also please give me the nutritive or feeding values of skimmed milk and buttermilk for swine as compared with corn meal, barley meal, bran middlings, &c , &c. I want to know what buttermilk is worth as compared with other foods for hogs and pigs.

Reply. "The average composition of skimmed milk, buttermilk, corn meal, and wheat bran is as follows:

	In 100 pounds there is found			
	Dry matter,	Protein,*	Carbohydrates,	Fat.
Skimmed milk	10. lbs.	3.5 lbs.	5.0 lbs.	0.7
Buttermilk................	9.9 "	3.0 "	5.4 "	1.5
Corn meal.................	85. "	9.09 "	70.76 "	4.63
Wheat bran..............	83. "	14.82 "	63.67 "	3.67

The above figures represent the average composition of these foods.

As can be seen by these figures it takes not far from eight and one-half pounds of skimmed milk or buttermilk to furnish as much dry matter to the animal as one pound of either corn meal or wheat bran. This dry matter differs in its digestibility in the several cases. While the animal digests practically all of the compounds of skimmed milk or buttermilk, only about nine-tenths of the dry matter of corn meal is digested, and three-fourths of the dry matter of wheat bran, so that about 7.5 pounds of either kind of milk will furnish about the same amount of digestible material as one pound of corn meal, the relation in the case of the milks and wheat bran being as 6.6 is to 1.

It should be noticed, further, that the milk does not contain the several food ingredients in quite the same relative quantities that the grains do. Seven hundred fifty pounds of skimmed milk would furnish 75 pounds of digestible matter, 26.25 pounds of which would be protein (nitrogenous material), and 42.75 pounds fat and sugar. One hundred pounds of corn meal would, on the other hand, furnish about 75 pounds of digestible material (the same amount as the 750 pounds of skimmed milk), only 8.2 pounds of which would be protein, and 65 pounds of which would be carbohydrates (starch, sugar, &c.). The fact that the milks furnish a larger rel-

*Mostly casein.

ative amount of protein than do the grains is in their favor in the comparison.

As to the possibility of making exact comparisons between different kinds of food, you are referred to page 76 of the last report of the Station, a copy of which is sent with this. Nevertheless, the above comparisons have a great deal of meaning when we consider the value of foods for general use."

Swale Hay *vs.* Timothy Hay.

Later, Mr. Chandler made the following inquiries in regard to swale hay and Timothy hay:

In the report of the Maine Board of Agriculture for 1880 on page 166, I find the analysis of *bog hay* or *fresh marsh hay*. Is that the same thing as New Gloucester swale hay? In this table on page 166 the standard of comparison is meadow hay. Please tell me just what is meant there by "meadow hay." If meadow hay there means first-class, No. 1, Herd's-grass or Timothy hay, I am surprised to see the money value of bog hay for feeding put at .90 when the market value is usually just about one-half the value of good hay.

Reply. "The analyses to which you refer probably fairly represent the composition of New Gloucester interval hay, taken as a whole.

It is very probable that in comparing the feeding value of Timothy hay and low meadow hay, farmers allow too high a value to Timothy hay. But this is opinion merely. 'Meadow hay' as given in fodder tables means hay from upland grasses—mixed grasses as we ordinarily find them mixed. The composition of 'meadow hay' (English grasses) does not differ greatly from the composition of pure Timothy, as you can see by any complete table of analyses. So far as mere composition is concerned, the grasses of the New Gloucester 'interval' are nearly if not quite equal to Timothy, and if we find them to be as digestible as Timothy, there is no reason why the latter should be of greater feeding value. The digestibility is the point concerning which we need more information, in order to make a comparison. Palatableness is often the criterion by which the nutritive value of a fodder is judged, but this is not a correct standard. Many farmers regard Timothy hay as a fodder whose value for consumption on the farm is much below its market price, and acting upon this belief they sell all their Timothy hay and feed the low-ground hay. With the prices of the two kinds of hay as 2 to 1, this is undoubtedly good business policy."

(*b*) DIGESTION EXPERIMENTS.

The work of ascertaining the digestibility of some of our common cattle foods, which was begun in 1885-6, has been continued in 1886-7. This work has had for one object the determination of the coefficients of digestibility of several feeding stuffs, but at the same time the opportunity has been improved for comparing the results obtained for protein by artificial digestion with those reached by the use of animals, and also of testing one or two generally accepted conclusions in the light of recently acquired knowledge. For the results of this comparison see "Laboratory and Experimental Methods."

The foods with which digestion experiments have been made are Timothy hay, clover hay, oat straw and potatoes. The animals used were two full grown wether sheep, which were confined during the time of each experiment in stalls that allowed perfect freedom of motion so far as lying down and moving forward and backward, but which were so narrow that the sheep could not turn around. The finely chopped food was fed in such a manner as to insure against loss, and the solid excrement was collected in the usual way by attaching a rubber bag to the animal by means of a light harness.

For the sake of convenience and completeness, the following explanations are offered for the second time:

The main facts of digestion, and those upon which the methods of digestion experiments are based, are the following: A portion of the food which an animal eats is dissolved by the several digestive fluids with which it comes in contact, viz., the saliva, gastric juice, pancreatic juice, etc. That which is dissolved, or digested, is absorbed by certain vessels which are distributed over the lining of the stomach and intestines, passes into the blood, and is then used to maintain and build up the animal body. The undissolved or undigested portion of the food is carried along the alimentary canal, passes from the body as the solid excrement or dung, and constitutes that part of the food which is useless for the purposes of nutrition. The method of ascertaining the digestibility of any cattle food is simple in principle. An animal is fed a weighed quantity of food, of which the composition is determined by analysis. The solid excrement is collected, weighed and analyzed, and the amount digested is the difference between that which is fed and that which is excreted. From the data thus obtained is calculated the percentage that is digested of each ingredient, these several percentages being called the *coefficients of digestibility*. As the process of digestion is slow, it is necessary to feed the animal on the weighed ration several days before collecting any excrement, in order that the contents of the intestines may become wholly freed from the residue of the previous food, so that the dung collected shall come wholly from the food tested. On account of the irregularity with which dung is voided, it is collected for several days, and from the total amount the average for one day is calculated.

Digestibility of Timothy Hay.

This hay was from grass that grew on the College farm and that had stood about two weeks after the period of full bloom. It was riper, therefore, than much Timothy hay that is fed, and undoubtedly proved to be somewhat less digestible than it would have been if cut earlier. The amount fed daily was 700 grams, or about 1½ pounds, to each animal.

For composition of the hay, see sample XXIII in previous table of fodder analyses. The composition of the water-free dung from each animal was the following:

	Ash.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fats.
Sheep 1	5.91	7.84	37.58	45.80	2.87
Sheep 2	5.52	7.36	39.40	44.97	2.72

From the weights of food and dung and the composition of each are calculated the digestibility of the hay in the case of each sheep, in the manner shown by the following tables. The weighed ration was fed for twelve days, during the last five of which the dung was collected.

TABLES SHOWING DIGESTIBILITY OF TIMOTHY HAY.

Sheep 1.

	Dry Substance.	Organic Matter.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fats.
	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Fed, 700 grams Timothy hay, daily,	620.6	594.6	41.6	202.2	331.9	18.7
Excreted, 741.8 grams dung, daily..	288.4	271.3	22.6	108.4	132.1	8.3
Digested	332.2	323.3	19.0	93.8	199.8	10.4
Per cent digested..................	53.5	54.4	45.6	46.4	60.2	55.6

Sheep 2.

	Dry Substance.	Organic Matter.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fats.
Fed, 700 grams Timothy hay, daily.	620.6	594.6	41.6	202.2	331.9	18.7
Excreted, 781 grams dung, daily ...	312.	294.8	22.9	122.9	140.5	8.5
Digested	308.6	299.8	18.7	79.3	191.4	10.2
Per cent digested	49.7	50.4	44.9	39.2	57.7	54.5
Average digestibility of hay with both sheep (per cent)	51.6	52.4	45.2	42.8	58.9	55.0

Digestibility of Clover Hay.

The hay from which the lot used in this trial was taken contained a very little Timothy. The clover was cut when partly out of bloom, and was dried thoroughly and stored in good condition. The amount fed daily to each animal was 700 grams or 1.5 pounds, except that in repeating the trial with sheep 2, 600 grams were fed. For composition of the hay reference is made to sample XXIV in the previous table of fodder analyses.

Below is given the composition of the water-free dung from each animal:

	Ash.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.
Sheep 1	8.63	10.44	41.76	35.56	3.61
Sheep 2	9.00	10.40	42.60	34.50	3.50
Sheep 2 (second trial)	10.67	12.40	37.53	36.14	3.26

The next tables show the results of the experiment with both sheep, as calculated from the data obtained. The trials were continued for the same time as in the experiment with Timothy hay, with the exception that in the second trial with sheep 2 the solid excrement was collected for six days.

Tables Showing the Digestibility of Clover Hay.

Sheep 1.

	Dry Substance.	Organic Matter.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fats.
Fed, 700 grams Clover hay, daily	622.3	578.4	70.4	212.5	274.7	21.8
Excreted, 677 6 grams dung, daily	276.3	252.5	28.8	115.4	98.2	10.0
Digested	346.0	325.9	41.6	97.1	176.5	10.8
Per cent digested	55.5	56.4	59.1	45.7	64.2	51.8

Sheep 2.

	Dry Substance.	Organic Matter.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fats.
Fed, 700 grams Clover hay, daily...	622.3	578.4	70.4	212.5	274.7	20.8
Excreted, 596.8 grams dung, daily...	280.3	255.1	29.5	119.4	96.7	9.8
Digested....................	342.0	323.3	40.9	93.1	178 0	11.0
Per cent digested	54.9	55.9	58.1	43.8	64.8	52.9

Sheep 2. (Second trial.)

Fed, 600 grams Clover hay, daily...	538.9	500.8	59.9	180.9	242.1	17.7
Excreted, 867 grams dung, daily ...	245.6	219.4	30.4	92.2	88.8	8.0
Digested	293.3	281.4	29.5	88.7	153.3	9.7
Per cent digested	54.4	56.2	49.3	49.0	63.3	54.8
Average digestibility, clover hay, three trials (per cent)	54.9	56.2	55.5	46.2	64.1	53.2

Digestibility of Oat Straw.

The straw used in the trial was from the general lot raised on the College farm.

In order to secure complete consumption of the ration only 350 grams (about ¾ pound) was fed daily to each animal. For this reason the results are not satisfactory for the protein, for reasons given later in this report. There are no known facts which justify the supposition that the smallness of the ration would affect to any serious extent any of the coefficients of digestibility except those for the protein and fat, therefore the results are given as obtained. The composition of the water-free dung follows :

	Ash.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.
Sheep 1	7.45	8.97	35.24	44.05	4.29
Sheep 2	7.14	8.45	36.47	43.79	4.15

In the tables which follow no figures are given for the digestibility of the protein, for the amount of nitrogen in the dung was more than that contained in the food given.

Tables Showing the Digestibility of Oat Straw.

Sheep 1.

	Dry Substance.	Organic Matter.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.
Fed, 350 grams oat straw, daily	315.0	302.1	12.5	132.1	146.8	10.7
Excreted, 419 grams dung, daily....	160.5	148.6	14.4	56.5	70.7	6.9
Digested	154.5	153.5	—1.9	75.6	76.1	3.8
Per cent digested..................	49.0	50.8	–	57.2	51.8	35.5

Sheep 2.

	Dry Substance.	Organic Matter.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.
Fed, 350 grams oat straw, daily....	315.0	302.1	12.5	132.1	146.8	10.7
Excreted, 410 grams dung, daily ...	152.2	141.3	12.8	55.5	66.6	6.3
Digested	162.8	160.8	—0.3	76.6	80.2	4.4
Per cent digested..................	51.7	53.2	–	58.0	54.6	41.1
Average digestibility of straw with both sheep (per cent)............	50.3	52.0	?	57.6	53.2	38.3

Digestibility of Potatoes.

Many tables giving the digestibility of feeding stuffs mention no coefficients of digestibility for tubers and roots, on the ground that they can be considered as practically completely digestible. It is not clear why this distinction is made in the case of tubers and roots when corn meal or some of the concentrated bye-fodders are but little if any less digestible.

Again, the conclusion was reached some time since by German investigators that the effect of feeding large quantities of tubers or roots in connection with coarse fodder is to seriously depress the digestibility of the coarse fodder, especially of the protein and crude fiber. Recent investigations in Germany, and some limited experiments made at this Station, seem to warrant a doubt whether this conclusion should not be modified.

The above considerations are discussed more fully on subsequent pages. In this connection there are only given the figures reached for the digestibility of the potatoes by the method adopted. These digestion trials with coarse fodder and potatoes were made for the purpose of studying the so-called depression of digestibility of the coarse fodder due to the potatoes, and not for the simple purpose of ascertaining the digestibility of potatoes, for in the latter case the method of procedure would have been different. The figures reached are undoubtedly somewhat too low for all the constituents of the potatoes, especially for the protein.

In these trials the plan adopted was to feed with the potatoes one of the coarse fodders, the digestibility of which had previously been determined by feeding to the same animals. Knowing the digestibility of the total ration, and of one of its constituents, viz., the coarse fodder, it is possible to calculate the digestibility of the potatoes. Trials were made with two sheep, Nos. 1 and 2, using oat straw and potatoes, and with sheep No. 2, using Timothy hay and potatoes. The analyses of these foods are given previously, Nos. XXVII, XXXIII, XXX and XXXII in the table of fodder analyses.

Below can be seen the composition of the water-free dung.

	Ash.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.
Sheep 1, oat straw and potatoes	7.85	13.45	35.67	39.29	3.74
Sheep 2, " " "	6.93	12.78	34.22	42.65	3.42
Sheep 2, Timothy hay and potatoes	10.67	12.40	37.53	36.14	3.26

From the composition and weights of the food and excrement is calculated the total digestible matter in the ration. From this is subtracted the digestible matter belonging to the coarse fodder, as previously determined, and the remainder is the amount of digestible material supplied from the potatoes. These calculations are clearly shown in the tables which follow.

Tables Showing the Digestibility of Potatoes.

Sheep 1.

	Dry Substance.	Organic Matter.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.
Fed, 350 grams oat straw	315.	302.1	12.5	132.1	146.8	10.7
Fed, 1000 " raw potatoes	242.4	234.2	26.4	5.6	200.8	1.3
Total fed	557.4	536.3	38.9	137.7	347.6	12.0
Excreted, 762 grams dung	213.8	197.0	28.8	76.2	84.0	8.0
Total digested	343.6	339.3	10.1	61.5	263.6	4.0
Digested from oat straw	154.5	153.5	—1.9	75.6	76.1	3.8
Digested from potatoes	189.1	185.8	12.0	–	187.5	.2
Per cent digested from potatoes	78.	79.3	45.4	–	93.4	13.

Sheep 2.

	Dry Substance.	Organic Matter.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.
Fed, 350 grams oat straw	315.	302.1	12.5	132.1	146.8	10.7
Fed, 1000 " potatoes............	242.4	234.2	26.4	5.6	200.8	1.3
Total fed..................	557.4	536.3	38.9	137.7	347.6	12.0
Excreted, 862.4 grams dung........	215.8	200.8	27.6	73.8	92.0	7.4
Total digested.............	341.6	335.5	11.3	63.9	255.6	4.6
Digested from oat straw............	162.8	160.8	—0.3	76.6	80.2	4.4
Digested from potatoes............	178.8	174.7	11.6	–	175.4	.2
Per cent digested from potatoes. ...	73.3	74.6	43.9	?	87.3	13.

Sheep 2.

	Dry Substance.	Organic Matter.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.
Fed, 500 grams Timothy hay.......	453.2	435.8	25.9	143.	252.6	14.3
Fed, 1,000 grams potatoes, boiled...	246.3	237.5	26.3	6.8	203.6	.7
Total fed....................	699.5	673.3	52.2	149.8	456.2	15.0
Excreted, 852 grams dung	277.0	260.9	29.2	101.3	122.8	7.5
Total digested.............	422.5	412.4	23.0	38.5	333.4	7.5
Digested from Timothy hay........	225.1	219.6	11.6	56.0	145.7	7.8
Digested from potatoes............	197.4	192.8	11.4	–	187.7	
Per cent digested from potatoes	80.1	81.2	43.4	?	92.1	?

AVERAGE.

	Dry Substance.	Organic Matter.	Protein.	Crude Fiber.	Nitrogen-free Extractive Matter.	Fat.
	%	%	%	%	%	%
Sheep 1, potatoes fed raw..........	78.	79.3	45.4	?	93.4	13.
Sheep 2, " " "	73.3	74.6	43.9	?	87.3	13.
Sheep 2, " " boiled........	80.1	81.2	43.4	?	92.1	
Average	77.	78.4	44.2	–	0.9	13.

Summary and Discussion of Digestion Experiments.

Below can be seen, brought together in one table, the percentages or coefficients of digestibility as determined from the data of the preceding experiments.

	Coefficients of Digestibility for			
	Timothy Hay.	Clover Hay.	Oat Straw.	Potatoes.
Dry Substance	51.6	54.4	50.3	77.0
Organic Matter	52.4	56.2	52.0	78.4
Protein	45.2	55.5	?	44.2 ?
Crude Fiber	42.8	46.2	57.6	?
Nitrogen-free Extractive Matter	58.9	64.1	53 2	90.9
Fat	55.	53.2	38.3	13. ?

The above figures are the answers to actual inquiries made of the animal as to the availability of the ingredients of the several foods for the purposes of nutrition. The meaning of these figures is plain. They mean, in the case of the clover hay for instance, that of each hundred pounds of *dry substance* fed 54.4 pounds were dissolved out by the digestive fluids, and that 45.6 pounds passed out of the animal unused, or that of each 100 pounds of *crude fiber* in the hay, only 46.2 pounds were retained for use in the animal body. Except for the protein and fats, the above figures are undoubtedly a close approximation to what they should be, the small error involved being relatively the same in all cases. The percentages given for the protein and fats are too small, the relative error in this direction being greater the less the quantity of protein and fat in the foods. (The nature and extent of these errors are discussed later.) For instance, the protein of the Timothy hay appears to be much less digestible than the protein of the clover hay. Sufficient facts are well established to warrant the statement that part of this difference at least is apparent rather than real, from the fact that as the Timothy hay contains but little over half as much protein as the clover hay, the percentage error in determining the digestibility of this ingredient is much larger in case of the Timothy.

Comparison of Timothy and Clover Hays.

It appears from the above figures that the dry substance of the Timothy hay proved to be nearly as digestible as that of the clover. Moreover, the digestibility of the several ingredients is not remarkably unlike in the two hays. There is, however, an important difference in the amount of certain kinds of material that was digested, which is due to the unlike composition of the hays. The small lots of hay used in the digestion experiments were selected to represent as nearly as possible large lots of hay that were in each case the product of one acre. An acre of pure Timothy grass and an acre of nearly pure alsike clover were cut and stored separately. The two lots were weighed when housed, and again on Dec. 20th. We have therefore the following data, from which we can reckon the amounts of digestible material of various kinds, per acre:

(1) The composition of the dry hays.

(2) The digestibility of the several ingredients of the hays.

(3) The production of dry hay per acre.

The composition of the hays as shown in the previous fodder analyses is given in this connection.

	Contained in 100 lbs. of		Digested from 100 lbs. of	
	Timothy Hay.	Clover Hay.	Timothy Hay.	Clover Hay.
	lbs.	lbs.	lbs.	lbs.
Dry Substance	88.66	88.90	45.7	48.3
Organic Matter	84.91	82.63	44.5	46.4
Protein	5.94	10.06	2.7	5.6
Crude Fiber	28.89	30.36	12.4	14 0
Nitrogen-free Extractive Matter	47.41	39.24	27.9	25.2
Fat	2.67	2.97	1.4	1.5

The yield of dry hay from the acre of Timothy was 3875 pounds, and from the acre of clover, 4075 pounds, the difference being only two hundred pounds. They were representative lots of grass with high cultivation. Here follow the quantities of digestible material per acre:

	Digested from 3,875 lbs. Timothy Hay.	Digested from 4,075 lbs. Clover Hay.
	lbs.	lbs.
Dry Substance	1,770.8	1,968.2
Organic Matter	1,724.4	1,890.8
Protein	104.6	228.2
Crude Fiber	480.5	570.9
Nitrogen-free Extractive Matter	1,081.1	1,026.9
Fat	54.2	61.1

The chief difference in the digestible material furnished by the two kinds of hay is that the clover supplies over twice as much digestible protein as the Timothy. The comparison of these hays is discussed in detail and at some length, because from Timothy and clover comes the bulk of the hay raised and consumed in Maine, and a clear understanding of the relative value of these fodders is important.

Oat straw. The digestibility of the organic matter of the oat straw seems to have been but little less than was the case with the hays. The conditions of the trials were not favorable to the most accurate results, especially for protein and fat.*

(c) FEEDING EXPERIMENTS.

The most important question connected with the practice of cattle feeding, and one which for some years has received a great deal of attention from investigators and practical men, broadly stated, is this:

Is it possible to cheapen the cost of meal and milk by so mixing a variety of cattle foods in the ration as to secure certain definite

*The digestibility of the potatoes and the effect of feeding them with coarse fodder upon the digestibility of the coarse fodder might properly be discussed here, only that this can be more clearly and conveniently done after the arrangement of certain analytical data given later under the head of experimental methods.

relations in the quantities of nutritive ingredients consumed, or are equally favorable results obtained by feeding in a hit-or-miss fashion such feeding stuffs as are conveniently at hand, or which the market seems to afford at the least cost per pound?

This question is equivalent to the inquiry whether in determining the purchasing power of one dollar the kind of food should not be considered as well as the weight, as for instance, whether in a given case the dollar should be expended for corn meal or cotton-seed meal, at the same ton price.

We have given in the German feeding tables certain definite standards according to which rations are to be compounded for animals of different kinds under varying conditions.

It is not claimed by any prominent agricultural chemists, and has not been for years, that these standards should be strictly followed in order to secure the best results from a given amount of food, but being the result of extended scientific investigations they certainly have some significance, and are regarded by conservative men who have given them considerable study as teaching some important truths and as suggesting a rational system of practice in cattle feeding.

In planning the feeding experiments conducted at the Station an attempt has been made to so shape many of them as to give information on the above general question. The dairy products of Maine are largely manufactured from purchased foods, and so this inquiry is one of great practical importance.

The experiments here reported have reference also to certain other points pertaining to the economy of feeding, such as methods of preparation of food, &c.

On subsequent pages will be given the results of feeding experiments designed to give information on the following points:

(1) Cotton-seed meal (or linseed meal) *vs.* corn meal for milk production.

(2) The use of cotton-seed meal (or linseed meal) in producing growth.

(3) The relation of the quantity of the ration to the profits of feeding for growth.

(4) The use of straw in feeding for growth.

(5) Whole corn *vs.* corn meal.

(6) Corn meal *vs.* corn-and-cob meal.

(7) Raw *vs.* boiled potatoes.

The first three points are all involved, more or less, in the general question of the composition of the ration, while the last three have to do with the method of preparing the food.

Experiments in Feeding Cotton-Seed Meal and Corn Meal for Milk Production.

This experiment is almost similar in its objects and methods to one conducted by the Station in 1885–6. The results are practically the same also.

The main question asked in the experiment is virtually this: Is an ordinary ration of hay and corn meal as economical for milk production as the same quantity of digestible food material would be when more nitrogenous? Or expressed in plain terms, is it profitable to substitute cotton-seed meal for a portion of the corn meal in such a ration?

The answer made to this question by the two years' experiments is the same, viz:

Under the conditions involved in the experiments, the substitution of cotton-seed meal for an equal quantity of the corn meal unmistakably increased the production of milk and butter to a profitable extent.

Last winter's experiment was carried out with four cows, two Jerseys and two grade Ayrshires.

Cow	A, Grade Ayrshire,	calved	Oct. 5th, 1886.
"	B, "	"	August (early part).
"	C, Jersey	"	Sept. 10th, 1886.
"	D, "	"	Sept. 15th, 1886.

Unfortunately all of these animals were light milkers, which fact makes the experiment less satisfactory than if the flow of milk had been heavy, because the test of the producing power of the rations was less severe.

The experiment was continued for twelve weeks, this time being divided into three periods of four weeks each.

First Period, 4 weeks, January 3d to 30th.	Cows A and C (each).....	18 lbs. Timothy, 3½ " corn meal, 2½ " cotton-seed meal.
	Cows B and D (each).....	18 lbs. clover hay, 3½ " corn meal, 2½ " cotton-seed meal.
Second Period, 4 weeks, Jan. 31st to Feb. 27th.	Cows A and C (each).....	18 lbs. Timothy, 6 " corn meal.
	Cows B and D (each).....	18 lbs. clover hay, 6 " corn meal.

Third Period, 4 weeks, Feb. 28th to Mar. 27th.	Cows A and C (each).....	18 lbs. Timothy hay, 3½ " corn meal, 2½ " cotton-seed meal.
	Cows B and D (each).....	18 lbs. clover hay, 3½ " corn meal, 2½ " cotton-seed meal.

Certain points in the plan of the experiment should be noted.

(1) The weights of food are the same throughout, the differences being in the kind of material.

(2) The rations in the 1st and 3d periods are alike, in both of which an equal weight cotton-seed meal is substituted for a portion of the corn meal of period 2d.

(3) Throughout all the periods two cows received Timothy hay and two clover hay, in other respects the ration being the same for all the cows.

During the last two weeks of each of the three periods, the following data were recorded:

(1) The weights of milk from each cow, night and morning.

(2) The percentages of cream from the night's and morning's milk of each cow.

(3) The composition of the night's and morning's milk from each cow.

(4) The weight of unsalted butter from the milk of each cow.

Record was also made of the weights of the cows at the beginning and end of each period, and also of the daily weight of any unconsumed food.

(1) *Composition of the milk.* The table below shows the average composition of the milk for the last two weeks of each period. The figures represent pounds in 100.

	Cow A, Ayrshire.		Cow B, Ayrshire.		Cow C, Jersey.		Cow D, Jersey.	
	Solids	Fat.	Solids.	Fat.	Solids.	Fat.	Solids.	Fat.
First Period......	12.58	3.57	14.54	4.60	14.58	5.33	14.14	4.66
Second Period ...	12.79	3 87	13.99	4.64	14.66	5.37	14.15	4.64
Third Period.....	12.60	3.78	14.48	4.91	14.48	5.04	14.19	4.65

These figures show the average composition of each cow's milk to have been practically the same for each period, a result somewhat surprising, as there is usually an increase in the solids and fats with the increasing length of time a cow is milked after calving.

(2) *Production.* The four following tables give a record of the quantities of milk, milk solids, fat, and unsalted butter produced by each cow during the last fourteen days of each period.

Cow A. (Yield for 14 days.)

	Weight of Milk.	Weight of total Solids.	Weight of actual Fat.	Weight of unsalted Butter.	
	lbs.	lbs.	lbs.	lbs.	
First Period	161	20.2	5.75	6.12	
Second Period	119	15.2	4.60	4.75	1.37 lbs. less butter than First Period.
Third Period	133	16.7	5.03	5.12	.37 lbs. more butter than Second Period.

Cow B. (Yield for 14 days.)

First Period	165	23.99	7.54	5.87	
Second Period	137	19.16	6.35	5.	.87 lbs. less butter than First Period.
Third Period	126	18.24	6.19	5 25	.25 lbs. more than Second Period.

Cow C. (Yield for 14 days.)

First Period	153	22.30	8.15	8.75	
Second Period	111¾	16.40	5.96	6.50	2.25 lbs. less butter than First Period.
Third Period	124⅝	18.00	6.28	7.19	.69 lbs. more butter than Second Period.

Cow D. (Yield for 14 days.)

First Period	220	31.10	10.25	9.50	
Second Period......	183¾	26.00	8.52	7.75	1.75 lbs. less butter than First Period.
Third Period......	182½	25.90	8.48	7.81	.06 lbs. more butter than Second Period.

An inspection of the preceding figures discloses the following facts:

(1) In passing from the first to the second periods, or from a mixture of cotton-seed meal and corn meal to a grain ration of pure corn meal, the average falling off in butter production was 20.3 per cent, while in passing from the second to the third periods, or from a grain ration of corn meal alone to a mixture of cotton-seed and corn meal, the increase in butter production was 5.9 per cent. The falling off in the first case ranged with the four cows from 14.8 per

cent to 25.7 per cent, and the increase in the second case ranged from .08 per cent to 10.6 per cent.

(2) The changes in production of total milk solids and also of fat are very nearly the same as with the butter.

An average of 21.9 per cent less solids and 19.4 per cent less fat was produced in the second period than in the first, and in the third period the average increase over the second period was 4.8 per cent of solids and 3 per cent of fat.

The verdict rendered by this experiment is very pronounced, from the fact that with no one of the four cows is the result an exception to the general result. The same was true of the experiment of 1885–6, in which three cows were used, so that in carefully conducted tests with seven cows, where every precaution against error has been taken, and where all the important facts have been obtained that the scales and chemical analysis could furnish, the results are uniformly in favor of substituting cotton-seed meal for part of the corn meal in a moderate grain ration. As will be seen from a subsequent analysis of these results, the amount of digestible material was practically the same in the three periods, so that we cannot resist the conclusion that there is such a thing as economy in combining a ration so as to secure the maximum work from the minimum quantity of food. What is the natural and rational outcome of this truth, then, but the formulating of feeding standards?

Sources of error. In order to be sure that the conclusions in regard to the result of the preceding experiment are not reached by fallacious reasoning, it is necessary to know that no other causes except the variations in the ration effected a change in the milk production, in passing from one period to another. Several causes might influence the result, those most likely to operate being

(1) A failure of the animals to consume all the ration.

(2) A gain or loss of weight by the cows, thus either consuming the food for other purposes than milk production, or else producing milk at the expense of the body and not of the food.

(3) Marked variations in atmospheric conditions, such as temperature, &c.

(1) *Consumption of ration.* During the first period the food was wholly eaten. For the two remaining periods the amount of refuse material weighed back was small, except in the case of Cow B in the third period.

No grain was left, the weights of unconsumed food given below consisting of hay:

	Second Period.	Third Period.
Cow A	4 lbs.	7½ lbs.
" B	6 "	48 "
" C	14 "	6 "
" D	8 "	5 "

Except in the one case mentioned, the weight of food not eaten was too small to perceptibly influence the results.

(2) *Gain or loss of weight of cows.* The following is a record of the weights of the cows at beginning and end of each period.

These figures are the average of four weighings on as many consecutive days.

	Cow A.	Cow B.	Cow C.	Cow D.
Beginning First Period	947½ lbs.	945 lbs.	875½ lbs.	895 lbs.
End " "	954 "	929 "	853 "	886 "
End Second Period	942 "	950½ "	863½ "	898 "

There was a failure to preserve the record of the weights of the cows at the end of the last period, so that the data in this direction are not so full as is desirable. The weights recorded, however, show very little variation, and it is difficult to establish any relation between the small changes that did occur and the increase or decrease in milk production, especially when an animal sometimes shows greater variations in weight which are not attributable to gain or loss of flesh.

(3) *Variations of temperature.* These experiments were continued through January, February and March. The average monthly temperatures at Orono were the following: January, 14.2° F.; February, 17.75° F. and March, 25.9° F. The higher temperature of March was favorable to the increased production of the third period, but the fact that February was slightly warmer than January does

not in any way account for, but is rather opposed to, the large decrease in the flow of milk during the second period.

Experiment in Feeding for Growth.

The questions involved in this experiment are two, viz: (1) Economy in the quantity of food, and (2) Economy in the composition of the food.

Ten steers, not far from eighteen months old, exceptionally uniform in size and quality, were used in this experiment. They were divided into five pairs, selected so as offset as much as possible any differences in size, quality, &c., and each pair was given a ration differing in some respects from the food of any other pair. The various rations fed were the following:

Ration A	15	lbs.	mixed hay (mostly Timothy).
Ration B	12	lbs.	mixed hay,
	3½	"	corn meal.
Ration C	12	lbs.	mixed hay,
	2	"	corn meal,
	1½	"	cotton-seed meal or linseed meal.
Ration D	10	lbs.	mixed hay,
	5	"	corn meal,
	2	"	cotton-seed meal or linseed meal.
Ration E	12	lbs.	oat straw,
	2	"	corn meal,
	2	"	cotton-seed meal or linseed meal.

It is important to notice certain points of comparison in these rations:

(1) Ration A was intended for a maintenance ration.

(2) Rations B and C were intended to produce moderate growth, are alike in quantity, but C differs from B in being much more nitrogenous.

(3) Ration D was intended to produce liberal growth. It differs from ration C but little except in quantity.

(4) Ration E has oat straw substituted for the mixed hay, the grain fed being an increase of one-half pound of cotton-seed meal over the grain of ration C.

The steers were fed on the experimental rations during two periods of sixty-nine (69) days each, and the various rations were fed to different animals in the second period than in the first, this being done in order to eliminate the errors due to the differences in animals. In all cases the food offered was completely consumed, and throughout the feeding period the animals were well and ate heartily.

First Period. (69 days.)

Kind of Ration.		Animal Fed	Weight at beginning of Period.	Weight at end of Period.	Gain of each Animal.	Total Gain from each Ration.
			lbs.	lbs.	lbs.	lbs.
Ration A........	15 lbs. mixed hay,	Steer 1	690	708	18	34
		" 2	763	779	16	
Ration B........	12 lbs. mixed hay, 3½ " corn meal.	Steer 3	738	796	58	85
		" 4	703	730	27	
Ration C........	12 lbs. mixed hay, 2 " corn meal, 1½ " linseed meal,	Steer 5	723	807	84	154
		" 6	677	747	70	
Ration D........	10 lbs. mixed hay, 5 " corn meal, 2 " linseed meal,	Steer 7	691	848	157	278
		" 8	839	960	121	
Ration E........	12 lbs. oat straw, 2 " corn meal, 2 " linseed meal,	Steer 9	803	851	48	109
		" 10	787	848	61	

Second Period. (69 days.)

Kind of Ration.		Animal Fed	Weight at beginning of Period.	Weight at end of Period.	Gain of each Animal.	Total Gain from each Ration.
Ration A........	15 lbs. mixed hay,	Steer 9	851	836	-15	-24
		" 10	848	839	- 9	
Ration B........	12 lbs. mixed hay, 3½ " corn meal,	Steer 7	848	862	14	15
		" 8	960	961	1	
Ration C........	12 lbs. mixed hay, 2 " corn meal, 1½ " cotton-seed meal,	Steer 3	796	884	88	159
		" 4	730	801	71	
Ration D........	10 lbs mixed hay, 5 " corn meal, 2 " cotton-seed meal,	Steer 5	807	928	121	249
		" 6	747	875	128	
Ration E........	12 lbs. oat straw, 3 " corn meal, 2 " cotton-seed meal,	Steer 1	708	786	78	149
		" 2	779	750	71	

If we now combine the results of both periods, which is done in the next table, we have the total gain from each ration for the whole time the experiment was continued, viz: 138 days.

Kind of Ration.	Gain of First Period, 69 Days.	Gain of Second Period, 69 Days.	Total Gain of Both Periods.	Average Gain of Each Animal Per Day.
	lbs.	lbs.	lbs.	lbs.
Ration A, 15 lbs. mixed hay.....	34	—24	10	.035
Ration B { 12 lbs. mixed hay ....; 3½ " corn meal .... }	85	15	100	.36
Ration C { 12 lbs. mixed hay ....; 2 " corn meal ....; 1½ " cotton-seed or linseed meal, }	154	159	313	1.16
Ration D { 10 lbs. mixed hay ....; 5 " corn meal ....; 2 " cotton-seed or linseed meal, }	278	249	527	1.91
Ration E { 12 lbs. oat straw.... ....; 2 " corn meal ....; 2 " cotton-seed or linseed meal, }	109	149	258	.93

The above figures show the total gain in live weight from feeding the several rations. As the exact weight of food eaten in each case is known, we are now prepared to calculate the cost of production with the various kinds and quantities of food. The prices at which the foods are reckoned are about the average prices for the season of 1886–7, viz: Hay $10 per ton, corn meal $1.20 per hundred pounds, and cotton-seed meal at $26 per ton.

There are two standpoints from which to view the matter of winter feeding. We may consider the actual cost of a pound of growth based upon the total quantity of food consumed, or we may compare the relative advantages of feeding merely a maintenance ration, and a ration that produces growth, more or less.

Some farmers wish to winter their young stock any way, and they hesitate between the policy of feeding liberally, and that of turning out steers in the spring weighing about what they do when driven to the barn in the fall. In this experiment we can calculate the cost of a maintenance ration, and also the added cost of feeding enough more or enough better food to produce more or less growth. If a farmer purposes to winter young cattle, and wishes to know the most profitable plan, he should consider whether the difference between the cost of a maintenance ration and a growing ration is balanced by the value of the growth obtained. In presenting the financial results of this feeding experiment, therefore, there is given in the next table not only the total cost of food for each pound of growth, but also the cost of each pound of growth after deducting the cost of maintenance.

	Total Value of Food.	Total Cost for Each Pound of Growth.	Cost of Each Pound of Growth after deducting cost of Maintenance.
Ration A	$20 70		
Ration B	28 15	28 cents.	7.4 cents.
Ration C	28 56	9 "	2.5 "
Ration D	37 54	7.1 "	3.2 "
Ration E	22 08	8.6 "	0.8 "

Some facts appear from these feeding experiments with steers that have a direct practical bearing.

(1) The amount of hay (mostly Timothy) necessary to maintain an animal without loss or gain was in these experiments nineteen (19) pounds daily for each thousand pounds of live weight.

(2) The cost of producing a pound of growth, based on the total value of food consumed, was least with the most liberal feeding. In no case, however, was the value of the growth equal to the total cost of the food.

(3) The results of these experiments show, nevertheless, that for the food which was consumed in excess of a maintenance ration* the steers returned liberal pay. The cost of keeping a pair of steers for 138 days on a maintenance ration, viz., 15 pounds of hay daily, was $20.70. On this ration the steers made only 10 pounds gain. By increasing the quality of the food in the case of ration C so that the total cost was $28.56, two steers gained 313 pounds in 138 days. The difference between the cost of the maintenance ration and ration C was $7.86, and the value of the growth produced was at least $10. In ration D the cost of the food was still greater, being $16.84 more than the maintenance ration, which was about the market value of the growth produced. It seems, then, that a farmer does well to feed growing stock a moderate excess of food above what is necessary to enable the animals to "hold their own."

*This is a ration that maintains the animal without loss, but which produces no growth.

(4) The substitution of cotton-seed or linseed meal for a portion of the corn meal of a moderate ration diminished the cost of production. During the first period steers 3 and 4 were fed daily $3\frac{1}{2}$ pounds of corn meal, while steers 5 and 6 received 2 pounds corn meal and $1\frac{1}{2}$ pounds linseed meal, this being the same weight of grain in each case. Steers 3 and 4 gained only 85 pounds in the same time that steers 5 and 6 gained 154 pounds. In the second period the rations were changed and steers 3 and 4 received the mixture of corn meal and cotton-seed meal, and gained 159 pounds in the same number of days that they required to gain 85 pounds in the previous period, when the grain ration was equally large but wholly corn meal.

Comparison of Rations.

In the preceding experiments with milch cows and steers the rations have differed widely in quantity or in composition, and as a result corresponding variations in production and growth have been observed. A close study of these rations is necessary in order to see clearly in what way and to what extent they differ. It is not enough to simply know the name and quantity of the food consumed, we must know of what it is composed and what part of its ingredients is appropriated to the uses of the animal body in order to understand why two rations similar in weight may be so dissimilar in effect. What we wish to learn concerning these rations is the quantities of *digestible* ingredients which each contained. These quantities can be calculated, as we know the composition of the foods and their digestibility. The method of calculation is simple. If corn meal contains 10 per cent of protein, 80 per cent of which is digestible, then each 100 pounds of the meal furnishes 8 pounds of digestible protein.

Milk rations. The rations given the milch cows are first considered.

Daily Rations of First and Third Periods.

Cows A and C.

	Total Organic Matter.	Pounds of Digestible Material.				Nutritive Ratio.
		Protein.	Nitrogen-free Extractive Matter.	Fats.	Total Nutritive Substances.	
	lbs.	lbs.	lbs.	lbs.	lbs.	
Timothy hay, 18 lbs.....	15.3	.483	7.25	.26	7.99	
Corn meal, 3½ lbs	3.	.286	2.30	.15	2.74	
Cotton-seed meal, 2½ lbs..	2.09	.98	.50	.25	1.73	
	20.39	1.749	10.05	.66	12.46	1: 6.1

Cows B and D.

Clover hay, 18 lbs	14.9	1.00	7.04	.28	8.32	
Corn meal, 3½ lbs........	3.0	.286	2.30	.15	2.74	
Cotton-seed meal, 2½ lbs..	2.09	.98	.50	.25	1.73	
	19.99	2.266	9.84	.68	12.79	1: 5.1

Daily Rations of Second Period.

Cows A and C.

Timothy hay, 18 lbs	15.3	.483	7.25	.26	7.99	
Corn meal, 6 lbs..........	5.2	.49	3.85	.26	4.60	
	20.5	.973	11.10	.52	12.59	1: 12.7

Cows B and D.

Clover hay, 18 lbs	14.9	1.00	7.04	.28	8.32	
Corn meal, 6 lbs..........	5.2	.49	3.85	.26	4.60	
	20.1	1.49	10.89	.54	12.92	1: 8.2

In order to more conveniently make a comparison, these rations are placed together in one table. The German standard ration is also given.

	Total Organic Matter.	Pounds Digestible Material.				
		Protein.	Nitrogen-free Extractive Matter.	Fats.	Total Nutritive Substances.	
	lbs.	lbs.	lbs.	lbs.	lbs.	
First & Third Periods, Cows A & C,	20.41	1.75	10.05	.66	12.46	1: 6.1
Second Period, Cows A & C	20.5	.97	11.10	.52	12.59	1:12.7
Difference..................	—.10	+.78	—1.05	+.14	—.13	
First & Third Periods, Cows B & D,	20.0	2.27	9.84	.68	12.79	1: 5.1
Second Period, Cows B & D.......	20.1	1.49	10.89	.54	12.92	1: 8.2
Difference	—.10	+.78	—1.05	+.14	—.13	
German standard ration for cows of same weight..................	21.6	2.25	11.25	.30	13.86	

The above figures show that the total amount of digestible or available material was practically the same for all cows in all the periods of feeding. But while this material did not differ in quantity it was essentially different in kind in the second period from what it was in the first and third. In the second period the digestible protein was over three-fourths of a pound less daily, and the digestible nitrogen-free extractive matter (starch, sugar, &c.) was over a pound more daily than in the other two periods. These figures have significance when we place beside them the fact that the average production of milk solids was 20.3 per cent less in the second period than in the first, and 5.9 per cent less than in the third. To what shall these differences be attributed, if not to the much smaller quantities of digestible protein contained in the rations of the second period?

It is important to notice in this connection that the cows eating Timothy hay were more affected by the changes in the grain ration than the cows eating clover hay. It is possible, but not probable, that this is a coincidence, but it can certainly be reasonably accounted for by the fact that in the second period the Timothy hay ration was much more deficient in digestible protein than the clover hay ration.

Rations for Growth. The rations used in the experiment with steers are subjected to the same critical comparison.

	Total Organic Matter.	Pounds of Digestible Material.				Nutritive Ration.	Daily Average Gain of One Steer.	Average Gain of One Steer in 69 Days.
		Protein.	Nitrogen-free Extractive Matter	Fats.	Total Nutritive Substances.			
First Period.								
Ration A	12.75	.40	6.04	.22	6.66	1:16.5	0.25	17
Ration B	13.20	.606	7.14	.33	8.04	1:13.1	0.61	42½
Ration C	13.17	.913	6.47	.40	7.78	1: 8.2	1.12	77
Ration D	14.5	1.328	7.69	.53	9.58	1: 6.8	2.00	139
Ration E	13.74	.911	6.77	.33	8.01	1: 8.3	.79	54½
Second Period.								
Ration A	12.75	.40	6.04	.22	6.66	1:16.5	-0.17	-12
Ration B	13.2	.606	7.14	.33	8.04	1:13.1	0.11	15?
Ration C	13.16	1.068	6.42	.42	7.90	1: 7.0	1.15	79½
Ration D	14.51	1.456	7.62	.56	9.64	1: 6.2	1.80	124½
Ration E	13.74	1.119	6.70	.36	8.18	1: 6.8	1.08	44½
German standard ration for maintenance of steers of weight fed	14.0	.56	6.40	.12	7.08	1:12.		
German standard ration for growth for steers of weight fed	19.2	1.28	9.60	.24	11.12	1: 8.		

This comparison of the rations fed to the steers shows that the growth varied with the amount of total digestible material consumed. In comparing one ration with another it is evident, however, that the same quantity of nutritive substances was not equally effective in all cases. Rations C and E contained no larger amount of nutritive substances than ration B, and yet the former rations uniformly produced more growth than the latter. Here again we find, as in the experiment with cows, that the most effective rations were the most nitrogenous.

The results of the Station's two winters' experimental feeding of cows and steers all point to one conclusion, viz: Economy in feeding requires that cattle foods should be purchased partly with reference to the most effective combinations of nutrients, and not wholly with reference to the prices.

(c) EXPERIMENT IN FEEDING WHOLE CORN AND MEAL.

A decided difference of opinion exists among farmers in regard to the relative merits of whole corn and meal as foods for producing pork. Probably a majority of farmers incur the added expense of feeding meal, believing that, pound for pound, the meal has enough greater value than the corn to more than repay for the increased cost of the former.

On this point no very accurate data have been secured. Single experiments are not sufficient to decide such questions as this, and the one reported in this connection was intended to be the first of a series. The testimony of this one experiment is very emphatic, however, and while it favors the views of some, it will be a surprise to others. It can be said for this experiment, that seldom is one conducted under fairer conditions and with fewer disturbing influences. The six pigs used in the feeding trial were Chester White, from the same litter. They were divided into two lots, so that the weight and appearance of the three pigs in each lot was as nearly alike as possible.

At the time of beginning the feeding the pigs were about five months old, their average weight being not far from 85 pounds.

The whole time of experimental feeding was one hundred and ninety-four (194) days, which was divided into two periods, the first period being 78 days, and the second 116 days. In the second period the rations were reversed, and the lot of pigs which had in the former period received corn were fed meal, and those which had previously eaten meal were given corn.

The rations were the following:

Period 1.

Lot 1.	Lot 2.
6 pounds meal, 6 " raw potatoes, Milk.	6 pounds whole corn, 6 " raw potatoes, Milk.

Period 2.

Lot 3.	Lot 4.
8 pounds whole corn,	8 pounds meal,
6 pounds raw potatoes,	6 pounds raw potatoes,
Milk.	Milk.

The quantity of milk fed daily was not uniform, owing to the limited supply, but the amount fed to each lot of pigs was always the same by measure, averaging about 4 quarts. The corn and meal fed were from the same lot, and so were the same in quality. In the first period the corn and meal consumed were out of a fine lot of the Flint variety, which was grown in Piscataquis County. In the second period western corn was used. It is to be noticed, then, that in each period the same weight of the same kind of food was given to each lot of pigs, the only difference in the rations being that the corn was fed whole to one lot, and as meal to the other.

Below can be seen the weights of the pigs at the beginning and end of the periods.

	Meal— Lot 1.	Whole Corn— Lot 2.
Period 1, weight December 28th	260 lbs.	255 lbs.
" " March 16th	416 "	418 "
Gain in 78 days	156 lbs.	163 lbs.
	Lot 2.	Lot 1.
Period 2, weight March 28th	436 lbs.	451 lbs.
" " July 25th	665 "	675 "
Gain in 118 days	229 lbs.	224 lbs.
Total gain in 196 days	385 "	387 "

The outcome of this experiment is,

(1) The same weight of whole corn and meal produced almost exactly the same growth, the difference being only two pounds.

(2) Six pounds of corn or meal produced in the first period slightly more growth daily than eight pounds in the last period. Several experimenters have called attention to the fact that the cost of

growth increases with the age or size of the animal. In this case, however, the corn was not quite the same in the two periods.

(3) The average daily gain of each animal for the whole time was within a small fraction of one pound. This was accomplished on a daily ration to each pig of 1.37 quarts* of corn or meal, two pounds of raw potatoes, and an amount of milk averaging not far from one and one-third quarts.

(4) Reckoning the corn at 64 cents per bushel and the meal at 60 cents for fifty pounds, the potatoes at 40 cents per bushel, and the skimmed milk and buttermilk at one and one-half cents per gallon, in each case the cost of the food was greater than the market value of the pork produced. The cost of the growth was 7.2 cents per pound live weight with the meal-fed pigs, and 6.95 cents with the corn-fed.

Experiment in Feeding Corn Meal and Corn-and-Cob Meal.

The relative value of corn meal and corn-and-cob meal is another point about which various opinions are held. It is argued in favor of grinding the ears of corn without shelling that the ground cob not only furnishes some nutriment but aids digestion by causing the mass of food in the stomach to be less compact and more readily acted upon by the digestive fluids. The statement often appears in agricultural literature that one pound of finely ground corn-and-cob meal is equal in value one pound "clear" meal. It remains to be seen whether these opinions will stand the test of carefully conducted experiments. It certainly does not appear from the general knowledge that we have concerning the composition of corn and cobs and the digestibility of clear meal that these extreme views can be substantiated. Certainly the results of the Station experiment in feeding clear meal and corn-and-cob meal are not favorable to crediting cobs with very much nutritive value.

The data collected by the Station show that on the average almost exactly one-fifth of the weight of dry ears of corn consists of cobs, consequently five pounds of corn-and-cob meal would contain four pounds of clear meal and one pound of ground cobs. Accordingly, in this experiment one lot of three pigs was fed four pounds of clear corn meal and the other lot five pounds of corn-and-cob meal daily.

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*The quart meaning 1-32 of fifty-six pounds.

The two lots of pigs were quite uniform in size and quality, being from the same litter. The age of the pigs at the beginning was five months. The feeding was continued for 81 days, with the rations given below.

Lot 3.	Lot 4
4 lbs. clear meal,	5 lbs corn-and-cob meal,
3 " potatoes,	3 " potatoes,
Milk.	Milk.

The gain of the two lots is next shown.

	Lot 3.	Lot 4.
Weight, May 5th	244	206
" July 25th	380	335
Gain in 81 days	136	129

This experiment would have been more satisfactory if the feeding had been continued during a second period with the rations changed about. So nearly alike were the two lots of pigs, however, that it does not seem possible that the presence of a pound of ground cobs in the food of Lot 4 could have added greatly to the nutritive value of the ration without the effect being seen in increasing their growth over that made by Lot 3.

It is proper to state that the corn-and-cob meal was ground fine.

Experiment with Raw and Boiled Potatoes.

It has been shown on previous pages that the composition of potatoes is only slightly changed by boiling. This being the case, it is difficult to understand how their nutritive effect would be materially changed by cooking in this way. The Station has made this matter the subject of an experiment, with somewhat unsatisfactory results, owing to the fact that in the second period of feeding one lot of pigs did not seem to relish their ration.

As in the two preceding feeding trials, the experimental animals consisted of six pigs which were selected from the same litter. They were, therefore, alike in age and breeding and were quite uniform in size and quality. They were fed in two lots of three pigs each.

The first feeding period extended through forty-four days, the daily rations being the following:

Lot No. 3.	Lot No. 4.
15 pounds raw potatoes,	15 pounds potatoes, boiled,*
1 pound corn meal,	1 pound corn meal,
4 quarts milk.	4 quarts milk.

* Weighed before boiling.

On these rations the two lots of pigs made the following gain:

	Lot 3.	Lot 4.
Weight, December 28th	119 lbs.	121 lbs.
" February 11th	179 "	188 "
Gain in 44 days	60	67

On changing the rations about, the pigs of Lot 4 were reluctant to eat raw potatoes, and it was nearly four weeks before the three would eat as much as ten pounds a day. Even then their food did not seem to be relished, and the potatoes were not promptly eaten. Consequently the experiment did not proceed satisfactorily during the second period, and the results obtained are not reported here. The apparent outcome of the first period's feeding is that the value of potatoes is not materially increased by boiling.

Rations for Poultry Raising.

The question of economy in the compounding of rations for the production of milk, meat and wool has received much study, from which valuable results have been secured. There seems to be no reason why an experimental study of the use of various classes of foods in poultry production would not lead to greater economy in this department of feeding, especially as this matter has not been the subject of very much investigation. A beginning, and only a beginning, in this direction has been made at the Station.

The question proposed, which has been the subject of only one experiment so far, is, whether in feeding poultry for growth an advantage would be gained by substituting in a grain ration some highly nitrogenous food, like oil meal, meat scrap, etc.? The experiment mentioned was carried on in October and November, 1886, twenty-four pure bred Plymouth Rock cockerels being used. These were divided into two lots of twelve each, the birds in each lot being as nearly alike in age and size as possible, and were confined in two roomy pens. In addition to the experimental food, the cockerels were given a small, equal amount of potatoes each day or two, and they had access to ground clam shells, gravel, and fresh water. Equal weights of food were fed to each lot throughout the experiment, consisting in one case of cracked corn alone, in the other case being a mixture of cracked corn and some highly nitrogenous food. An attempt was made at first to feed for the latter ration a mixture of corn and cotton-seed meal, but this was given up as a failure after several days' trial, even a small quantity of this mixture being eaten with reluctance. Beef scrap was then substituted for the cotton-seed meal, with good results.

The quantities fed at first, beginning October 8th, were as follows:

Lot 1. 640 grams* cracked corn, daily, or at the rate of one quart by weight, to fifteen birds.

Lot 2. 540 grams cracked corn, daily, 100 grams beef scrap, daily. Total, 640 grams.

On October 19th, the rations were increased:

Lot 1. 800 grams cracked corn, daily, or at the rate of one quart by weight, to twelve birds.

Lot 2. 600 grams cracked corn, daily, 200 grams beef scrap, daily. Total, 800 grams.

On Oct. 11th, the two lots were weighed, and again on Oct. 28th. The weights at the two dates are given below:

	Oct. 11th.	Oct. 28th.	Gain.
Lot 1	35½ lbs.	39½ lbs.	4 lbs.
Lot 2	35 "	43¾ "	8¾ "

It seems, then, that in seventeen (17) days the twelve birds which were fed pure cracked corn gained four (4) pounds, and that those which

*One pound—454 grams.

were given a ration of equal weight in which beef scrap was substituted for a portion of the corn gained 8¾ pounds. This was an average gain of one-third of a pound for each bird in the first lot, and almost three-fourths of a pound for each bird in the second lot.

The pounds of food eaten in the seventeen days, with the cost of the same, are given below. The corn is reckoned at 62½ cents for fifty pounds, and the beef scrap cost 2½ cents per pound.

	Corn.	Scrap.	Total Fed.	Cost of Food.	Cost per lb. of Gain.
Lot 1...........	27½ lbs.	-	27½ lbs.	39½ cts.	8.6 cts.
Lot 2...........	21½ "	6 lbs.	27½ "	43¾ "	4.77 "

On October 29th, an equal weight of dried blood was substituted for the beef scrap, the weights of corn fed in the two cases remaining the same, and these rations were fed for fourteen days.

Below can be seen the weights of the two lots at the beginning and end of this period:

	Oct. 29th.	Nov. 12th.	Gain.
Lot 1....................................	39½ lbs.	43¾ lbs.	4¼ lbs.
Lot 2....................................	43¾ "	47¼ "	3½ "

Here the advantage seems to be slightly with the pure cracked corn, which tends to throw suspicion on the correctness of the result when beef scrap was fed. There is quite a difference in the composition of the beef scrap and blood, which can be seen by the following analyses:

	Water.	Ash.	Albuminoids.	Carbohydrates.	Fat.
Beef scrap...........................	1.33	8.3	57.69	....	32.95
Dried blood..........................	6.69	6.64	65.12	....	16.23
Corn (av.)...........................	10.54	1.55	10.59	69.73	5.49

An equal weight of the blood contains only about half as much fat as the scrap, but this difference alone does not seem sufficient to explain the apparent difference in effect.

One important point should be noticed in this connection, which is the value of the growth as compared with the cost of the food. The twenty-four cockerels gained in the thirty-two days 20½ pounds, this increase having a value of at least $2.50. They consumed 94 pounds of corn and 12½ pounds of scrap and blood, the whole costing $1.50. The half bushel of small potatoes fed had scarcely any market value.

Certainly no other form of meat can be produced in Maine at a cost for food of three-fifths of its market value.

TESTS OF VARIETIES.

In 1886 the Station grew forty varieties of potatoes, twenty varieties of oats (so-called varieties) and six varieties of barley. This was done with especial reference to making an exhibition of varieties of grain, etc., at our State fairs, but at the same time the work was carried on in such a manner as to secure a record of the relative yield.

POTATOES.

Forty varieties of these were planted, twenty hills of each. The same weight of seed was used in each case, the potatoes being cut so as to secure a uniform distribution of the eyes. No other record was kept than the date at which the tops began to die, and the total yield of tubers from each twenty hills.

The land on which the potatoes were planted was a mellow loam, very uniform in character. It produced two tons of hay to the acre in 1885, and received previous to the planting of the potatoes a fairly liberal application of dissolved bone black and muriate of potash. For some unknown reason nearly every tuber of every variety was scabby, so that none were placed on exhibition. The planting was done on May 21, and the tubers were dug on September 1. The tops of some of the varieties scarcely showed signs of decay when the digging was done, and in these cases the date of the death of the tops cannot be given.

The varieties given in the following table are classed by seedsmen as follows: Nos. 1 to 14 and 25, early; Nos. 15 to 24, intermediate; Nos. 26 and 30 to 41, late.

Number.	Variety.	Tops Began to Die.	Yield of 20 Hills—lbs.
1	Thorburn	Aug. 16	40¾
3	Clark's No. 1	" 28	30½
4	Rose Magnum Bonum	Dug	20½
5	Early Ohio	Aug. 16	19½
6	Early Maine	" 24	28
7	Early Vermont	" 24	23½
9	Watson's Seedling	" 24	20¼
10	Vanguard	" 20	26
10½	Eight Weeks	" 24	36¼
11	Early Sunrise	" 20	24½
11½	Pearl of Savoy	" 28	37½
12	Hall's Early Peach Blow	Dug	28¼
11½	Triumph	Aug. 20	14¼
13	Early Essex	" 24	20¾
14	Beauty of Hebron	" 20	28¾
16	Orange Co. White	" 28	47
17	Dunmore	–	43½
18	Queen of the Roses	" 25	31
19	Rural Blush	Dug	39½
20	Garfield	Dug	33½
21	Improved White Rose	Aug. 28	34¾
22	White Star	" 28	34
23	St. Patrick	" 28	38
24	Vermont Champion	" 26	30½
25	Belle	" 26	37½
26	Rochester Favorite	" 28	36
27	Perfect Peach Blow	" 26	39½
28	Charter Oak	" 26	37½
30	Great Eastern	" 28	40
31	Dictator	" 28	31
32	Empire State	" 26	23½
33	Burbank Sport	" 25	25
34	Dakota Red	" 25	25
35	Thorburn's Late Rose	Dug	23½
36	Late Beauty of Hebron	"	36
37	O. K. Mammoth Prolific	Aug. 28	30½
38	White Elephant	" 28	30½
39	Red Elephant	" 28	26
40	Jumbo	" 28	11½
41	White Seedling	Dug	13

OATS.

These were sown on plots sixty feet long and six and five-sixths feet wide, one quart of seed on each plot. The soil and method of manuring were the same as in the case of the potatoes. The sowing was done on May 22, and each plot was cut as soon as the grain was ripe enough. The dates of cutting and yields of grain are given below.

No. of Plot.	Variety.	Date of Cutting.	Yield of Grain Per Plot—lbs.	Yield Per Acre—bushels.
1	Triumph	Aug. 28	8¾	29
1½	"	" 28	8½	29
2	Welcome	" 16	14¾	49
3	White Probestier	" 24	18	59.6
3½	" "	" 24	17½	58
4	Mold's Ennobled	" 24	13½	44.7
5	Clydesdale	" 16	16½	54.7
6	Russian White	" 28	18½	60.7
7	Surprise	" 24	18	59.6
8	Hopetown	" 28	10¾	35.7
9	Henderson's Clydesdale	" 16	15½	51.3
10	New Race Horse	" 16	15½	51.3
11	White Belgian	" 16	16	53
12	Black Tartarian	" 24	15¾	52.1
12½	" "	" 24	15½	51.3
13	White Schoener	" 24	15¼	50.5
14	White Australian	" 24	12¼	40.6
15	White Victoria	" 16	11	36.4
16	Harris	" 10	7	23.2
17	Hogan	" 16	4	16.4

BARLEY.

The barley was sown on plots the same in size as the oat plots, the amount of seed being the same. Each plot was cut when the grain was ready. The results follow:

No. of Plot.	Variety.	Date of Cutting.	Yield of Grain Per Plot—lbs.	Yield Per Acre,—bushels.
1	Imperial	Aug. 16	13	28.7
2	Mensbury	" 16	13	28.7
3	Chevalier	" 24	10½	23.2
4	Nepaul	" 16	7¾	17.1
5	Melon Barley	" 24	12	26.5
6	Purple Hulless	" 24	9½	21.

There seems to be a great difference in the productiveness of the varieties of potatoes and grain mentioned above. The yields here recorded should not be too closely adhered to in judging the several varieties, because the errors involved in working with so small plots are relatively large, and the yield is also affected to a certain extent by the locality in which the seed was grown, as well as by other conditions.

DAIRY PRODUCTS.

The experiments with different rations for milk have involved the analysis of a large number of samples taken from the milk of several cows, and from the analytical data that have thus accumulated can be drawn facts that are of interest if not of value, which were not noticed in the previous discussions of the more important results of the experiments. But besides these data, and of more importance to dairymen, are the results of some experiments in cream raising which the Station has carried on during the months of June and July of the present season.

The points concerning which the various experiments and the numerous analyses furnish information are the following:

(*a*) The effect of varying the temperatures at which milk is set.

(1) Upon the volume (or weight) of cream.

(2) Upon the composition of the cream.

(3) Upon the quantity of cream required for one pound of butter.

(4) Upon the amount of fat left in the skimmed milk.

(*b*) The effect of varying the time which milk stands before skimming, upon the volume (or weight) and composition of the cream.

(*c*) The residue of fat in skimmed milk after twelve hours as compared with a longer time of setting.

(*d*) The comparative composition of night's and morning's milk.

The evidence which is furnished by the experimental data presented in this connection is emphatic and conclusive on some of the above points.

(1) THE EFFECT OF THE TEMPERATURE AT WHICH THE MILK IS SET UPON THE VOLUME OF CREAM.

This is a matter of especial importance in the manufacture of creamery butter by the plan adopted at all Maine butter factories, viz: Cream and not milk is furnished to the factory, and in most cases each patron shares in the proceeds of butter sales in proportion to the volume (or weight) of cream which he supplies.

This method is just, provided the cream is of the same value in all cases, *i. e.*, has the same butter-producing capacity. Indeed, if the differences in the value of cream from different patrons were only slight, this plan would be sufficiently equitable when applied to the butter product of a whole season. The facts here set forth justify the belief that the quality of cream furnished to our creameries by different patrons constantly varies in quality to so great an extent as to render unfair a division of profits on the basis of the volume of cream supplied.

The most potent cause of such variation is the large differences in the temperature at which different patrons set their milk. The existence of this fact is more than suspected by many who have been intimately connected with the manufacture of factory butter, but the figures which are given here as the result of the Station experiments may be a surprise to some, as showing the large and constant differences in the value of cream that have a direct relation to the temperature at which the milk is set.

It undoubtedly is true that the patrons of butter factories raise their cream at widely differing temperatures. This is plainly proved by the replies to inquiries addressed by the Station to the managers of six Maine butter factories.

These inquiries covered three points:

(1) The methods of cooling the milk.

(2) The temperature at which the milk is set.

(3) The valuation of the cream.

It is necessary to give only a brief digest of the replies received.

(1) The methods of cooling milk vary from the use of ice in a tank to setting the milk in a cool cellar, or hanging it in an unused well.

(2) The temperatures at which the milk is set vary from 38° to 60° Fahrenheit, in some cases rising as high as 65°.

(3) In two cases the cream from different patrons is tested and valued according to quality, and in four cases the patrons are paid in proportion to the inches of cream without regard to its quality.

The plan adopted at the Station for the experiments in setting milk at different temperatures was this:

The milk of three new milch cows was thoroughly mixed night and morning in a large tin can and divided by weight into equal portions, which were set for the cream to rise at different temperatures. The cream from each portion was weighed, analyzed, and after a sufficient quantity had been collected the whole of each lot was churned, and the weight of butter ascertained. Six trials of this kind were made, each trial including the milk of three cows for four to five days. The temperatures at which the different portions of milk were set ranged during the six trials 35° to 60° F., these limits being those stated to be used by the patrons of Maine butter factories.

Below is a summary of the results of these trials.

TABLE SHOWING THE QUANTITIES OF CREAM OBTAINED AT DIFFERENT TEMPERATURES.

	Weight of Milk Set.	Weight of Cream.	Per Cent of Cream by Weight.	Pounds of Milk Required for One Pound of Cream.
	lbs.	lbs.	%	lbs.
First Trial.				
Milk set at 35°	142.75	28.75	20.1	4.97
" " 40° to 45°	142.75	23.50	16.4	6.08
Second Trial.				
Milk set at 35°	123.75	23.75	18.8	5.32
" " 45° to 48°	123.75	19.50	15.7	6.35
Third Trial.				
Milk set at 35°	133.	25.50	19.2	5.22
" " 45° to 50°	133.	19.50	14.7	6.82
Fourth Trial.				
Milk set at 45°	122.	21.90	17.9	5.56
" " 55°	122.	17.13	14.0	7.12
Fifth Trial.				
Milk set at 45°	114.50	19.87	17.4	5.76
" " 60°	114.50	14.75	12.9	7.76
Sixth Trial.				
Milk set at 45°	102.	18.44	18.1	5.53
" " 50°	102.	16.37	16.0	6.22

In every instance the colder milk has furnished the larger volume of cream.

The following summary shows the extent of the differences in the six trials.

First Trial, colder milk 35°, warmer milk 40° to 45°, colder milk gave 22.3 per cent more cream.

Second Trial, colder milk 35°, warmer milk 45° to 48°, colder milk gave 19.2 per cent more cream.

Third Trial, colder milk 35°, warmer milk 45° to 50°, colder milk gave 30.8 per cent more cream.

Fourth Trial, colder milk 45°, warmer milk 55°, colder milk gave 27.8 per cent more cream.

Fifth Trial, colder milk 45°, warmer milk 60°, colder milk gave 34.7 per cent more cream.

Sixth Trial, colder milk 45°, warmer milk 50°, colder milk gave 12.6 per cent more cream.

The meaning of these figures is that differences ranging from 5° to 15° in the temperature at which milk is set caused large variations in the amounts of cream obtained.

The amount of milk required for a pound of cream was increased one-eighth in the case of the smallest difference of temperature (sixth trial), and over one-third in the case of the largest difference (fifth trial). In general the higher the temperature the smaller the weight of cream.

(2) THE EFFECT OF THE TEMPERATURE AT WHICH MILK IS SET UPON THE COMPOSITION OF THE CREAM.

The question which now presents itself is this: What relation is there between the composition of cream and the volume? Or, to put the question in another form, are the smaller volumes of cream which are raised at the higher temperatures the result of a more imperfect separation of fat from the milk, or is the cream of more value pound for pound than that raised at lower temperatures? The cream obtained in five of these trials was analyzed, and below are given the percentages of solids and fat. The more fat cream contains the more butter a given volume will make.

TABLE SHOWING THE COMPOSITION OF CREAM RAISED AT DIFFERENT TEMPERATURES.

	Cream Contained.*	
	Solids.	Fat.
	%	%
First Trial.		
Milk set at 35°	29.06	21.66
" " 40° to 45°	34.32	27.06
Second Trial.		
Milk set at 35°	29.05	21.94
" " 45° to 48°	35.20	27.60
Fourth Trial.		
Milk set at 45°	29.56	22.56
" " 55°	33.00	26.35
Fifth Trial.		
Milk set at 45°	30.11	21.85
" " 60°	32.12	24.05
Sixth Trial.		
Milk set at 45°	28.15	21.41
" " 50°	28.79	22.42
Average for cream from colder milk	29.19	21.93
" " warmer milk	32.42	25.64

*The samples of cream that were analyzed were taken just before the cream was churned.

In every instance the cream raised from the warmer milk contained a larger percentage of fat than the cream from the colder milk, the differences ranging from 1.00 per cent to 5.66 per cent.

(3) THE RELATION OF THE TEMPERATURE AT WHICH MILK IS SET TO THE AMOUNT OF CREAM REQUIRED FOR A POUND OF BUTTER.

However conclusively the analysis of cream may determine its value, the ultimate and most satisfactory test is made in the churn. In all these trials the several lots of cream taken from the milk set at different temperatures were churned. In the next table a comparison is made between the quantities of cream and butter.

TABLE SHOWING THE BUTTER VALUE OF CREAM RAISED AT DIFFERENT TEMPERATURES.

	Weight of Cream.	Weight of Unsalted Butter.	Pounds of Cream Required for One Pound of Butter.
	lbs. oz.	lbs. oz.	lbs.
First Trial.			
Milk set at 35°	28 — 12	6 — 11	4.30
" " 40° to 45°	23 — 8	6 — 11	3.51
Second Trial.			
Milk set at 35°	23 — 4	5 — 14	3.96
" " 45° to 48°	19 — 8	5 — 12	3.39
Third Trial.			
Milk set at 35°	25 — 8	6 — 12	3.78
" " 45° to 50°	19 — 8	6 — 4	3.12
Fourth Trial.			
Milk set at 45°	21 — 15	5 — 12	3.82
" " 55°	17 — 2	5 — 0	3.42
Fifth Trial.			
Milk set at 45°	19 — 14	5 — 6	3.70
" " 60°	14 — 12	4 — 8	3.28
Sixth Trial.			
Milk set at 45°	18 — 7	5 — 0	3.69
" " 50°	16 — 6	4 — 8	3.64

The above figures confirm the testimony of the analyses of the cream as to the relative value of the different lots, and show conclusively that a difference of a few degrees in the temperature at which cream is raised has an important influence upon its value. In the first three trials the cream from the colder milk averages a fifth less in value than the cream raised at approximately 10° higher temperature.

(4) THE RELATION OF THE TEMPERATURE AT WHICH CREAM IS RAISED TO THE QUANTITY OF BUTTER OBTAINED, OR TO THE RESIDUE OF FAT LEFT IN THE SKIMMED MILK.

It is noticeable that when the warmer milk reached a temperature much above 45°, the amount of butter obtained was considerably less than that made from the milk set at 45° or colder. In the first trial the same quantity of butter was obtained from the two lots of milk, but in this case the warmer milk did not reach a temperature above

45°. In the fifth trial 114½ pounds of milk set at 60° made 14 ounces or one-eighth less butter than the same quantity of the same milk set at 45°.

The natural conclusion is that with the higher temperatures more fat was left in the skimmed milk, and this conclusion is sustained by analyses that were made of the skimmed milk from the night's and morning's milk of every day during the six trials. The following table gives the weight of skimmed milk of each trial, the average per cent of fat in it, and the total quantity of fat it contained.

TABLE SHOWING THE FAT IN SKIMMED MILK.

	Weight of Skimmed Milk. lbs. — oz.	Per cent of Fat in Skimmed Milk.	Weight of Fat left in Skimmed Milk. Ounces.
First Trial.			
Milk set at 35°	114	.29	5.3
" " 40° to 45°	119 — 4	.36	6.9
Second Trial.			
Milk set at 35°	100 — 8	.38	6.1
" " 45° to 48°	104 — 4	.35	5.8
Third Trial.			
Milk set at 35°	107 — 8	.37	6.4
" " 45° to 50°	113 — 8	.57	10.4
Fourth Trial.			
Milk set at 40°	100 — 1	.35	5.6
" " 55°	104 — 14	.65	10.9
Fifth Trial.			
Milk set at 45°	94 — 10	.44	6.7
" " 60°	100 — 0	.89	14.2
Sixth Trial.			
Milk set at 45°	83 — 9	.30	4.0
" " 50°	85 — 12	.71	9.8

These analytical results coincide with the opinion expressed by observing dairymen that if milk is set at 45°, or below, a more complete separation of the fat occurs and more butter is obtained than at higher temperatures. When the milk was set at 60°, the fat which remained in the skimmed milk was two and one-half to three times that left when the temperatures ranged from 35° to 45°.

(5) THE COMPARATIVE WEIGHT AND COMPOSITION OF CREAM FROM MILK AFTER 12 AND 24 HOURS' STANDING.

In these six trials in raising cream the milk was skimmed in the morning, so that the morning's milk of the previous day had stood 24 hours, and the night's milk 12 hours. The cream from the night's and the morning's milk was kept separate, weighed and analyzed, consequently it is possible to compare that from 12 hours' setting with that from 24.

Composition of Cream After 12 and 24 Hours' Setting of Milk.

Trial	Temperature	Setting	Weight of Milk.	Weight of Cream.	Pounds of Milk to One Pound of Cream.	Composition of the Cream. Solids.	Composition of the Cream. Fat.
			lbs. oz.	lbs. oz.	lbs.	%	%
First Trial	Milk at 35°	Morning, 24 hours	64 — 0	12 — 12	5.0	30.06	22.59
		Night, 12 "	78 — 12	16 — 0	4.9	28.07	20.74
	Milk at 40° to 45°	Morning, 24 "	64 — 0	11 — 4	5.7	34.18	27.34
		Night, 12 "	78 — 12	12 — 8	6.3	33.84	26.79
Second Trial	Milk at 35°	Morning, 24 "	61 — 4	11 — 4	5.4	30.00	23.01
		Night, 12 "	62 — 8	12 — 0	5.2	28.10	20.88
	Milk at 45° to 48°	Morning, 24 "	61 — 4	9 — 8	6.4	35.60	29.12
		Night, 12 "	62 — 8	10 — 0	6.2	32.80	26.07
Fourth Trial	Milk at 45°	Morning, 24 "	56 — 12	10 — 4	5.5	30.50	23.58
		Night, 12 "	65 — 4	11 — 11	5.5	28.62	21.54
	Milk at 55°	Morning, 24 "	56 — 12	8 — 0	7.1	34.70	28.21
		Night, 12 "	65 — 4	9 — 2	7.1	31.29	24.48
Fifth Trial	Milk at 45°	Morning, 24 "	54 — 4	9 — 4	5.8	30.12	21.87
		Night, 12 "	60 — 4	10 — 10	5.5	30.10	21.83
	Milk at 60°	Morning, 24 "	54 — 4	6 — 13	8.0	31.99	27.74
		Night, 12 "	60 — 4	7 — 15	7.7	29.25	21.36
Sixth Trial	Milk at 45°	Morning, 24 "	48 — 12	8 — 15	5.5	28.64	21.96
		Night, 12 "	53 — 4	9 — 8	5.6	27.65	20.87
	Milk at 50°	Morning, 24 "	48 — 12	8 — 1	6.0	29.48	23.00
		Night, 12 "	53 — 4	8 — 5	6.4	28.10	21.85

The above record of cream analyses shows that without exception the cream from morning's milk, which had stood 24 hours, contained a larger percentage of fat than the night's milk, which stood 12 hours. The average difference in ten comparisons is 2.20 per cent of fat. The average difference when the milk was set below 45° is 1.28 per cent, and the average when the milk was set at temperatures ranging from 45° to 60° is 3.58 per cent. The richest cream appears from this to be that which is obtained from milk which is set for a long time at a high temperature.

(6) THE RESIDUE OF FAT IN SKIMMED MILK AFTER 12 HOURS' SETTING AND AFTER 24 HOURS.

The figures bearing upon this point, which are the averages of 25 or 26 analyses in each case, show nothing new, but simply accord with general belief and the results of other experimental tests.

FAT IN SKIMMED MILK AFTER 12 AND 24 HOURS' SETTING OF MILK.

	Variations of Percentages of Fat in Skimmed Milk.	Average Percentages of Fat in Skimmed Milk.
	%	%
Morning's milk, after 24 hours at 35° to 48°	.23 to .40	.33
Night's milk, after 12 hours at 35° to 48°	.31 to .52	.39
Morning's milk, after 24 hours at 50° to 60°	.31 to .72	.61
Night's milk, after 12 hours at 50° to 60°	.40 to 1.06	.80

It seems that, with the milk used in these experiments, 12 hours' setting when the temperature was below 48° was as good as 24 hours, the difference in the percentages of fat in the skimmed milk in the two cases being only six-hundredths of one per cent, or one pound of fat to 1666 pounds of skimmed milk. With temperatures ranging from 50° to 60° there was a difference in favor of 24 hours, amounting to nineteen-hundredths of one per cent, or one pound of fat to 526 pounds of skimmed milk. When 12 hours' setting under 48° is compared with the same length of time at 50° to 60°, a large difference appears, amounting to one pound of fat to 244 pounds of skimmed milk.

(7) THE COMPARATIVE COMPOSITION OF NIGHT'S AND MORNING'S MILK.

During the past two years the Station has made 267 analyses of morning's milk, and an equal number of night's milk from the same cows. These analyses have been made at different times in the year, and include the milk of ten cows. The milking was uniformly done at very nearly the same hour night and morning. The table below gives the average percentages of total solids and fats.

TABLE COMPARING THE COMPOSITION OF NIGHT'S AND MORNING'S MILK.

	Composition of the Milk.	
	Solids.	Fat.
Cow Belle, 34 days between Dec. 29 and March 9, morning's milk,	15.11	5.48
" " " " night's milk...	15.10	5.67
Difference	.01	—.19
Cow Helen, 34 days between Dec. 29 and March 9, morning's milk,	14.26	4.85
" " " " night's milk...	14.15	4.85
Difference	.11	
Cow Juno, 34 days between Dec. 29 and March 9, morning's milk,	14.75	5.01
" " " " night's milk...	14.75	5.18
Difference	–	—.17
Cow A, 35 days between Jan. 17 and March 27, morning's milk...	12.89	3.92
" " " " night's milk.....	12.44	3.57
Difference	.45	.35
Cow B, 35 days between Jan. 17 and March 27, morning's milk ..	14.47	4.79
" " " " night's milk.....	14.24	4.65
Difference	.23	.14
Cow C, 35 days between Jan. 17 and March 27, morning's milk...	14.80	5.40
" " " " night's milk.....	14.35	5.09
Difference	.45	.31
Cow D, 35 days between Jan. 17 and March 27, morning's milk ..	14.32	4.76
" " " " night's milk.....	14.04	4.56
Difference	.28	.20
Mixed milk, 3 cows, 23 days, between June 13 and July 29, morning	13.85	4.81
" " 26 " " " night ..	13.34	4.21
Difference	.51	.60

These analyses show that the morning's and the night's milk of the Jersey cows Belle, Helen and Juno, in the winter of 1885–6, differed but very little. In the case of the grade Ayrshires A and B, and the Jerseys C and D, in the winter of 1886–7, the morning's milk was better than the night's by a small constant difference. The mixed milk of three common cows during June and July of the present season contained .51 per cent more of solids and .60 per cent more of fat in the morning than at night, which means that it would take 114.2 pounds of night's milk to make as much butter as 100 pounds of morning's milk. These averages indicate a much greater difference between morning's and night's milk in the summer than in the winter.

COMMENTS.

These comments are based entirely upon such facts as appear from the Station experiments in cream raising and from the analyses that have accompanied these and other experiments. The work done in this direction has resulted, for the most part, in setting forth, in an experimental and illustrative way, certain facts that are important to dairymen, but which are not new to many. The figures given in the several tables, although they may to an extent illustrate truths already known, have value in that they measure somewhat definitely differences whose existence has been known but whose importance many have not fully appreciated.

From the Station experiments and analyses the following facts appear:

(1) The butter value of cream is seriously modified by the temperature at which the milk is set, the cream from the higher temperatures having the greater value.

This fact points to the necessity of requiring all the patrons of butter factories to set milk at the same temperature, if the proceeds of butter sales are to be divided on the basis of the inches of cream. Farmer A, who uses ice, has a great advantage over Farmer B, who does not.

(2) Not only is a much larger volume of cream obtained, but a somewhat more complete separation of fat from the milk is secured at temperatures below 45° than at higher temperatures. Using the data obtained in these experiments as a basis of calculation, it appears that for each 100 pounds of milk set, about nine ounces more butter are obtained at 48° or below, than at 60°. Each dairyman

must determine for himself whether this gain will render the use of ice profitable.

(3) The fat seems to separate from the milk as completely in 12 hours as in 24 when the milk is set at 48° or below, but at higher temperature there is considerable difference in favor of 24 hours setting.

MISCELLANEOUS.

ADULTERATION OF MOLASSES.

Early in June of 1886 three samples of molasses were sent to the Station by a merchant doing business in Maine, with the request that they be examined for the presence of tin. Tin was found in appreciable quantity in two of the three samples. Later five more samples of molasses were collected in this State, in four of which tin was found. This indicates that tin exists in molasses quite generally at the present time. The claim is made that tin is introduced into molasses in the form of the chloride (muriate), the object of its use being to lighten the color of the molasses and thus improve its appearance. It is also stated that a portion or all of the tin thus introduced separates from the molasses, the completeness of this separation varying greatly in different cases, without doubt. That which remains in solution does not seem to be enough to produce immediate poisonous effects, although it is possible that the continuous presence of tin in human food might prove to be injurious to health. Three grains of chloride of tin are a sufficient quantity to act violently upon the organs of digestion, but even if we were sure that all the tin in molasses remains in the form of the chloride, a person would be obliged to eat a large quantity of molasses at one time in order to poison himself. At the same time, it is undoubtedly safer and wiser to eat molasses free from tin, and so it is considered that the presence of this metal in one of our common articles of food is a matter of some public interest.

The sugar of molasses consists of two forms, at least, viz., *sucrose*, or the ordinary granulated sugar, and *glucose*, a difficultly crystallizable sugar not nearly as sweet as sucrose. The sweetening power of molasses is diminished by increasing the glucose at the expense of the sucrose, which would be the case whenever molasses is adulterated with glucose syrup. Determinations of the sucrose and glucose were made in the above mentioned samples, and the percentages obtained are given in the following table of results:

No. of Sample.	Kind of Molasses.	Water—Per cent.	Sucrose—Per cent.	Glucose—Per cent.	Total Sugar—Per cent.	Presence of Tin.
1		20.6	41.1	27.9	69.	Trace.
2		21.7	44.2	21.8	66.	Tin.
3		–	–	16.54	–	None.
4	Porto-Rico	20.3	44.6	19.1	63.7	None.
5	Ponce Porto-Rico	23.47	46.2	17.7	63.9	Tin.
6	Mixture	22.22	38.6	24.0	62.6	Tin.
7	Porto-Rico	23.45	44.5	21.4	65.9	Tin.
8	Porto-Rico	20.9	45.3	21.2	66.5	Tin.
	Average	21.8	43.5	21.9	65.4	

It does not appear that any of the samples analyzed contained very much more glucose than is attributed to unadulterated molasses, the total percentages of sugar being very nearly the same that are usually found.

Two or three observations in connection with these analyses may be of interest.

(1) The color of molasses seems to have no relation to the amount of sugar it contains, or in other words, to its sweetening power, or food value. The dark brands of molasses are usually cheaper than the light, so that it is economy to use the former where the effect of the color of the molasses upon the appearance of the food is not considered.

(2) When it is merely a question of making food sweet, and not of securing the molasses flavor, molasses is very little more economical than granulated sugar, at present prices. A gallon of molasses weighs eleven pounds very nearly. The eight samples analyzed contained on the average 65.4 per cent of sugar, or 7.2 pounds to the gallon. Allowing the retail price to average 45 cents per gallon, the cost of the sugar per pound would be 6¼ cents.

Nearly one-third of this sugar, however, is glucose, which has a lower sweetening power than granulated sugar, and when we allow for this fact, the cost of sugar in the better grades of molasses must be nearly as large with present prices as when bought in the form of pure granulated sugar.

A. L. Moore, Esq., of Limerick left at the Station a sample of molasses which he suspected of being inferior in quality. The following statement was sent to Mr. Moore: "We have determined the sucrose (cane sugar) and glucose in the sample of molasses which you left at the Station. The results are as follows:

Sucrose.	Glucose.	Total Sugar.
20 per cent.	33 per cent.	53 per cent.

This is a poor molasses. It contains too small a percentage of total sugar, and too large a part of this sugar is glucose. In good molasses the glucose should constitute considerably less than one-half the total sugar. By reference to a former bulletin of the Station, showing the sugar in eight samples, you can see that the molasses you left with us is poor in comparison."

INSECTICIDES.

Insecticides have come to be very useful to the farmer in protecting his crops from the ravages of insects, and a knowledge of the composition of those offered for sale is a matter of considerable importance. Three of these preparations have been examined by the Station, viz:

Paris Green, London Purple, Hammond's Slug Shot.

In all of these the poisonous ingredient must be arsenious acid (oxide) or its compounds, so that in each case the value of the preparation as an insecticide is determined approximately by the amount of arsenious acid present, though in one instance the presence of a small amount of "dead oil" may add to the value of the preparation as a preventive. The following are the results of the analyses of the above named materials:

	Paris Green, Per cent.	London Purple, Per cent.	Hammond's Slug Shot, Per cent.
Arsenious Oxide (white arsenic)	47.68	55.35	1.20
Cupric Oxide	27.47		
Calcium Oxide (lime)	–	26.23	29.41
Sulphuric Acid (anhydride)	.78	.22	42.05
Carbonic Acid	–	.27	
Acetic Acid	7.16		
"Dead oil" (by difference)*	–	–	5.00
Insoluble residue	2.34		
Water of hydration (calculated)	–	–	18.91
Moisture	1.35	5.29	3.43

*Also determined approximately.

The Paris Green is mainly an aceto-arsenite of copper, or in other words, a compound of acetic acid, arsenious acid and copper. The London Purple is composed mainly of arsenite of lime, containing, besides, quite an amount of coloring matter.

Hammond's Slug Shot does not make so good showing as either of the other preparations, as over nine-tenths (exactly 90.37 per cent) of it appears to be nothing but plaster. It contains only 1.2 per cent of arsenious acid, and approximately 5.00 per cent of a heavy oil. Paris Green contains almost forty (40) times as much arsenious acid as Hammond's Slug Shot, and London Purple over forty-six times as much. Or to put the relations in another form, two and one-half pounds of Paris Green, or two and one-fifth pounds of London Purple would furnish the arsenious acid for one hundred pounds of Hammond's Slug Shot. The latter contains some heavy oil which is not found in the other preparations.

ANALYTICAL* AND EXPERIMENTAL METHODS.

In presenting the results of the analytical and experimental work of the Station the purpose has been to avoid much reference to the details of the methods adopted in securing these results, because facts of this sort are chiefly of interest to the analyst and investigator and have very little value to agriculturists who desire only to know the practical bearings of an analysis or experiment. At the same time, it is proper for some statement to be made of the methods used, so that those who desire so to do may intelligently criticise the work of the Station. This is briefly done in what follows, besides which are some data and observations bearing upon certain methods of investigation.

METHODS OF FERTILIZER ANALYSIS.

The official methods as adopted by the Association of Official Agricultural Chemists (see proceedings of third annual convention) have been quite closely followed in the inspection of fertilizers. The only variation of any importance that has been made is in the determination of potash. After the addition of barium hydrate in excess, with subsequent heating, the solutions of ammonium hydrate and ammonium carbonate are added without previous filtration, and without heating the mixed precipitates are allowed to settle, when they are thrown upon a filter and thoroughly washed. This causes a great saving of time as compared with two filtrations, for not only is one filtration saved, but the mixed precipitates filter much more rapidly and wash more easily than the precipitate from barium hydrate. Numerous comparisons of this method with the one involving two filtrations have been made during the past two or three years, with no appreciable difference in results.

Determination of Nitrogen. In all cases where admissible, the Kjeldahl method of determining nitrogen has been used, and it has been found to be time saving and accurate. It has repeatedly stood the test of comparisons with the soda lime and absolute methods. The modifications of the Kjeldahl method suggested by Arnold, As-

*The analytical work of the Station has been entirely performed during the past year by Mr. Bartlett and Mr. Merrill.

both, and Jodlbauer for the determination of nitrogen in materials containing nitrates have been tried to quite an extent, with somewhat unsatisfactory results. These modifications are now being given a systematic trial, the results of which are reserved for future publication.

Determination of the Character and Value of the Organic Nitrogen in Fertilizers. The possible sources of the organic nitrogen in fertilizers are numerous. This form of nitrogen may come, for instance, from blood or from leather, both of which materials are in the market, but which differ greatly in value, not only commercially, but as a source of available plant food. It is very important to know whether commercial fertilizers contain organic nitrogen in such poor forms as leather, hair, wool, etc.

The Report of the Connecticut Experiment Station for 1885 contains results of a study of a method proposed by previous investigators for the determination of the value of organic nitrogen in fertilizers, viz: The digestion of the fertilizer with a pepsin solution for a given time, and the subsequent determination of the nitrogen not brought into solution. The figures so far as published show that nitrogenous organic materials have a comparative digestibility in a pepsin solution that accords fairly well with the supposed comparative agricultural value.

With a view to making a practical application of this method in the inspection of fertilizers, Mr. Merrill has determined the percentage of organic nitrogen in eleven of the leading fertilizers sold in Maine, that remains undissolved by the pepsin solution.

Previous to doing this, however, and as a preparation for the work on fertilizers, and to compare his results with those of others, rather than to take up a study begun by others, Mr. Merrill submitted quite a number of nitrogenous materials to the pepsin digestion*.

These materials were obtained for the Station through the kindness of fertilizer manufacturers, and the only description that it is possible to give of them is the name under which they appeared in the markets.

Unless otherwise mentioned, these substances were passed through a sieve with 1-25 inch meshes before digestion.

*The pepsin solution was made by dissolving 5 grams of scale pepsin in 1000 c. c. of .2 per cent hydrochloric acid. Two grams of the substance were digested for 12 hours on each of two consecutive days with 200 c. c. of this solution, at a temperature of 40 degrees C. During the time of digestion 2 c. c. of a ten per cent solution of hydrochloric acid were added at regular intervals until the digestive fluid contained 1 per cent of the acid.

		Total Nitrogen.	Undigested Nitrogen.	Digested Nitrogen.	Per cent of total Nitrogen Digested.
		%	%	%	
I	Dried blood....................	12.96	.35	12.61	97.29
II	" "	13.06	.87	12.19	93.34
III	" soft red blood.............	13.21	.31	12.89	97.58
IV	" blood	11.98	.59	11.39	95.08
V	Fish scrap....................	6.79	2.77	4.02	59.20
VI	Herring scrap..................	6.56	1.14	5.42	82.62
VII	Chicago hog tankage	4.88	2.05	2.83	57.99
VIII	Beef tankage..................	2.86	1.47	1.39	48.60
IX	Meat meal	10.30	2.50	7.80	75.73
X	Bone meal—1-50 inch or less......	3.41	1.08	2.33	68.33
XI	Ammonite, A	12.42	3.05	9.37	75.44
XII	Azotin	9.70	2.09	7.61	78.41
XIII	Hoof meal—extremely fine	13.73	.50	13.23	93.36
XIV	Leather, A*	13.05	.41	12.59	96.84
XV	" B*	13.11	.52	12.59	96.03
XVI	" C	6.75	4.96	1.79	26.52
XVII	" D	6.39	5.90	.49	7.67
XVIII	Horn & hoof meal, 1-25 inch or less,	14.67	10.92	3.75	25.56

*Samples Leather A and Leather B were sent to the Station purporting to be prepared leather, but subsequent inquiry failed to identify them as such. They are undoubtedly dried blood.

The percentages of solubility in the pepsin solution shown above agree in general with those obtained by other analysts in all cases where similar materials can be compared.

There is a notable difference in the solubility of the two samples of hoof meal XIII, and the horn and hoof meal, XVIII. This is due, in part at least, to the difference in mechanical condition, sample XIII being about as fine as it could be ground. Next to the leather the hog tankage VII, beef tankage VIII and fish scrap V, have the lowest solubility. Dried blood uniformly has the highest.

In treating the eleven mixed fertilizers previously mentioned with the pepsin solution, the method already described was followed, except that before digestion the two grams of fertilizers were thrown on a filter and leached with 75 c. c. of water added in repeated small quantities. Additional samples were leached in the same way and the organic nitrogen soluble in water was determined.

No.	Per Cent of Nitrogen in Fertilizers.				Solubility in Water.		Solubility in Pepsin Solution.	
	Nitrogen as Nitric Acid.	Nitrogen as Ammonia.	Organic Matter.	Total Nitrogen.	Nitrogen Soluble in Water.	Organic Nitrogen Soluble in Water.*	Nitrogen not Soluble in Pepsin Solution.	Total Per Cent of Organic Nitrogen Soluble in Pepsin Solution.
1	.12	.49	1.53	2.14	.99	.38	.33	78.43
2	....	.12	2.91	3.03	1.10	.98	.92	68.38
3	....	.75	1.89	2.64	1.89	1.14	.48	74.60
4	....	.65	2.52	3.17	1.50	.85	.79	68.65
5	.79	.10	1.58	2.47	.91	.02	.36	77.22
6	....	.37	2.33	2.70	1.46	1.09	.54	76.82
7	....	.51	1.87	2.38	1.00	.49	.73	60.96
8	.54	.14	2.27	2.95	1.29	.61	.39	87.22
9	.42	.14	2.04	2.60	1.29	.73	.48	76.47
10	....	.83	2.18	3.01	1.51	.68	.69	68.35
11	....	.16	2.71	2.87	1.03	.87	1.32	51.29

*Total nitrogen soluble in water minus the nitrogen from nitrates and ammonia salts.

In none of these fertilizers does the organic nitrogen show so low a solubility as to plainly indicate that its source is leather, hair, wool, or any substance of the same grade, but it is very clear that in some cases the ammoniates used are not of such high grade as dried blood, or the various forms of prepared meat. Nos. 7 and 9 may derive their nitrogen from fish scrap or from a mixture of high and low grade materials. So great is the variation in the solubility of fairly high-grade ammoniates that it seems impossible to decide by this method whether the organic nitrogen is or is not in part derived from low-grade ammoniates. For this reason the names of the mixed fertilizers used for the above determinations are not mentioned.

ARTIFICIAL DIGESTION COMPARED WITH RESULTS OBTAINED FROM EXPERIMENTS WITH ANIMALS. THE ERRORS INVOLVED IN DIGESTION EXPERIMENTS WITH ANIMALS.

Several investigators have proposed within a comparatively recent time to measure the digestibility of cattle foods by the solubility of their protein in certain artificial solutions of pepsin and pancreas extract that are similar in action to the digestive fluids of the stomach and intestines of animals. In testing this method comparisons have been made between the results obtained by the use of artificial solutions and by experiments with animals. These comparisons have brought into especial prominence the errors involved in the coefficients of digestibility for protein as determined in the ordinary way. The main facts developed by several investigations, which bear upon the above points, are summarized in what follows:

(1) The feces of animals contains varying quantities of bile compounds, epithelial cells, mucus, &c., some of which contain nitrogen. These cause an error by increasing the apparent amount of undigested protein.

(2) The quantity of these substances appearing in the feces is stated to vary within wide limits with the amount of digestible material in the food eaten.

(3) When comparisons of artificial digestion and the results of experiments with animals have been made with the same material, the former method has invariably given higher coefficients of digestibility for protein, the difference being somewhat inversely to the amount of protein in the food.

(4) It is claimed that the artificial method gives correct results and that these differences are due to the presence in the feces of certain gall and intestinal products already mentioned, which do not belong to the undigested food residue, and which cause the digestibility of protein to appear less than it really is, when this is measured by the difference between the nitrogen of the food and that of the feces.

(5) Stutzer* has proposed that the undigested protein of the food be measured by the nitrogen left in the feces after submitting it to digestion with a pepsin solution. Pfeiffer† has compared the results obtained in this way with those of the artificial pepsin-pan-

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*Zeit. Phys. Chemie X, p. 157.

†Ibid X, p. 561 and XI, p. 1.

creas digestion, and his experiments indicate that not only are the gall and intestinal products wholly soluble in a pepsin solution, but that the two methods will give very nearly the same coefficients for protein.

Station experiments. In a previous part of this report are described several digestion experiments with sheep, for the purpose of determining the digestibility of a number of cattle foods. These experiments have given opportunity to secure additional information on some points involved in a comparison of methods, and which bear upon conclusions in regard to the digestibility of food under certain conditions. The following determinations were made:

(1) The digestibility of the protein of the several foods by artificial pepsin-pancreas* digestion.

(2) The nitrogen extracted from the feces by successive treatment with alcohol, ether and water.

(3) The nitrogen extracted from the feces, both fresh and after drying, by digestion with a pepsin solution.

Results with artificial pepsin-pancreas digestion. The table below gives the percentages of protein digested from a variety of cattle foods by this method. For a description of these foods reference is made to the "Analyses of Feeding Stuffs" in a former part of this report.

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*The pepsin solution used consisted of 5 grams of scale pepsin dissolved in one liter of 0.2 hydrochloric acid. Two grams of the substance were digested for 24 hours (12 hours on each of two consecutive days) in 250 c. c. of this solution, hydrochloric acid (0.1 per cent) being added at regular intervals until the solution contained 1 per cent. The undigested residue was then washed thoroughly and submitted to digestion in a pancreas solution, made after a method suggested by Dr. R. H. Chittenden of Yale College. (See Report Conn. Exp't Station for 1885, p. 45.)

The sweet breads (pancreas) of neat cattle were finely cut and allowed to remain in a large quantity of alcohol for a week or more. After the alcohol was strained off, the residue was extracted with ether, dried, ground and bottled. To prepare the solution, 25 grams of the dry pancreas, together with 2.5 grams of salicylic acid and 250 c. c. of water were heated for 12 hours at 40 degrees C. The solution was then filtered, and the residue washed until the filtrate and washings amounted to one liter. Two hundred c. c. of this solution were used in each experiment, with 0.6 gram of sodium carbonate and a few drops of a solution of 20 grams thymol in 100 c. c. alcohol. The digestion was continued for the same length of time as with the pepsin solution.

	Per cent of Protein Digested by Pepsin-Pancreas Digestion.
Timothy hay,* XV	54.5
Timothy hay, XXIII	56.5
Timothy hay, XXXIII	60.4
Clover hay, XXIV	52.
Clover hay, XXXVII	56.2
Oat straw, XXVII	45.6
Potatoes, raw, XXX	94.1
Potatoes, boiled, XXXII	91.9
Corn meal,* XX	82.5
Corn-and-cob meal,* XXII	82.5
Corn cobs,* XXI	2.4
Cotton-seed meal, XXXVIII	91.5
Cotton-seed meal, XXXV	91.8
Linseed meal, XXIX	88.8
Linseed meal, XXXIV	89 6

*See Report of 1885-6. Digested after keeping in the Laboratory for one year.

Solubility of fecal nitrogen in alcohol, ether and water, and in a pepsin solution. These determinations were made with the dried and ground feces. Two grams of the material were treated, after which the undissolved nitrogen was determined. The alcohol, ether and water were used *ad libitum.* The pepsin digestion was the same as with fodders. The next table compares the results by the two methods of treatment.

Feces From	Total Nitrogen in Feces.	Solubility of Fecal Nitrogen in Alcohol, Ether and Hot Water.		Solubility of Fecal Nitrogen in Pepsin Solution.		Per Cent of Total Nitrogen in Feces Soluble in Pepsin Solution and not in Alcohol, Ether and Water.
		Per Cent in Feces.	Per Cent of Total Nitrogen in Feces.	Per Cent in Feces.	Per Cent of Total Nitrogen in Feces.	
Timothy hay, XXIII, sheep 1	% * 1.25	.25	20.	.46	36.8	
" " " 2	1.18	.18	15.2	.36	30.5	
Average	....	....	17.6	....	33.6	16.
Clover hay, XXIV, sheep 1	1.67	.21	12.5	.44	26.3	
" " " 2	1.68	.22	13.1	.43	25.6	
Average	....	....	12.8	....	25.9	13.1
Oat straw, XXVII, sheep 1	1.43	.30	20.9	.42	29.4	
" " " 2	1.35	.21	15.5	.54	40.	
Average	....	....	18.2	....	34.7	16.9

Oat straw, XXVII ...... } Raw potatoes, XXX .... } Sheep 1	2.15	.50	23.4	.97	45.1	
" " " 2	2.05	.57	27.8	1.13	55.1	
Average	....	....	25.6	....	50.1	24.5
Timothy hay, XXXIII.. } Boiled potatoes, XXXII, } Sheep 2	1.68	.35	20.8	.78	46.4	25.6
Clover hay, XXXVII	1.98	....	....	.60	30.3	
Corn meal, XX,† pig	2.15	....	....	1.14	53.	
Corn-and-cob meal, XXII,† pig	1.43	....	....	.63	44.	

* All these percentages are reckoned on the basis of the water-free substance.

† After standing a year. See Report for 1885–6.

It appears that much more of the nitrogenous material is extracted by pepsin digestion than by alcohol, ether and water. The later solvents take out mainly the bile compounds. What they fail to remove is probably mucus, which is dissolved by the pepsin solution.

"There is good reason for believing that the feces contain considerable mucus. Kellner* has made the observation that when the excrement of sheep is dried the outer coating separates from the nodules and rolls together in a thin paper-like form. He concludes that this outside layer is strongly impregnated with mucus. He found that when the excrement is freed from these coatings it contains a much smaller percentage of nitrogen than before and that the average amount of nitrogen thus removed was equivalent to .36 gr. for each 100 gr. of dry substance. Those who have conducted digestion experiments cannot fail to have noticed that occasionally strings of jelly-like matter are present in the feces, which must be largely mucus."†

It is plainly true that much of nitrogen in the feces does not properly belong to the undigested residue of the food. It cannot at present be shown that the pepsin solution extracts no more than the nitrogen of this kind, but that it does so seems improbable.

Comparison of artificial pepsin-pancreas digestion, experiments with animals. and the method proposed by Stutzer. These comparisons are made by the use of data previously given under the head of "Digestion Experiments" and those furnished by the last two tables. This is done in the next table. In most cases the figures are the average of two trials.

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* Bied. Centr. Agr. Chemie X, p. 157.

† From Agricultural Science, Vol. I, p. 9.

	From 100 Parts of Protein in Food, there was Digested		
	By Pepsin-pancreas Digestion.	In Experiments with Animals.	Reckoned on basis of Nitrogon in feces not soluble in pepsin solution.
Timothy hay, XV	54.5	42.1	
Timothy hay, XXIII	56.6	45.2	63.7
Clover hay, XXIV	52.	58.6	69.4
Clover hay, XXXVII	56.2	49.3	64.8
Oat straw, XXVII	45.6	—8.9	28.9
Oat straw, XXVII / Potatoes, XXX	78.5	27.5	63.8
Timothy, XXXIII / Potatoes, XXXII	74.4	43.9	70.1
Corn meal, XX	82.5	86.1	93.4
Corn-and-cob meal, XXII	82.5	75.7	86.1

In these comparisons no satisfactory agreement is seen to exist between any two methods. Either the artificial digestion failed to act upon the protein of the food as vigorously as the digestive fluids in the animal, or the pepsin solution extracted from the feces a portion of the nitrogen belonging to the real undigested food residue.

Relation of pepsin-soluble nitrogen in feces to the amount of dry substance digested. This has been calculated for each digestion experiment, and the results which follow vary widely from .400 of a gram of nitrogen to each 100 grams dry substance digested, which is the relation proposed by Kellner* for estimating the quantity of nitrogen in the feces not belonging to the undigested food residue.

*Bied. Centr. Agr. Chemie X, p. 763.

	Digested Daily, Grs.	Nitrogen in the Daily Excrement that is soluble in pepsin solution.	Weight of Nitrogen soluble in pepsin solution for each 100 grs. digested dry substance.
Timothy hay, XXIII	320.4	1.23	.38
Clover hay, XXIV	344.	1.21	.35
Clover hay, XXXVII	293.3	1.47	.50
Oat straw, XXVII	158.6	.75	.47
Oat straw, XXVII; Potatoes, XXX	342.6	2.25	.65
Timothy, XXXIII; Potatoes, XXXII	422.5	2.16	.51

Fecal nitrogen soluble in a pepsin solution before and after drying. Pfeiffer* has made the observation that the nitrogen in the feces coming from waste gall and intestinal products is completely soluble in a pepsin solution only when the feces are treated in a fresh condition, *i. e.*, before drying. He found that when the dried feces of pigs which contained no undigested food residue was submitted to a pepsin digestion only about half the nitrogen was brought into solution, but that all the nitrogen was extracted by this treatment when the dung was kept in alcohol without drying.

In the Station digestion experiments with sheep one-thirtieth of each day's excrement was put into alcohol, and at the end of each experiment the whole was filtered as dry as possible, thoroughly mixed, and eight grams submitted to a pepsin digestion.

One-tenth of the daily excrement was dried over a water bath, ground, mixed, after which two grams were digested. The percentages of undissolved nitrogen found by the two methods, as given below, are based upon the total dry substance in the feces. The solubility of the nitrogen compounds does not seem to have been affected by the drying.

*Zeit. Phys. Chemie X, p. 568.

Feces From	Insoluble in Pepsin Solution after Drying.	Insoluble in Pepsin Solution before Drying.	Difference.
	%		
Timothy hay, sheep 1	.79	.81	—.02
" " " 2	.82	.82	
Clover hay, sheep 1	1.23	1.30	—.07
" " " 2	1.25	1.31	—.06
Oat straw, sheep 1	1.01	.90	.11
" " " 2	.81	.74	.07
Oat straw, Raw potatoes } Sheep 1	1.18	1.26	—.08
" " " 2	.92	.92	

The Errors of Feeding Experiments.

Conclusions in regard to the relative value of different rations for growth, when based upon changes in the live weight of animals, are criticised on the ground that the daily variations in weight of an animal are very large, and may cause the change in weight between two given weighings to be much more or less than the actual growth which the food has caused. These changes in weight not due to growth are caused largely by variations in the contents of the stomach and intestines and in the amount of water drank. The extent of the error from this cause can be partially controlled by the exercise of care in giving animals food and water at regular intervals, and by taking all the weights at the same time of day.

In the Station experiments, besides precautions of this kind, the weights upon which gain or loss is based are the average of four weighings on as many consecutive days.

In order to show the extent of the error which the apparent results of these feeding trials are likely to involve, all the daily weighings of the ten steers, 120 in all, are given in this connection, with the averages of each set of four weighings.

	Daily Weights of Steers.									
	Steer 1.	Steer 2.	Steer 3.	Steer 4.	Steer 5.	Steer 6.	Steer 7.	Steer 8.	Steer 9.	Steer 10.
December 29th	687	772	733	704	731	679	698	857	809	785
" 30th	691	760	738	712	718	673	692	841	801	791
" 31st	689	762	743	698	721	678	691	825	804	791
January 1st	695	761	739	700	725	679	685	833	798	784
Average	690	764	738	703	724	677	691	839	803	788
March 8th	704	781	795	727	795	742	841	948	835	838
" 9th	705	783	801	735	806	745	849	965	866	858
" 10th	711	774	793	730	811	750	850	957	852	844
" 11th	713	781	797	730	818	752	854	971	852	855
Average	708	880	796	730	807	747	848	960	851	849
May 16th	783	849	885	796	933	871	864	955	837	841
" 17th	788	856	886	805	925	872	853	960	844	845
" 18th	789	842	880	800	921	871	861	966	833	830
" 19th	785	855	885	803	932	886	869	964	830	840
Average	786	850	884	801	928	875	862	961	836	839

Taking the weights recorded above as an indication of the extent of errors that are likely to occur in work of this kind, there is reason for considerable confidence in the apparent results of a feeding experiment continued for over four months. Another error always accompanying experiments in feeding for growth is the varying capacities of different animals for utilizing food in the direction of growth. This error can be eliminated in part, at least, by changing the rations so that each of two rations to be compared shall be fed to the same animal or animals for a certain length of time. Another method of doing the same thing is to feed all the animals on the same ration for a time, and then use the comparative results as a basis for correcting the apparent gain on different rations. The former method was used by the Station in the experiments previously discussed.

LICENSE FEES.

The following is a list of the manufacturers of fertilizers, whose goods are sold in Maine, who are licensed to sell fertilizers in this State during 1887.

American Manufacturing Company, Boston, Mass.	
Allen Fertilizer	$50 00
Atlantic Fertilizer Company, Boston, Mass.	
Mayo Superphosphate	50 00
Bowker Fertilizer Company, Boston, Mass.	
Bowker's Hill and Drill Phosphate	50 00
Stockbridge's Specials	15 00
Bowker's Ammoniated Dissolved Bone	15 00
Bradley Fertilizer Company, Boston, Mass.	
Bradley's X. L. Superphosphate	50 00
Bradley's Potato Manure	15 00
Original Coe's Superphosphate	15 00
Bradley's Circle Brand and Potash	15 00
B. D. Sea Fowl Guano	15 00
Clark's Cove Guano Company, New Bedford, Mass.	
Bay State Fertilizer	50 00
Thoroughbred Lawn, Garden and Plant Fertilizer	15 00
Cleveland Dryer Company, Cleveland, Ohio.	
Cleveland Superphosphate	50 00
Common Sense Fertilizer Company, Boston, Mass.	
Common Sense Fertilizer, No. 2	50 00
Common Sense Fertilizer, Diamond D	15 00
Crocker Fertilizer & Chemical Company, Buffalo, N. Y.	
Ammoniated Bone Superphosphate	50 00
Potato Hop and Tobacco Phosphate	15 00
Special Superphosphate	15 00
Cumberland Bone Company, Portland, Me.	
Cumberland Bone Superphosphate	50 00
Cumberland Seeding Down Fertilizer	15 00
C. D. Stanford, Bangor, Me.	
Farmer's Choice	50 00

E. Frank Coe, New York, N. Y.	
E. Frank Coe's High Grade Ammoniated Bone Superphosphate	$50 00
F. S. Farrar & Company, Bangor, Maine.	
Farrar's Superphosphate	50 00
Flamingo Guano Company, Baltimore, Md.	
Flamingo Guano	50 00
Liebig's Ammoniated Superphosphate	15 00
Glidden & Curtis, Boston, Mass.	
Soluble Pacific Guano	50 00
Red Beach Plaster Company, Red Beach, Me.	
Red Beach Bone Superphosphate	50 00
Sagadahoc Fertilizer Company, Bowdoinham, Me.	
Sagadahoc Superphosphate	50 00
Dirigo Grass & Grain Fertilizer	15 00
Standard Fertilizer Company, Boston, Mass.	
Standard Superphosphate	50 00
Standard Fertilizer	15 00
Standard Guano	15 00
J. A. Tucker & Company, Boston, Mass.	
Bay State Superphosphate	50 00
Wilkinson & Company, New York, N. Y.	
Wilkinson's Superphosphate	50 00
Williams & Clark Company, New York, N. Y.	
Americus Ammoniated Bone Superphosphate	50 00
Americus Special Potato Fertilizer	15 00

Law Establishing the Maine Fertilizer Control and Agricultural Experiment Station.

CHAPTER 294, PUBLIC LAWS OF 1885.

AN ACT to establish an Agricultural Experiment Station.

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

SECTION 1. That for the purpose of protection from frauds in commercial fertilizers, and from adulterations in foods, feeds and seeds, and for the purpose of promoting agriculture by scientific investigation and experiment, the Maine Fertilizer Control and Agricultural Experiment Station is hereby established in connection with the State College of Agriculture and Mechanic Arts.

SECTION 2. The direction and management of this station shall be committed to a board of managers, to consist of five members, namely: the professor of agriculture of the State College of Agriculture and Mechanic Arts, ex-officio; the secretary of the state board of agriculture, ex-officio, and three members to be appointed by the governor, whose terms of office shall be three years, except in the first appointment, one shall be designated to serve but one year, and one to serve two years.

SECTION 3. The board of managers shall be called together by the secretary of the board of agriculture, at such place in this state as he may designate, within thirty days of the approval of this act, for the purpose of transacting such business as may be required to put the station in operation; and thereafter the board of managers shall hold a meeting annually, at Augusta, on the Tuesday preceding the third Wednesday of January, for the transaction of business relating to the station. Other meetings may be called, on due notice, by the president, at such times and places as will best promote the objects contemplated by this act.

SECTION 4. The board of managers shall organize by the election of a president, a secretary and treasurer, who shall severally hold their offices for one year and until their successors are elected. They shall locate the station herein provided for, and shall appoint a director, who shall have the general management and oversight of the analyses, investigations and experiments necessary to carry out the purposes named in section one of this act, and shall employ competent assistants to aid in prosecuting the work of the station. It shall, whenever public interest will be promoted thereby, publish by bulletin or otherwise, the results of its investigations and experiments, and shall make an annual report of its work to the governor and council, which shall be printed and bound with the report of the secretary of the board of agriculture.

SECTION 5. The sum of five thousand dollars, annually, is hereby appropriated to the Maine Fertilizer Control and Agricultural Experiment Station, and the governor and council, from time to time, shall draw their warrant on the state treasurer for such sums of money as are necessary to defray the expenses herein provided for, not exceeding in any one year the appropriation herein named, an account of which shall first be approved by the president and secretary of the board of managers.

SECTION 6. The board of managers shall receive no compensation for time and services rendered, but shall be reimbursed for actual expenses incurred in the performance of their duties.

SECTION 7. Any manufacturer, company, or person who shall offer, sell, or expose for sale in this state, any commercial fertilizer, the price of which exceeds ten dollars per ton, shall affix to every package, in a conspicuous place on the outside thereof, a plainly printed certificate, stating the number of net pounds in the package sold or offered for sale, the name or trade-mark under which the article is sold, the name of the manufacturer, and the place of manufacture, and a chemical analysis stating the percentage of nitrogen, or its equivalent in ammonia in available form, of potash soluble in water, and of phosphoric acid in available form, soluble or reverted, as well as the total phosphoric acid.

SECTION 8. The manufacturer, company or person selling or offering for sale in this state, any commercial fertilizers exceeding ten dollars per ton in price shall, on or before the first day of April annually, or before offering the same for sale, procure a license from the board of managers, authorizing the sale of said fertilizers in the state, and shall pay for the same the sum of fifty dollars for a single brand, and fifteen dollars for each additional brand offered for sale; and shall furnish the secretary of the board of managers, at the time of their appointment, the names of all agents authorized by him to sell the same in this state.

SECTION 9. This act shall not apply to the article known as porgy chum, or fish scrap, or fish waste of any kind, or bone, when offered for sale unmixed with other fertilizing material; nor shall it apply to parties manufacturing fertilizers in quantities less than twenty-five tons per year, or to fertilizers in possession of dealers or agents at the time of approval of this act.

SECTION 10. The director of the station, or any person by him deputized, is hereby empowered to select from three different parcels or packages of commercial fertilizers, taken from three different sections of the state, held or offered for sale in this state, quantities not exceeding two pounds from each package, which quantities shall be for analysis, the average of the several analyses shall be taken to compare with the certificate found on the given packages, held or offered for sale; and he shall select each year, at least three samples, as aforesaid, from each brand held for sale, and shall secure these analyses at the station. The agent shall select these samples, in the presence of some representative of the company, from which the quantities are so selected, and shall deliver one-half of said samples, properly sealed by him, to said representative.

SECTION 11. The secretary of the board of managers shall register, in a suitable book kept in his office, a list of all licenses issued, and of fees received therefor, and a list of all brands of fertilizers sampled; and all license fees received by the board of managers shall be paid into the treasury of the state.

SECTION 12. Any person or party, who shall offer or expose for sale any commercial fertilizer, without complying with the requirements of sections seven and eight of this act, or shall permit an analysis to be attached to any package of such fertilizer, stating that it contain a larger percentage of any one or more of the constituents named in section seven of this act than it really does contain, shall be fined not less than one hundred dollars nor more than three hundred dollars for the first offense, and not less than two hundred dollars nor more than five hundred dollars for each subsequent offense; and the offender shall, in all cases, also, be liable for damages sustained by the purchasers of said fertilizers, *provided, however*, that the deficiency of one per cent of nitrogen, potash, or phosphoric acid claimed to be contained, shall not be considered as evidence of fraudulent intent.

SECTION 13. All acts and parts of acts inconsistent with this act are hereby repealed.

SECTION 14. This act shall take effect when approved.

[Approved March 3, 1885.]

APPENDIX.

Annual Report of the State Pomological Society.

1886-7.

AUGUSTA, June 18, 1887.

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 1886–7.

Yours Respectfully,

SAMUEL L. BOARDMAN, *Secretary.*

MAINE STATE POMOLOGICAL SOCIETY.

Annual Exhibition of 1886.

The fourteenth annual exhibition of the Maine State Pomological Society was held at Lewiston, September 14 to 17, 1886, in connection with the annual exhibition of the Maine State Agricultural Society. The exhibit of the Society was placed upon the third floor of the large exhibition hall on State Fair Park, three wings of which were entirely given up to the Society's use, thus making one-third more floor and table space occupied by the exhibits than was the case at the fair of 1885. The exhibits were also more attractively arranged than at any previous fair, the location of the tables in the South Wing of the large hall having been changed, in order to give some variety to the displays, and the collections of cut flowers heretofore shown in the end of the North Wing were moved to the centre of the hall. The light was not quite as good here as it was in the old position, but what was lost in this respect was gained in variety of arrangement and the pleasing effect of a change in the appearance of the hall. A floral arch opening from the East Wing to the centre of the hall was another pleasing change in arrangement from previous years, and was admirably fitted up under direction of President Pope and with the assistance of Mr. Geo. M. Roak of Auburn.

The various collective exhibits of the Society, as for instance, the State, county and single variety exhibits, were each arranged by themselves, and all were most attractively displayed. For the best general exhibition of apples there were thirteen entries. In the class of county collections, the following-named counties did not exhibit, viz: Aroostook, Hancock, Piscataquis, Washington and York. In the class of best five autumn apples there were thirteen entries; in that of winter apples, eighteen; in that for best collection for home use, thirteen. In the second division of apples, single plates of separate varieties, there were three hundred and eighty-seven entries.

For the best general collection of pears there were seven entries; and for other entries in class II, a total of one hundred and thirty-five entries. There were but few entries of grapes. In class IV, plums, there were forty-six entries. In the miscellaneous class, which embraced canned and preserved fruits, there was a total of one hundred and eighteen entries. The department of flowers, class VI, was large and more attractive than for some years past, a fine display of pot plants having been made by G. M. Roak of Auburn. The entries in this class numbered sixty-one.

The general rules of the exhibition, together with the several premiums awarded in the various classes, are herewith given. Names of fruit and other articles for which no competition appeared are not given; and the numbering of the various prizes, as published in the list of premiums, has been omitted.

GENERAL RULES OF THE EXHIBITION.

1. The general regulations of the joint exhibition will govern this department. as far as applicable thereto, and except as herein otherwise provided.

2. Entries may be made at the office of the Secretary, in Augusta, personally or by letter, until September 11th, and after that at the Exhibition Building at the Park, up to and including the first day of the exhibition, Tuesday, September 14th.

3. Exhibitors are requested to present full and accurate lists of the varieties of fruit or other articles to be entered; and to specify the premium for which each article is entered; also to affix their names and post-office addresses, so that the same may be correctly transferred to the books and exhibition cards.

☞Persons intending to make entries will confer a special favor by sending lists of the same to the Secretary at an early day.

4. All fruits and flowers offered for premiums must have been grown by the exhibitor, and any violation of this rule will debar or forfeit the premium. Specimens offered for *exhibition only*, by others than the growers, must in all cases have the name of the grower affixed, if known.

5. All fruits and flowers exhibited must, as far as possible, be correctly named according to the standard nomenclature adopted by the Society, and it will be the duty of the standing committees of the Society to examine labels and correct all errors in nomenclature during the exhibition.

6. Where a certain number of specimens or varieties, or a definite quantity of any article, is required by the schedule, exhibitors should conform to such requirement; and larger quantities will not be admitted except by special arrangement with the Executive Committee, having reference to economy of space and the symmetry of exhibition.

7. Dishes and labels for the exhibition of fruits, and phials and stands for cut flowers, will be furnished by the Society, and no others will be admissible. No premium will be paid on any article which is accompanied by an advertisement or business card.

8. Exhibitors must see to the delivery of their contributions, and will be required to put them *in the places designated for them.* After the articles are arranged they will be under the exclusive charge of the Society, and the owners will not have liberty to remove them until the exhibition is closed. All reasonable precautions will be taken for the safe keeping of articles on exhibition after their arrival and arrangement upon the tables, but the Society will not be responsible for any loss or damage that may occur.

9. No premium will be awarded merely for want of competition, nor unless the article exhibited is worthy of it; and the committees are authorized to withhold the first and award the second or any subsequent premium, or none, at their discretion, according to merit. They are also to withhold all premiums from any articles not exhibited according to the rules, or where any unfair practice has been attempted by the exhibitor.

10. The committees are authorized to recommend gratuities for any new or rare fruits, flowers, plants, or articles of merit for which no premiums have been offered.

11. When a specimen is presented for identification, the exhibitor shall communicate all the information he possesses as to the origin and local appellation.

12. No member of any of the committees for awarding premiums shall, in any case, vote or decide respecting an award for which such member may be a competitor, or therein have an interest; but in such case such member shall temporarily vacate his place upon the committee.

13. All premiums awarded will be payable by the Treasurer in sixty days after the close of the exhibition: *subject, however, to the following conditions and limitations*, viz:

1st.—The Society guarantees to pay premiums and gratuities to the amount of $500, but reserves the right, if more than that amount is awarded, to make such a *pro rata* reduction as will reduce the whole amount payable to that sum.

2d.—All premiums not applied for before the first day of January next shall revert to the Society.

3d.—The Society's premiums are open for competition to all persons residing in the State; but when premiums and gratuities exceeding $1.00 and less than $20.00 are awarded to a person not a member of the Society, the fee for membership will be deducted therefrom; and when premiums and gratuities amounting to $20.00 or more are awarded to any person not a life member of the Society, the fee for life membership will be deducted therefrom; and in either case certificates of membership will be issued accordingly.

LIST OF PREMIUMS AWARDED.

Class I.—APPLES.

FIRST DIVISION.

Rules. Entries for all premiums in this division must consist of five specimens of each variety exhibited, and (except Nos. 18, 19, 20 and 21) of at least twenty correctly named varieties, and not more than fifty. Entries for premiums Nos. 18 and 19 must be separate and distinct collections, not embracing any other collection or specimens, and in awarding the premiums regard will be had both to the quality of the specimens and the value of the varieties exhibited.

By "named varieties" is meant such as are named and described in some standard work on pomology, or have been named and approved by some national or state horticultural society.

In adopting 20 as the number of varieties required in these collections (1 to 17), the Society does not intend to encourage the multiplication of varieties; and the committee will be instructed, in awarding the premiums, to have regard to *quality* and *value* rather than to the number of varieties, and will be authorized to recommend gratuities for meritorious collections embracing less than the number of varieties required as above.

Awards. For best general exhibition of apples, grown by the exhibitor in any part of the State: W. R. Wharff, Gardiner, $15.00; Miss L. L. Taylor, Lakeside, $10.00; G. W. Blossom, Turner, $5.00.

Best general exhibition of apples grown by the exhibitor in Androscoggin County: John Dunton, Lewiston, $10.00; I. T. Waterman, East Auburn, $8.00; D. J. Briggs, South Turner, $5.00.

For the same in Cumberland County: S. R. Sweetser, Cumberland Center, $10.00; Milton Dyer, Cape Elizabeth, $8.00.

For the same in Franklin County: M. C. Hobbs, West Farmington, $10.00; E. F. Purington, West Farmington, $8.00; Henry Judkins, $5.00.

For the same in Kennebec County: E. A. Lapham, Pittston, $10.00; Charles S. Pope, Manchester, $8.00; R. H. Gardiner, Gardiner, $5.00.

For the same in Knox County: Elmas Hoffses, Warren, $10.00.

For the same in Lincoln County: E. W. Dunbar, Damariscotta, $10.00; H. J. A. Simmons, Waldoborough, $8.00

For the same in Oxford County: C. H. George, Hebron, $10.00; S. M. King, South Paris, $8.00.

For the same in Penobscot County: J. E. Bennoch, Orono, $10.00; H. W. Brown, Newburg, $8.00; E. H. Kenniston, Simpson's Corner, $5.00.

For the same in Sagadahoc County: L. R. Powers, $10.00; C. E. Sanford, Bowdoinham, $8.00; H. S. Cary, Topsham, $5.00.

For the same in Somerset County: F. E. Nowell, Fairfield, $10.00; J. S. Hoxie, North Fairfield, $8.00.

For the same in Waldo County: M. E. Bartlett, East Dixmont, $10.00; Mrs. A. B. Strattard, Monroe, $8.00.

For the best five varieties of autumn apples: C. H. George, $3.00; S. R. Sweetser, $2.00; D. J. Briggs, $1.00.

For the best five varieties of winter apples: H. T. & S. E. Leech, East Monmouth, $3.00; James Bickford, Carmel, $2.00; F. E. Nowell, $1 00.

For best collection of apples for house use: H. J. A. Simmons, $5.00; C. H. George. $3.00; S. R Sweetser, $2.00.

For best collection of crab apples: J. S. Hoxie, $1.00.

SECOND DIVISION.

Rules. Entries for premiums in this division must consist of from five to ten specimens, according to size, of each variety exhibited, and must be separate specimens from any exhibited in the first division.

Awards. Alexander: Miss L. L. Taylor, $1.00; J. E. Bennoch, 50c.

American Golden Russet: I. T. Waterman, $1.00; T. M. Lambert, Auburn, 50c.

Baldwin: I. T. Waterman, $1.00; D. H. Knowlton, Farmington, 50c.

Benoni: J. S. Hoxie, $1.00; T. M. Merrill, New Gloucester, 50c.

Black Oxford: E. H. Kenniston, $1.00; L. M. Berry, Winthrop, 50c.

Blue Pearmain: R. H. Gardiner, Gardiner, $1.00; H. W. Brown, 50c.

Briggs' Auburn: Miss L. L. Taylor, $1.00.

Cole's Quince: J. E. Bennoch, $1.00.

Deane: Miss L. L. Taylor, $1.00; J. S. Hoxie, 50c.

Duchess of Oldenburg: S. R. Sweetser, $1.00; A. W. King, Charleston, 50c.

Early Harvest: T. M. Lambard, Auburn, $1.00.

Fall Harvey: Miss L. L. Taylor, $1.00; J. E. Bennoch, 50c.

Fameuse: S. R. Sweetser, $1.00; F. E. Nowell, 50c.

Franklin Sweet: Miss L. L. Taylor, $1.00.

Gravenstein: S. R. Sweetser, $1.00; Charles S. Pope, 50c.

Grimes' Golden: E. A. Lapham, $1.00; H. W. Brown, 50c.

Hightop Sweet: F. E. Nowell, $1.00; H. S. Cary, 50c.

Hubbardston Nonesuch: Miss L. L. Taylor, $1.00; T. M. Merrill, 50c.

Hunt Russet: F. E. Nowell, $1.00: Elmas Hoffses, 50c.

Jewett's Fine Red: S. R. Sweetser, $1.00; Miss L. L. Taylor, 50c.

King of Tompkins County: C. H. George, $1.00; E. H. Kenniston, 50c.

King Sweeting: F. E. Nowell, $1.00; A. W. King, 50c.

Large Yellow Bough: C. H. George, $1.00; E. A. Lapham, 50c.

Moses Wood: Elmas Hoffses, $1.00; Miss L. L. Taylor, 50c.

Mother: Charles S. Pope, $1.00; Miss L. L. Taylor, 50c.

Northern Spy: C. H. George, 1.00; E. W. Dunbar, 50c.

Orange Sweet: J. S. Hoxie, $1.00; H. W. Brown, 50c.

Peck's Pleasant: D. P. True, Leeds Centre, $1.00; J. S. Hoxie, 50c.

Pomme Royale: C. H. George, $1.00; Charles S. Pope, 50c.

Porter: E. G. Woodside, Lewiston, $1.00; I. T. Waterman, 50c.

President: L. H. Blossom, Turner Centre, $1.00; I. T. Waterman, 50c.

Primate: L. R. Powers, $1.00; Miss L. L. Taylor, 50c.

Pumpkin Sweet: C. S. Chase, $1.00; H. S. Cary, 50c.

Red Astrachan: S. R. Sweetser, $1.00; J. S. Hoxie, 50c.

Red Canada: Lorinda Skillings, Lewiston, $1.00.

Red Russet: S. R. Sweetser, $1.00; Mrs. M. L. Robbins, Winthrop, 50c.

Rhode Island Greening: I. T. Waterman, $1.00; C. H. George, 50c.

Rolfe: B. G. Allen, $1.00; J. E. Bennoch, 50c.

Roxbury Russet: W. R. Wharff, $1.00; C. H. George, 50c.

Russet: F. E. Purington, $1.00; D. C. Averill, Temple, 50c.

Sops of Wine: I. T. Waterman, $1.00; F. E. Nowell, 50c.

Somerset: Miss L. L. Taylor, $1.00; F. E. Nowell, 50c.

Starkey: Charles S. Pope, $1.00; A. W. King, 50c.

Talman's Sweet: L. Skillings, $1.00; T. M. Merrill, 50c.

Tetofsky: J. S. Hoxie, $1.00.

Wagener: N. W. Harris, Auburn, $1.00; J. S. Hoxie, 50c.

Wealthy: S. R. Sweetser, $1.00; J. E. Bennoch, 50c.

Williams' Favorite: J. S. Hoxie, $1.00; Miss L. L. Taylor, 50c.

Winthrop Greening: L. M. Berry, $1.00; F. E. Nowell, 50c.

Yellow Bellflower: R. H. Gardiner, $1.00; H. W. Brown, 50c.

Crab Apples: J. Bickford, Carmel, 50c; Miss L. L. Taylor, 25c.

Class II.—PEARS.

For best general exhibition of pears: Samuel Rolfe, Portland, $12.00; L. J. Perkins, Portland, $8.00; D. P. True, Leeds Centre, $5.00; John Dunton, Lewiston, $3.00.

For best single variety winter pears, L. J. Perkins, $2.00.

For best single variety autumn pears, L. J. Perkins, $2.00; H. T. & S. E. Leech, East Monmouth, $1.00.

For best dish of Bartlett: L. G. Jordan, Lewiston, $1.00; C. A. Leavitt, Turner, 50c.

Belle Lucrative: J. S. Hoxie, $1.00; S. M. King, South Paris, 50c.

Beurre d' Anjou: L. G. Jordan, $1.00; I. T. Waterman, 50c.

Beurre Superfin: D. P. True, $1.00.

Beurre Clairgeau: D. J. Briggs, $1.00.

Beurre Diel: D. J. Briggs, $1.00.

Buffum: Samuel Rolfe, $1.00; S. W. Shaw, 50c.

Clapp's Favorite: L. J. Perkins, $1.00; A. B. Chipman & Son, West Gloucester, 50c.

Duchesse d' Angouleme: J. O. Howe, Lewiston, $1.00; A. B. Chipman & Son, 50c.

Eastern Belle: J. S. Hoxie, $1.00; J. E. Bennoch, 50c.

Flemish Beauty: Mrs. I. V. McKenney, Auburn, $1.00; G. W. Blossom, 50c.

Glout Morceau: D. J. Briggs, $1.00.

Howell: L. H. Blossom, $1.00; J. S. Hoxie, 50c.

Lawrence: J. E. Bennoch, $1.00; D. P. True, 50c.

Louise Bonne de Jersey: D. P. True, $1.00; G. C. Chase, Lewiston, 50c.

Nickerson: H. J. A. Simmons, $1.00; S. W. Shaw, 50c.

Seckel: Mrs. I. V. McKenney, $1.00; S. W. Shaw, 50c.

Sheldon: S. W. Cook, Lewiston, $1.00; G. C. Chase, 50c.

Swan's Orange: S. W. Shaw, $1.00: C. H. Hibbard, Lewiston, 50c.

Souvenir du Congress: Samuel Rolfe, $1.00.

Vicar of Winkfield: S. W. Cook, $1.00; D. P. True, 50c.

Winter Nelis: J. E. Bennoch, $1.00.

Special Premium: Admiral Farragut, Eastern Belle and Indian Queen, J. E. Bennoch, 50c each.

Class III.—GRAPES.

For best exhibition of grapes grown with artificial heat: J. C. Baker, Lewiston, $8.00.

For best cluster of Black Hamburgh, White Muscat, Muscat Hamburgh, White Chasselas, Lady Downes, Buckland Sweet Water, White Nice, Red Chasselas, Chasselas Musque: J. C. Baker, each, $1.00.

For best exhibition of grapes grown in open air: J. S. Hoxie, $5.00; D. P. True, $3.00.

For best single variety grown in open air: Mrs. I. V. McKenney, $2.00; J. S. Hoxie, $1.00.

For best three bunches Delaware: J. S. Hoxie, $1.00.

Hartford Prolific: J. S. Hoxie, $1.00.

Adirondac: D. H. Swan, Waterville, $1.00.

Wilder: D. H. Swan, $1.00.

Worden: J. S. Hoxie, $1.00.

Moore's Early: Mrs. I. V. McKenney, $1.00.

Class IV.—PLUMS.

For best general exhibition of plums: John Dunton, Lewiston, $8.00; D. P. True, $5.00.

For best dish of plums of any variety: M. P. Hawkins, Auburn, $2.00; E. W. Dunbar, Damariscotta, $1.00.

For best Green Gage: L. R. Powers, $1.00; C. H. Hubbard, Lewiston, 50c.

Purple Gage: J. S. Hoxie, $1.00; E. W. Dunbar, 50c.

Red Gage: D. P. True, $1.00.

Yellow Gage: F. E. Nowell, $1.00; D. P. True, 50c.

Coe's Golden Drop: G. W Chase, $1.00.

General Hand; F. E. Nowell, $1.00.

Yellow Egg: D. P. True, $1.00.

Lawrence: J. S. Hoxie, $1.00.

McLaughlin: E. W. Dunbar, $1.00.

Lombard: C. H. Hubbard, $1.00; Lorinda Skillings, 50c.

Smith's Orleans: D. P. True, $1.00.

Class V.—MISCELLANEOUS.

For best peck cultivated cranberries: J. A. Morton, Bethel, $2.00; I. T. Waterman, $1.00.

For best exhibition of nursery pear trees: D. J. Briggs, $2.00.

For best variety of canned fruits, pickles, preserves, etc., made and put up by the exhibitor: Mrs. D. H. Colby, Lewiston; $3.00; Mrs. O. G. Douglas, Lewiston, $2.00.

Canned peaches: Mrs. P. W. Murch, Lewiston, $1.00; Mrs. Benson Grant, Lewiston, 50c.

Canned plums: Mrs. P. W. Murch, $1.00; Mrs. A. W. Penley, Auburn, 50c.

Canned strawberries: Mrs. O. G. Douglas, $1.00; Mrs. A. W. Penley, 50c.

Canned raspberries: Mrs. D. H. Colby, $1.00; Mrs. O. G. Douglas, 50c.

Canned cherries: Mrs. O. G. Douglas, $1.00; Mrs. D. H. Colby, 50c.

Canned quinces: Mrs. O. G. Douglas, $1.00; Mrs. D. H. Colby, 50c.

Canned pears: Mrs. E. M. Leavitt, Auburn, $1.00; Mrs. Benson Grant, 50c.

Canned tomatoes: Mrs. T. W. Murch, 1.00; A. B. Chipman & Son, 50c.

Preserved quinces: Mrs. D. H. Colby, $1.00; Mrs. O. G. Douglas, 50c.

Preserved apples: Mrs. D. H. Colby, $1.00; Mrs. O. G. Douglas, 50c.

Preserved plums: Mrs. O. G. Douglas, $1.00; same, 50c.

Preserved pears: Mrs. D. H. Colby, $1.00; A. B. Chipman & Son, 50c.

Preserved strawberries: Mrs. O. G. Douglas, $1.00; Mrs. D. H. Colby, 50c.

Preserved raspberries: Mrs. D. H. Colby, $1.00; Mrs. O. G. Douglas, 50c.

Preserved currants: Mrs. O. G. Douglas, $1.00; Mrs. Benson Grant, 50c.

Preserved cherries: Mrs. Frances Hoyt, Winthrop, $1.00; Mrs. D. H. Colby, 50c.

Tomato catsup: Mrs. O. G. Douglas, $1.00; Mrs. A. W. Penley, 50c.

Jar quince jelly: Mrs. Benson Grant, $1.00; Mrs. Frances Hoyt, 50c.

Jar apple jelly: Mrs. O. G. Douglas, $1.00; Mrs. D. H. Colby, 50c.

Jar currant jelly: Mrs. D. H. Colby, $1.00; same, 50c.

Jar strawberry jelly: Mrs. O. G. Douglas, $1.00; Mrs. Frances Hoyt, 50c.

Jar grape jelly: Mrs. E. M. Leavitt, $1.00; Mrs. O. G. Douglas, 50c.

Grape marmalade: Mrs. Benson Grant, $1.00.

Canned currants, citron; preserved citron, cranberries, barberries: Mrs. O. G. Douglas, each, $1.00.

Green gage jelly, rhubarb jelly, damson jelly: Mrs. Benson Grant, each, $1.00.

Class VI.—FLOWERS.

FIRST DIVISION.

RULES. In this class no article can be entered for more than one premium. All plants and flowers entered for premium must positively be in their places at the exhibition room on the second day of the Fair at 9 o'clock A. M.

AWARDS. Best display of cut flowers filling not less than one hundred phials: Mrs. Charles Stanley, Winthrop, $10.00; Mrs. A. B. Strattard, Monroe, $8.00; Mrs. J. L. Douglas, Bath, $5.00; Miss Cora E. Ring, Richmond, $3.00.

For best display dahlias: Mrs. Charles Stanley, $2.00; G. M. Roak, Auburn, $1.00.

Asters: Miss M. L. Pope, Manchester, $1.00; Mrs. Charles Stanley, 50c.

Gladiolus: G. M. Roak, $2.00.

Verbenas: Mrs. Charles Stanley, $2.00.

Chinese pinks: Mrs. Charles Stanley, $1.00.

Pansies: Mrs. Charles Stanley, $1.00.

Japan lilies: Mrs. Charles Stanley, $2.00; Mrs. A. B. Strattard, $1.00.

Phlox Drummondii: Mrs. Charles Stanley, $1.00.

Stocks: Mrs. Charles Stanley, $1.00.

Balsams: Mrs. Charles Stanley, $1.00.

Chrysanthemums: Mrs. A. B. Strattard, $2.00; Mrs. Charles Stanley, $1.00.

Petunias: Mrs. Charles Stanley, $1.00; Mrs. A. B. Strattard, 50c.

SECOND DIVISION.

For best pair parlor bouquets: Mrs. Charles Stanley, $1.00.

For best pair wall bouquets: Mrs. Charles Stanley, $1.00; Mrs. Frances Hoyt, 50c.

For best pair hand bouquets: Mrs. Charles Stanley, $1.00; Miss Helen M. Hoyt, Winthrop, 50c.

Basket of wild flowers: Miss Cora H. Stanley, Winthrop, $1.00; Mrs. Frances Hoyt, 50c.

Everlasting flowers: Mrs. Frances Hoyt, $1.00.

Fancy basket of flowers: Miss Cora H. Stanley, \$2.00; Mrs. Frances Hoyt, \$1.00.

Floral design: G. M. Roak, \$5.00; Mrs. Charles Stanley, \$3.00;

Floral pillow: Mrs. A. B. Strattard, \$5.00.

Floral wreath: Mrs. A. B. Strattard, \$2.00; Miss Cora E. Ring, \$1.00.

THIRD DIVISION.

For best exhibition of green-house plants: G. M. Roak, \$8.00.

For best exhibition of ferns, geraniums, begonias and coleus: G. M. Roak, each, \$2.00.

For single plants of tuberose, double geranium, salvia splendens, foliage begonia, flowering begonia, coleus, fuchsia and carnation, G. M. Roak, each, 50c.

PROCEEDINGS OF THE WINTER MEETING.

Proceedings of the Winter Meeting.

The annual Winter Meeting of the Society was held in Music Hall, Farmington, on Thursday and Friday, February 3d and 4th, 1887. The invitation to the Society to hold its meeting in this interesting part of the State was made by the Franklin County Agricultural Society, the Farmington Grange, and the citizens of Farmington. The local committee of arrangements consisted of M. C. Hobbs, West Farmington; D. H. Knowlton and S. R. Leland, Farmington, and Edward W. Hall, Chesterville; and the success of the meeting, one of the largest and most profitable the Society has ever held, is due in great measure to the excellent arrangements and earnest work of these gentlemen. The forenoon of the first day of the convention was devoted to a business meeting of the Society, at which the annual reports of the Secretary and Treasurer were presented, the election of officers for the ensuing year made, and reports of committees presented. The details of these several matters, with a list of the members of the Society, are found in other parts of this report.

FIRST DAY. AFTERNOON.

The Society met at 1.30 P. M., President Charles S. Pope, Esq., in the chair. Hon. J. G. Hoyt of Farmington was then introduced, who delivered the Address of Welcome.

ADDRESS OF WELCOME.

By Hon. J. G. Hoyt.

Mr. President: Because it has been assigned to me to open this convention with a few remarks, it should not be assumed that I am qualified to impart instruction upon the subject which you have assembled to consider to-day, for there are many resident gentlemen who are far better informed than I am upon fruit culture. I shall leave that subject mainly in the hands of the members of the Maine State Pomological Society and other practical fruit growers, who are amply able to entertain this meeting upon all matters laid down in your programme.

It is always in order nowadays (no matter what may be the immediate subject under consideration) for the American orator or speaker to roam at his will and speak upon such topics as he may choose. Availing myself of this license, I hope you will not consider it inappropriate in me if I spend the few minutes at my command in speaking of the past and present of Maine, as seen from the standpoint of one who has been cognizant of and, in a humble way, identified with the people of this State in their struggle for a better inheritance, industrially and socially, during the last four decades. Forty years ago the State of Maine was emphatically poor, meaning, of course, the people of the State. The farmers were poor, the mechanics were poor and the great mass of the people were poor. There was very little money in circulation, and the most of the business was carried on by barter or exchange, and always on credit of six months or a year, and then perhaps a long note with high interest. There were no markets in the State worthy the name. There were no railroads, no telegraph and no daily papers. There was no labor-saving machinery on the farm, in the shop or in the house. There were but very few industries in the State. There were no savings banks in the State simply because the people had no savings. And it was not known or believed that there were any resources on the earth, or in it, except such as might be developed in the line of agriculture. A large proportion of the farms were under mortgage at ten or twelve per cent interest.

Our young men, who should have been the strength and glory of the State as soon as they became of age, and oftentimes before, turned their backs upon us, impelled by some indefinable belief that somewhere beyond the present confines there must be a "land flowing with milk and honey." Our young women also left us to go into the mills and factories of other States, and into the families of the rich in the great cities, to earn money to clothe themselves with and to send to the poor ones at home. This is a dark picture, yet it is as true as dark. But the indomitable spirit of the "old stock" held their faces to the grindstone and endured. And now, without going into the processes and struggles of the people up out of that low estate, let us look at the other side of this picture.

To-day, we have railroads running through the entire length of the State, and from the sea-board penetrating back into the interior counties. We have the telegraph, the telephone and the daily paper. Thousands of industries have sprung up in all parts of the State. Resources have been developed that were never dreamed of forty years ago. Mills and factories have been built on all our streams and rivers. Savings banks have grown up in all parts of the State in which to store the savings of the people. The farmer of to-day is armed with modern improvements, and, with the markets of the world at his command, is not the scrimped-up man of olden times.

The great heart of the State is moved with the spirit of enterprise. The man of Maine sits down to his evening paper and learns through the "signal service" of the country that a blizzard is on its way east, carrying death and destruction in its path, and he congratulates himself that before it reaches Maine it will have spent its force. He reads perhaps in the same paper that yesterday the mercury was fifteen degrees below zero at St. Louis, and twenty below at Chicago, and thirty below at Minneapolis, and sixty below in Manitoba, and he is better satisfied with his own State than ever before. He reads of earthquakes in the "sunny South" but it creates no fear that his own walls are in danger of tumbling down over his own head. He reads of thousands of people in the south-west on the verge of starvation and he turns with thankfulness to the well-supplied homes of Maine. He reads of thousands of cattle perishing on western plains for want of shelter, and he rejoices in the knowledge that his own sleek horses and fat cattle and sheep are comfortably housed.

The man of Maine on the whole feels that our State is not only a good State to live in, but a good State to emigrate to. Maine, instead of being abandoned as formerly, is now sought by thousands of people from all over the country for her healthy climate, for her splendid scenery and for her glorious summers. From Old Orchard to Bar Harbor, yea, from Kittery to Calais, and from the mountains down to the sea, Maine is a vast summer pleasure ground.

Maine has her representatives in every State in the Union, and perhaps in every country in the world, and however honorable, and wealthy, and useful they may have become, and however happy they may be in their new homes, I doubt if there are many among all these sons and daughters who do not at some time have a longing to look once more upon these hills and valleys, these mountains and rivers, these school-houses and churches, and these homes and faces in dear old Maine.

Mr. President, yours is the advancing column of the coming industry of the Pine Tree State. You are the representatives of the higher life of the farmer. It cannot be denied that there is much in the farmer's life that is purely and simply drudgery, that never enlists his higher and nobler sympathies. But here is something ennobling and refining, something that captivates the mind. A man falls in love with it as the artist falls in love with his ideal. He commences with his tree no larger than his whipstick, and when it differs not much from the forest sapling or the sapling at the wayside, but he knows that inside of that bark there is the germ of a delicious, soul-inspiring fruit. He plants it, he waters it, and trims and educates it, and treats it as a thing of life; he follows it up through its slow growth and development until he sees it bud and blossom, and then the long-wished-for and long-waited-for fruit appears, and his soul has a satisfaction that the mere toiler for money knows not of.

Gentlemen, we welcome you to Franklin County, one of the smallest and humblest of the family of counties. Yet even here we have felt the pulsations of that new blood that has entered into the veins and arteries of the "body politic." Just as you enter the gateway of the county, there is a granite hill, which in the days of which I have been speaking, was barren and unsightly, and of value only as it furnished the underpinning for the few straggling houses in the vicinity, and for the outlying villages. During the year 1886 that hill has been the scene of a busy industry. One hundred and eighty-one skilled men have quarried and shipped eleven hundred and forty-six (1146) car loads of "paving blocks" for the streets of the great city of Cincinnati. They have also quarried and shipped six hundred (600) car loads of granite for the Maine Central Railroad and its branches, for bridges, culverts, and other masonry.

Other parties have cut out and shipped stone for monuments and building purposes, to the amount of fifty car loads more; and all this in addition to the ordinary home consumption.

Coming still farther into the county, there has been built within a few years a railroad up under the shadow of Mt. Blue and beyond, and the great "inland seas" of Northern Maine have been opened up, where the whole piscatorial fraternity of the country can come and gratify that immortal longing which has been transmitted down from or through Isaac Walton. Still more recently, a railroad has been built up towards the approaches of Mt. Abram, and there, in the original forest where the sound of the "woodman's axe" was never heard before, mills have been erected capable of cutting out forty thousand (40,000) feet of lumber per day, and cars stand ready to transport it to the markets of the world. A large number of men are there employed, and it is estimated that they will work up during the season six million (6,000,000) feet of lumber.

We cannot boast of having any "money kings" in this county, and if we had them, I do not think that we should be any better off industrially, but we have "apple kings," and I notice that one of these potentates is on your programme to speak to-day. This gentleman raised this last season fifteen hundred (1500) barrels of apples, and every barrel was grafted fruit; and he manufactured his own barrels, and of that fifteen hundred barrels of apples he evaporated twenty-one hundred (2100) bushels; and that fruit thus prepared and put into the market in his inviting way, is worth as much as the best quality of raisins, pound for pound.

Perhaps the best illustration that I can give you of the thrift and general prosperity of our people may be found right here; just across the way there is an institution, modest and with little noise of machinery, but very telling in its figures; I mean the savings bank. You will find deposited there over four hundred thousand dollars ($400,000) of the people's money, and not one dollar of the insurance money paid in, on account of the recent fires, is included in that amount. The People's Trust Company of this town has also on deposit three hundred thousand dollars ($300,000) above its capital stock.

There is another savings bank in the thriving town of Phillips, with one hundred thousand dollars ($100,000) more, making eight hundred thousand dollars of the savings of the people piled away in this little county. There are also three other banking institutions in the county with a capital stock of two hundred and twenty-five thousand dollars ($225,000) more.

Gentlemen, on behalf of the Franklin County Agricultural Society and also on behalf of the Grange in this place, as well as on behalf of the farmers and the people of this town of Farmington, I bid you welcome. We welcome you to this once the "loveliest village of the plain," now stricken and humbled. Its magnificent streets were the pride of our own people, and the envy of those less favoured. Those streets were lined with the homes of cultivated and intelligent people ; with comely and pleasant Christian churches ; with well-kept and prosperous hotels, and with substantial and beautiful business blocks ; but they all went down in one night, and in those ruins (for the time being) were buried the hopes and ambitions of a lifetime. But, thanks to the recuperative power of this people, we pledge you here to-day, if you will re-visit this place at some time in the near future, we will show you above those ashes, houses more costly and beautiful, churches more modern and complete, hotels more commodious and prosperous, business blocks more substantial and imposing, and a larger and more flourishing business. Hail to the possibilities of Maine!

The response to the above address was made in behalf of the Society, by the Secretary, Samuel L. Boardman.

D. J. Briggs, Esq., first Vice President, then assumed the chair, and introduced Charles S. Pope, Esq., who proceeded to deliver his annual address.

ANNUAL ADDRESS.

By President Charles S. Pope.

Ladies and Gentlemen: It was with pleasure we received the invitation to hold our annual meeting at Farmington, as we had for years desired to meet with the fruit growers of Franklin County. It is particularly fitting that we should hold a meeting at this time, here in the center of one of the finest fruit-growing sections of the State. We cannot wonder that the early settlers thought this a goodly land to possess, when we take into account its great beauty of scenery, happily combining mountain and intervale, and its fertility. Their descendants have added orcharding, for which the land is admirably adapted, to ordinary farm pursuits, and have carried it on so successfully that the region is now widely and favorably known for its orchard products. Among so many thoroughly conversant with the theory and practice of fruit growing we anticipate an unusually pleasant and profitable meeting.

Since our last meeting death has removed from our midst one of our most earnest and enthusiastic members, Hon. R. H. Gardiner of Gardiner. For three years President of this Society, he was one whom we shall truly miss, with his ready counsel and sympathy. He was ever ready to advance the best interests of the Society, either by his purse or his own personal efforts. I need not dwell upon this subject, as it will receive the more extended notice it merits from the committee appointed to prepare a memorial of his life and labors. We may also fittingly mention here, the death of Hon. Marshall P. Wilder, the founder and President of the American Pomological Society. A long life actively devoted to advancing the interests of horticulture had endeared him to pomologists everywhere, and we, in common with our sister societies, gratefully acknowledge the debt we owe to this pioneer.

Having in his younger days a love for rural life, he chose farm work rather than a college course. Later he became a merchant in Boston, spending his morning hours in superintending the work in his garden and orchard. Since retiring from business some years ago he has spent nearly all his time in his favorite occupation, the culture of fruits and flowers and flora-hybridizing. It can truthfully be said that no man in this country has done so much for the cause of floriculture and pomology as Marshall P. Wilder.

Our September exhibition, which was held in connection with the State Fair, was in some respects more satisfactory than usual. We had all the space needed for spreading the fruit, and by making some changes in the arrangements of fruits and flowers, the exhibit was more pleasing and much more convenient for the awarding committee. While it is impossible in the rooms assigned us to make an artistic display, we think still further improvements can be made that will add very much to the attractiveness of the exhibition. I would again call your attention to the fact that it will be impossible to give satisfaction to exhibitors until we are able to employ expert judges who have no personal interest in the exhibit.

We recommended last year that the Society take some measures to encourage the setting of trees in public places, and we hail with pleasure the suggestion of Governor Bodwell, in his address, that a law be enacted, appointing a day, as a holiday, to be known as "Arbor Day," to be devoted to the planting of trees, useful and ornamental. We suggest a committee be appointed by the Society, whose duty it shall be to use their influence in giving this bill a passage.

I would call your attention to a bill which has been presented to Congress by Hon. W. W. Hatch of Missouri, entitled "A bill to establish agricultural experiment stations in connection with the agricultural colleges in the several States." It seems to us that this is a step in the right direction, and such a station rightly equipped, with competent officers, would be of incalculable benefit to the fruit growers as well as the farmers of Maine. How many fields of potatoes were entirely destroyed before we learned how to kill the potato bug? How many apple trees were ruined by the forest-tree caterpillar, a few years ago, because we did know how to meet the enemy? And now we have the apple maggot, *Trypeta Pomonella*, with no remedy to stop his ravages, and the disease commonly called "apple scab," caused by a fungus named *Fusicladium Dentriticum*, which has caused more damage in this section than all the insects combined. I fear some of us will be obliged to abandon the raising of the Baldwin unless something can be found to check this disease. These and the myriads of other destructive agents call for help which could best be furnished by such a station.

I would recommend that a committee be appointed to urge our delegation in Congress to support this bill.

We would suggest meanwhile that all who are troubled with the disease called apple scab should be self-constituted members of a committee to experiment, both by feeding the trees, with a view of supplying some constituent that may be lacking in the soil, and by showering the trees while the apples are small with some mixture that will kill the fungus without injuring the foliage, and report at our next meeting. In this way something may be discovered that will keep the disease in check, without too great trouble and expense.

Since human nature is prone to indolence and neglect, except when pleasure and comfort are the immediate results of effort, many of us become indifferent and need to be reminded at least once a year that our fruit trees are calling for more dressing, that the borers need looking after, that the codling moth is increasing and the apple maggot is abroad, all urging better care and more attention, if we would make a profit from the orchard.

While some of these subjects require reiteration, there are still left other topics fraught with ever renewed interest—the comparing and examination of new varieties, improved methods of culture, and new modes of dealing with the enemies of the fruit grower. These admit of sufficient variations to keep alive an interest and enthusiasm and render our meetings as profitable as they are pleasant.

I would reply to the charge of sameness in my annual addresses as did the old preacher when his congregation complained because his discourse was about the same week after week: "When you mind this I will try and give you something new."

Following the address of President Pope, the next exercise was the presentation of the Gardiner memorial:

MEMORIAL OF HON. ROBERT HALLOWELL GARDINER, LATE PRESIDENT OF THE SOCIETY.

By Samuel L. Boardman.

From the foundation of our Society it has been a devout custom to place upon record in its Transactions memorials of its deceased members, thus preserving among the workers of to-day recollections of the lives and services of its founders and helpers of the past, as an incentive and for the emulation of those who will carry on its good work when we who are here shall all have become numbered with the "silent majority." In accordance with this pious and reverent example it becomes our sad duty to commemorate the life and work of the late Robert Hallowell Gardiner, a member of our Society from 1877 to his decease, and its President from 1880 to 1884.

Mr. Gardiner was descended from a long line of honorable and distinguished ancestry. His great-grandfather, Dr. Sylvester Gardiner, was born in Kingston, R. I., in the year 1707, was educated in England and France under the best schools and instructors, and became one of the most learned and accomplished physicians and surgeons of the time. He was one of the proprietors of the Kennebec Purchase, which, commencing its scheme of colonization in 1757, did so much for the settlement and development of the fertile sections along the Kennebec River, and as agent of the company was largely instrumental in shaping its policy and promoting its prosperity. To him the praise should be ascribed of settling the region of ancient Pownalborough and the entire Kennebec valley. In a history of the Kennebec Purchase, in the Collections of the Maine Historical Society (Vol. II, p. 279), it is said, "To his enlarged views, indefatigable exertions and liberal mind may be attributed those plans which so rapidly advanced the prosperity of the Patent." "He brought an uncommon zeal, a ripe judgment, great business talent and a powerful interest in the growth of the country to bear on this enterprise, and so confident was he of success that he was willing to commence at his own expense what the large company of Proprietors had never been able to accomplish." He received from the company a grant of four hundred acres of land, and continued to accumulate possessions of real estate until at one time he owned one hundred thousand acres of land. The present city of Gardiner was named in his honor. At the breaking out of the Revolution Dr.

Gardiner embraced the cause of Great Britain, left Boston with the British army and went to Halifax. His property was confiscated by Government and sold at auction, but in consequence of a legal flaw in the proceedings it was, at the conclusion of peace, restored to his heirs. Dr. Gardiner died August 8, 1786, aged 76 years.

A daughter of Dr. Gardiner, Hannah, married Robert Hallowell, who was born in Boston in July, 1739, and who died in Gardiner in April, 1818. A memorial tablet under the corner of Christ Church, in that city, says of him that he was "a man of firm integrity, distinguished courtesy, and strong affections." A son was born to Hannah Hallowell at Bristol, England, during the absence of his parents and grandparents to that country 10 February, 1782, and was named Robert. His grandfather, Dr. Gardiner, displeased at the religious and political views (he was a Unitarian and a republican) of his eldest son John, willed all his property to this grandson, when he was only five years of age, on condition that he should assume the name of Gardiner. This he did on becoming of age, in 1802, and a special act of the Legislature of Massachusetts, passed March 11 of that year, enabled him to take the legal name of Robert Hallowell Gardiner, he having just graduated at Harvard University ranking second in a large class which contained many afterwards very distinguished names. After graduating he spent two years abroad, and then came to the Kennebec to assume the management of his estate. He married, in 1804, Emma Jane Tudor of Boston, daughter of the late Hon. William Tudor, one of her brothers being the late William Tudor, the first editor of the *North American Review*, and the biographer of James Otis; and another, the late Frederic Tudor, who was the originator of the modern ice business and whose love for beautifying nature is shown in the tens of thousands of trees which he planted on the bleak coast of Massachusetts along what is now the beautiful and popular Nahant shore.

Mr. Gardiner was a man of great energy of character, singularly simple and unostentatious in manner of life, generous, kind-hearted and just. He was the first Mayor of Gardiner; the President of its savings bank from its organization to his decease; for many years an overseer and for nineteen years a Trustee of Bowdoin College; for a long time President of the Kennebec Bible Society; an influential member of the Board of Visitors of the State Hospital for the Insane, and for eleven years President of the Maine Historical Society of which he was one of the original members. He died 22

March, 1864, aged 82 years. A memorial stone in Christ Church, Gardiner, says, in the expressive language of the late Bishop Burgess, that from youth to old age he was the "leader, benefactor, and godly example" of the people of that parish.

Robert Hallowell Gardiner, third child and eldest son of the above, the subject of our present sketch, was born in Pittston, Nov. 9, 1809, the family moving the next year to Oaklands. In an autobiographical sketch of Mr. Gardiner, prepared for use in his college class biographies, with extracts from which your committee have been favored, he said of himself that "there are probably very few persons in attaining old age who can, like him, look back to their boyhood and youth without a single memory to mar the delights of those days," and that cheerful, innocent spirit, as innocent and fresh as a happy child's, remained with him through life, and enabled him to bear many trials and adversities without despondency. Mr. Gardiner was educated first by a private tutor at home, then at Partridge's Military Academy at Norwich, Connecticut, then at the Gardiner Lyceum—the first school established in this country for giving a scientific and industrial education, in the founding of which his father had done great service—after which he went to the famous Round Hill School, Northampton, Massachusetts, and then entered the class of 1830 at Harvard University, in the Sophomore class.

After graduating Mr. Gardiner engaged in business in this State, but was unsuccessful. He then accepted an invitation of Col. Long of the U. S. Ordnance Corps to go to Georgia and assist in making surveys for a State road from what is now Atlanta to the Tennessee River. There he spent three years, during which time he became attached to the lady who afterwards became his wife, Miss Sarah Fenwick Jones, daughter of Noble Wymberly Jones of Savannah. They were married June 28, 1842. A few years after their marriage it became necessary, for the management of Mr. Gardiner's large property, for them to remove to Augusta, Ga., where the attempt was being made to establish manufactures and develop the resources of the South. Into these business projects Mr. Gardiner entered heartily and did all in his power to promote their success. A friend who knew him at that period writes of him: "His life during this time was that of a private citizen, respected and beloved by the community at large, esteemed for his kind and charitable heart, and honored for the zeal he displayed in promoting the material interests of the South." He was the first President of the Augusta Manufacturing Company, and in 1851 was a member of the city council of that city. Mrs. Gardiner and her sister, afterwards wife of the Rev. William H. Harison, D. D., built, at their own expense, the Church of the Atonement, in Augusta, and to this work Mr. Gardiner himself gave a great deal of the labor of love. He was for many years a delegate to the General Convention of the Protestant Episcopal Church from Georgia, meeting in those sessions his father who had been for many years, and until his death continued to be, a delegate from Maine to the same body.

On the breaking out of the Rebellion, Mr. Gardiner and his wife came north, and afterwards visited Europe, where they spent several years. On the death of his father, in 1864, he took up his permanent residence at Oaklands, where the remainder of his life was spent. Mrs. Gardiner died in 1869. They never had children. Mr. Gardiner succeeded his father as Treasurer of the Maine Episcopal Missionary Society, and as Senior Warden of Christ Church.

After the death of his wife Mr. Gardiner devoted his time to the care of his orchard, farm and garden, and also to church and philanthropic work. In referring to this period the writer of an obituary notice in the Gardiner Home Journal says: "Through weary years the church and the Master's work have been to him his greatest joy and supplied the place of wife and children. They have been served with a heart pure and loving, ever ready to spend and to be spent in any good cause, ever ready to respond, and to even anticipate the call of charity and the cry of woe."

The famous orchard of Bellflowers at Oaklands was the especial pride and care of Mr. Gardiner. This orchard was planted in 1863, and commenced to bear for the first time in 1879. He gives an account of the same and its management in our Transactions for 1880–81. It numbers about three hundred trees and its yield in 1886 was seven hundred barrels. The care of this orchard and of his ornamental grounds and garden, was a source of constant pleasure to Mr. Gardiner, and many of the trees were grafted and pruned by his own hands. Meteorological records have been kept at Oaklands for nearly fifty years, since 1869 by Mr. Gardiner himself. He was greatly interested in this work, exacting as it was, and was very prompt in forwarding the monthly reports to the Smithsonian Institution at Washington, and to the local papers. Some idea of the exacting nature of the work may be gathered from the fact that each day's record demanded three different observations of temperature, barometer, winds and cloudiness—and for each day's observations thirty-nine different columns of tables were required to be filled out, and at the end of each month nineteen different and additional columns, to contain the results of monthly averages. And yet up to only two days before his death Mr. Gardiner had filled out these tables himself. At the end of the month he has been many times known to work till 2 o'clock in the morning making out his averages and copying the tables for the Smithsonian and the public press. All this work was conscientiously performed for years, not only with no compensation, but at a considerable personal expense for instruments and apparatus. The Smithsonian regarded him as one of its best correspondents. In view of the value of these records and their increasing importance to science the longer they are continued, it is a matter for public congratulation that they were taken up at the point where Mr. Gardiner's accurate but weary hand stopped its work, and are now continued by Rev. Charles L. Wells, the rector of Christ Church.

Mr. Gardiner became a member of our Society in 1877, and took great interest in its exhibitions and meetings. Whenever possible he was a large exhibitor, and so long as health allowed attended all our winter meetings. At the annual meeting of the Society held at Lewiston in 1880, Mr. Gardiner was elected President, and received a re-election for three successive years following. His annual addresses, although generally brief, were well written, contained good thought, correct information and were chiefly devoted to apple orcharding, the specialty in which he was most interested. All his energies seemed to be engaged in behalf of our Society and its work, and many are the members who will long remember his animated presence and cheerful conversation while in attendance upon our meetings and exhibitions.

Mr. Gardiner was a member of the New England Meteorological Society, and of the Maine Historical Society. In the objects and work of the last named he was much interested, and the occasions were very rare when he did not attend its regular meetings at Brunswick and Portland, as well as its summer excursions.

The estate at Oaklands comprises about four hundred acres. It is one of the most lovely spots on one of the most beautiful of our Maine rivers—in the midst of fine and varied scenery. The mansion-house was built in 1835–36. It is of Hallowell granite, in the English style of architecture of the time of Henry VIII, with buttresses, turrets and battlements of hammered granite. So distinguished an architect as the late Mr. Richard Upjohn, who designed Trinity Church, New York, was consulted in the making of its plans. Its main front faces the river—which is some four or five hundred yards distant—between which is a fine lawn. The house has a frontage of ninety feet, the large hall running the entire length, and its main portion extending to the roof. There are over thirty rooms in the house, the library, parlor and dining-room occupying the east front, being 14 feet high, and finished in plain solid wood. The library is large and rare, and upon the walls of the hall and parlor are family portraits of three or four generations, by distinguished painters, and copies by some of the best Italian artists of the more celebrated paintings in the Florentine galleries, obtained by members of the family when abroad. The cost of the house was $32,000. For years it has been the seat of great hospitality and good cheer. The late Bishop Burgess writing of the life at Oaklands during the time of Mr. Gardiner, Sr., says: "The judges of the courts on their circuits did not fail to become his visitors. Every intelligent traveller from abroad who came to the Kennebec was almost sure to bring letters which threw open its doors. The clergy were ever honored under his roof for the sake of Him by whom they were sent." Between 1822 and 1840, Oaklands was frequently visited by the late distinguished author, Hon. George Ticknor, who, in his memoirs, describes the daily life there as "like that which forms so graceful a feature in the country life of England." In 1874, when on his eastern tour, President Grant and his suite were entertained at Oaklands, in right royal, though simple style, by the subject of our notice who was then its chief. By the will of Mr. Gardiner this place descends to his nephew, Robert Hallowell Gardiner of Boston, a young and brilliant lawyer, who intends to keep up its former character, and who has already become a life member of our Society.

During the past summer Mr. Gardiner had not been very strong, although his indomitable will and energy kept him active in spite of slight bodily indispositions, even when these were long continued and would to most persons have made them sick. He would not "give up." "I *must* rally from this indisposition, somehow," he said to his nephew only a few hours before he died, making an attempt to raise himself in bed—and this was characteristic of his whole life. It was his happiness to be busy, to be active, to be doing something for others. On Friday, Sept. 10th, he recorded his meteorological observations and made up the table of the day's results. Our annual exhibition was to open the 14th, and he had been busy for a day or two in getting together his fruit, and making arrangements for the fair. On the 10th, he wrote a letter to your Secretary in regard to his exhibit, which was the last letter he ever penned. In it he said: "I fear on account of the drouth and the early date of the fair there will not be so good a display of fruit as usual. I hope, however, to be able to make a fair show. I have been quite unwell for some weeks but hope to be strong enough to go to Lewiston on Tuesday." He penned a few directions to his head farmer in regard to the exhibit which he was to make, and these were found upon his table after his decease and faithfully carried out. He died on Sunday, September 12th. Mr. Merrill took charge of his collection, some thirty varieties, and it was given the central place in the Kennebec County exhibit, marked off from the others by a festoon of crape. In the centre was a beautiful floral design, the work of Mr. Roak, which consisted of a wreath of white lilies and buff roses, cut in twain by a sickle of dark pansies, the handle of which was composed of white carnations. A mourning card contained the words "Robert Hallowell Gardiner, 1809–1886."

On the day of his funeral His Honor, Mayor Ladd, issued a proclamation to the business men of Gardiner, asking them, "in respect to the memory of a life-long and esteemed citizen," to close their places of business from 4 to 6 o'clock P. M., and this was universally observed, as showing the "respect due to an aged and honest citizen." The vestry of Christ Church passed resolutions in which was expressed: "His life has been replete with earnest zeal for the Master's cause and the good of the church, increasing more and more with each passing year unto its perfect end. The community has lost a valued citizen, the poor a friend and benefactor whose charity knew no bounds, and we a brother, friend and leader whose place in our hearts now thrills with pain at our loss—which is his gain." The Board of Missions of the Episcopal Diocese of Maine recorded its tribute to the deceased in these words: "We, its members, feel that it is an honor to ourselves rather than to him to recognize and recall his refined courtesy, his unvarying kindness, and his unostentatious liberality; and to have seen in him, one who, through youth, manhood and old age, was one who received the kingdom of heaven as a little child and has now gone home to his reward."

Obituary notices in the press of the State were general. The Gardiner *Home Journal* said: "The eyes of many will grow dim as they read that he has gone to join his wife in the home above, of which they loved to teach, and to which they sought to lead the way by the pure example of a godly life." The *Kennebec Reporter* said: "Public spirited as a citizen, scrupulously honorable as a man of business, affectionately liberal as a friend, his death will be remembered by the entire community." The *Boston Daily Advertiser* said: "The death of Robert Hallowell Gardiner in the Maine city named for his family, is an unwelcome reminder that a fine illustration is lost to us of simple and noble courtesy. The coarse aggressiveness of some newly rich people was offset, in a measure, by his winning example of gentle blood working out in an unpretentious life. New England is seeing many repulsive instances of money-made manners, and Mr. Gardiner's life ought not to be forgotten." These, among many other notices and expressions of a similar nature, show the worth of character of our deceased associate, and the esteem in which he was held by those who knew him best, and their mention in this sketch renders a more formal tribute of our own unnecessary.

His funeral occurred on Wednesday, September 15th, the Right Rev. Henry A. Neely, Bishop of Maine, officiating; being largely attended by church, parish and people—many distinguished gentlemen from different parts of the State being present. The church was simply decorated with golden rod and the wild asters, a chain of oak leaves from Oaklands being twined about the chancel rail. While our last annual fair was in progress, and thousands of careless visitors were crowding past his fine exhibit, devout men were carrying his remains to their last resting place in the little yard of Christ Church. In the blessed faith of our holy Christianity we believe that his ransomed soul had already been granted an abundant entrance into that glorious land where the fruits and flowers exist in a beauty and fragrance which is immortal.

At the conclusion of the reading of this Memorial, it was given a passage by a rising vote.

Mr. P. Whittier of Chesterville then read the following paper.

MY EXPERIENCE IN ORCHARDING, AND MARKETING THE FRUIT.

By Phineas Whittier.

Mr. President, Ladies and Gentlemen:—I do not come before you as a fancy fruit grower with plenty of money to do as I please, but one who has been so cramped for funds as to labor under great disadvantages. Without saying anything against stock-raising, dairying, grain-growing or any other branch of farming (for I think that there is a chance for fair success in any of those pursuits when intelligently engaged in by persons who love the business), I thoroughly believe myself when I say that there is far the easiest and greatest chance for satisfactory success in orcharding in this section of the State, for a person who likes the business, of any one thing I know of. Right here, let me say, that the surest way for a person to make a failure is to engage in that which he has no liking for. We have an abundance of good and cheap orchard land and are near good markets. We can raise the best and latest keeping fruit. All that is lacking is the right kind of men, those who have faith in the business, great courage, perseverance and a good share of patience to wait for the fruits of their labor. Not those whose faith and courage are good for one year and when ill-luck and circumstances make things look dark will give up beaten. There are many discouragements to meet, and he who would succeed must be a man of such faith and determination as to make a steady and long struggle and never give up. None others need expect to obtain any great reward, for in orcharding, steady and constant care is more necessary than in almost anything else. It is a settled conviction with me, that with an orchardist no better than myself, almost any of our hard and rocky farms, and even old pastures, now worth from $500 to $2000, can be made to produce for sale, each year, more value of fruit than they are now worth, besides getting something from stock, especially sheep. This is not guess work. I have worked this problem all out and proved it, and if any doubt it I can show how it is done.

Many fruit culturists go to Florida, thinking to make fortunes in orange groves, but many of them get discouraged because it requires more labor and expense in fertilizing and clearing the land in order to succeed than it would to get a good orchard of apple trees here in Maine, besides it must be a very favorable location for orange trees to escape the occasional freezes. I think the chances for success are largely in favor of apple raising here, especially for any one without considerable capital. No matter how poor one is, if he is able to keep his farm and has his health, if he is made of the right kind of stuff, he can succeed as an orchardist here. Your worthy Secretary suggested that what I may say should embody my experiences, studies and observation as to orcharding. Now, I have not time to touch on but few of the many points of this subject, and if you will pardon me, I will first say something of myself, of the disadvantages, discouragements and hardships I have had to overcome to obtain what success I have, and speak of them for the encouragement of others who have like ones to overcome.

Orchardists, like poets, are born, not made, and if I can be called one you will see that I am not to be blamed, and I take no credit to myself. I cannot remember the time when it was not my delight to plant trees and watch their growth. After becoming of age, I worked by the month one season, and the next spring I bought 90 acres of old, rocky pasture and wood land for $400 and all I could pay towards it was $75. There were 60 or 70 old natural fruit apple trees on it, considered worthless. Not over 5 or 6 acres of the lot had ever been ploughed. It was good orchard land, but no better than thousands of other lots and not so good as many. The first three years I spent in clearing eight acres and building a house and barn and getting some of the old pasture ready for crops, which got me considerably more in debt. I then married and moved on to the place when 25 years old, and then commenced setting apple trees from a small nursery I had started on father's farm. I also commenced planting nurseries on my own land. I had the old trees grafted and I trimmed, cultivated and manured them, and I have taken a great deal of good fruit from them and they are quite profitable trees yet. I struggled along 4 or 5 years after that. My trees had not yet commenced bearing enough to help and I found with the strictest economy I could barely support my family without paying even the interest on my debts. I went to Massachusetts to earn money in a shop to pay my debts. With hard work, both myself and wife, I succeeded in three years and came back with the same determination to make a good fruit farm, and I went to work with renewed zeal, planting nurseries, setting trees and caring for those already set. After years of hard work and care I had got well under way with quite an orchard, when, lo! one spring when the snow went off I found several hundred trees completely ruined by mice. Determined not to be beaten thus, I planted a larger nursery, set out all the trees I had that would do, and took great pains to guard against mice. After several years, when I had repaired damages and enlarged my orchard, the grasshoppers came and the next spring I found 500 of my trees dead and almost all of them damaged. I confess that I felt sick for a day or two, but it soon passed off and my determination to succeed rose higher than ever. I then had quite a large lot of trees in the nurseries and the next few years found me setting more trees than I ever did before, and working hard to repair damages. Soon after came caterpillars, and for three years it was a hard fight, but, as I could fight them better than I could grasshoppers, I did it so successfully that they did but little damage to my trees.

I have mentioned only a few of the obstacles I have had to overcome. In addition to everything else I, at two different times, lost $2600, clean cash, and all before my orchard was any great income; and this has kept me continually in debt, at least until recently. So you see that poverty and hard luck has been my lot. You may ask what encouragement is there in all this? Well, I will tell you. I have steadily increased the sales of fruit from my $400 lot from one or two hundred dollars after the first eight or ten years, to probably upwards of $3000 this year, having already sold $1825 worth, and I still have five or six hundred barrels of my best apples on hand, and my fruit is increasing faster than ever before, with a large share of my trees not yet come into bearing. I fancy that with proper care I have something that will last as long as my children and grandchildren may live. I have obtained this with only my two hands to help me, and have all the while depended on my farm to support my family. Hold, I have made a slight mistake. My better half should come in for a good share of the credit.

A man, having made a fortune in some other business, may take a notion to try farming. He can by lavish expenditure of money take an old, worn-out farm, and succeed in making it the most productive of any in the vicinity; and have the best stock, and the best and most convenient buildings and neatest surroundings, but at a cost far above the money value of the improvements, or what can ever be got out of them. This is one kind of success, but not the kind that those of us desire who depend on our farms for our support, and not the kind that many of us common farmers can stand a great deal of; but no one is so poor, if he has possession of an acre of land, that he cannot start an orchard, and if cared for it will be something that will pay the best of any improvements that can be made by a person of limited means.

One of the most important things to make orcharding profitable is to know how to dispose of the crop to the best advantage, especially those that are not fit for an extra nice No. 1. I at first got me a cider mill and made large quantities of cider, and I must sell it to make it pay, and in doing so it made me feel so mean that I stopped it. I next tried feeding to stock, but that was not satisfactory. Then after evaporators came around I sold to be evaporated; that did better. I then bought an evaporator and have evaporated on my own account for several years, and I am better satisfied with this way of disposing of my No. 2 apples than any other I have tried.

When apples are plenty and cheap at harvest time, it requires some faith for most people to be at extra expense to carefully handle, sort and store them, but it will pay well every time. Roughly-handled and badly-sorted ones must be marketed early or they will be in very bad condition later, and then it is that extra nice ones will bring a high price, even if the market is glutted with the poor ones. I have never known it to fail. When I sold to agents who were buying for large city dealers, they would not and could not pay me enough extra to make it profitable for me to put up an extra nice quality; but when I began to send them into market with my own brand, to be sold on their merits, I found it to pay me well to have them very nice in every respect, and if any are a little nicer than the rest, I put them in the middle of the barrel. Only about one-half of the crop will, on an average, make such a quality of No. 1's as I send to market, and they will net me more money than they all would put up as apples are usually. About one-half of the remainder will make a very good second quality, that will pay some years to send to market, but I usually find it to pay best to evaporate them. I consider it absolutely necessary for those who raise several hundred barrels of apples to have each an evaporator, in order to dispose of the fruit satisfactorily. I think that two or three times as much net profit, one year with another, can be made by evaporating the poorest as in any other way, especially if pains are taken to make a very nice article. When I say poorest, I do not mean unripe, ill-flavored or crabbed, but that unfit for No. 1's by being bruised, wormy or under-sized. Such apples well pared, with extra care in trimming, and rightly bleached and dried, make a very nice quality. For those who do not raise enough to pay for them to have an evaporator, canning can be done at a profit, and it would cost but a small sum to fit up for that on a small scale.

Apples should be marketed in good, tight, new, clean barrels of full size; but I warn you that it will be useless to have ever so nice barrels unless the fruit is equally good, and if it has not been carefully handled when picking and storing, the best sorting in the world after that cannot make them nice enough to bring a fancy price.

For those who raise limited quantities, and who do not wish to send into market their fruit under their own brand, I think more money can be obtained for their fruit by sorting it, as others usually do, than by making it extra good. It is the practice of some shippers to send apples abroad, No. 1 and 2's all together, with only care to cover the barrel heads with X's, and will pay about the going market price for them. If this can be followed it will be a good chance for careless fruit growers to dispose of their fruit, but I fear it will be bad for the reputation of Maine fruit. There is a greater difference in price between extra good fruit and that which has been carelessly handled and sorted, later in the season, than there is in the fall or early winter. Fruit that has been badly handled must be disposed of early or else there will be a great loss on it; and if it is put into market late it will be in bad condition, and then it is that very nice fruit will bring a very satisfactory price, and I have never known it to fail, often selling for nearly double market price. I cannot find language strong enough to express my contempt of the practice of deaconing apples, or putting good ones at the ends of the barrel and poor ones in the middle. It is the silliest and most suicidal practice I know of. What opinion can a man have of himself, to say nothing of the opinion of others, who sells fruit which he declares to be nice and alike all through but proves to be poor all except a few on top, and he knows he will be found out almost as soon as he is gone; and then again, how many times can he sell his fruit there except at the price of poor fruit, no matter how well it appears or what he says about it?

Many, if not most, of the wholesale buyers and commission men desire to have their apples put up with about one-half bushel of the best ones at the faced end of the barrel. If you are looking for a commission merchant, and he directs you to put up your apples in that way, look out for him, but if he desires to have them put up alike all through, whether he is buying of you or is to sell on commission, you may score one for his honesty with you as well as his customers, and he is the one who will get the best price for your really nice fruit.

The fruit interest in this State is destined to be an important one and a profitable one too, if we will only take care to put it up as it should be in order to gain a high reputation, and every one who does not do so is an injury to the business. If we would increase our profits from fruit we had better spend our time and energies in increasing the production, than to spend them in trying to sell poor apples for No. 1's. I know of parties that try so hard to sell all of their crop for No 1, that they have to look up a new buyer every year. That is not the way to make orcharding profitable nor the way to make an honest man feel satisfied with himself.

Maine fruit commands a little better price than that from other States, but it is not because it is better sorted or handled, but because of its later keeping qualities. Where we now get twenty-five cents per barrel higher for our apples we should and could by care in putting them up get dollars more per barrel with such apples as we can raise. I wish all fruit growers and shippers could realize the advantages to be gained by establishing a high reputation for extra sorting and handling our apples and the sooner it is done the easier and better for us.

DISCUSSION.

Mr. W. P. Atherton. Do you manufacture your own barrels?

Mr. Whittier. Yes, sir, I have followed that practice for some years. I have the material worked up at the mill and put them together myself.

Question. The matter of feeding apples to stock is an open question and one of considerable importance, and I should like to know if you think it a profitable method of using up refuse fruit?

Mr. Whittier. In reply to the question I would say that in my opinion it is a practice that amounts to but very little. It may be of considerable benefit to the stock but I do not think it will pay, especially where you have to hire help. If you could do the work yourself it would be a good way of using up poor apples.

Question. What would you do when a man has from three to four hundred bushels of refuse apples which he does not know what to do with? That is my case and I feel too mean to make them up into cider. What has been your experience, and have you experimented any in this matter?

Mr. WHITTIER. During the first of my experience as an orchardist, for about four years, I could do nothing else with the refuse fruit. I fed from three to six hundred bushels to sheep. They liked them very much but it did not pay me to do it. I should say that if a man had time and could afford to hire help it would pay, but if he could not I would employ some other way of using up the poor fruit. I know that it does not pay me to take care of it in that way.

Mr. S. R. LELAND, Farmington. Will it pay better to feed them to pigs than to sheep?

Mr. WHITTIER. I fed apples to a shoat from the fall until the following spring and could not see that the animal was in any better condition than before for having received them. I boil them until soft and then feed them mixed with meal or shorts.

Mr. D. J. BRIGGS, South Turner. I would like to return to the subject of barrels. What size barrel do you use and how much will they hold?

Mr. WHITTIER. The barrels are seventeen and one-quarter inches in diameter across the head, with the staves twenty-eight inches long. The way they are set up makes considerable difference with the amount they will hold. If the staves are narrow there is some bilge. I should mix the staves and thus insure a better uniformity in the capacity.

Mr. BRIGGS. We have been making our own barrels and there has been a great deal of discussion about the matter and much difference of opinion in regard to the amount that a barrel should hold. What do you consider the proper amount for a barrel to hold?

Mr. WHITTIER. I do not think I can state definitely in relation to it. There is a great deal of difference everywhere. Some heap the measure and others do not. I think it almost impossible to state, either by bulk or weight, the amount which it would take to make a barrel of apples.

Mr. LELAND. Has the time arrived for the use of new barrels?

Mr. WHITTIER. Yes, sir, it is time now.

Question. Do new barrels increase the value of the fruit?

Mr. WHITTIER. Yes, sir, because many of the old barrels that are picked up are unfit for packing apples into. I want good new barrels and then I feel safe about my fruit. I have tried both ways and think it better and in the end cheaper to use new barrels.

Question. What kind of wood is used for making the barrels?

Mr. WHITTIER. Most any kind of wood will do.

Question. Is poplar used?

Mr. WHITTIER. Yes.

Question. Is basswood used, and is there danger of its moulding?

Mr. WHITTIER. Basswood is unfit for barrels because it shrinks too much. Some buyers will take any kind of barrels. I bought one thousand barrels last year and would have been willing to have paid more than I did for them.

Mr. ATHERTON. What is the usual price for them?

Mr. WHITTIER. Twenty-five cents for old, and thirty-one cents for new ones, is what I pay.

Mr. BRIGGS. In our town we make about two thousand barrels and they are of beech and birch and have six hoops made of ash that are one inch and a quarter wide. We pay thirty-two cents a barrel for them and buyers say that they will pay ten cents more on the barrel where they are put up in new ones than they will when the barrels are old. Unless old barrels are cleaned by steam it is impossible to get them into condition fit to pack apples into them. Therefore, I should say use good, new barrels. It is with this as with everything else, the best packages bring the highest prices.

Mr. ATHERTON. I would like to enquire in relation to the influence which sheep have upon an orchard and also their influence upon the codlin moth. Most orchards are troubled with this insect pest and as my orchard is no exception I had the idea of putting in sheep if I could free it from their depredations. Are your apples more free from the influence of the moth on that account?

Mr. WHITTIER. My orchard is in three or four enclosures, all adjoining. The apples in the western portion, which is pastured to sheep, are not one-quarter as wormy as those in the other three parts. After the trees get to growing, if you have a large flock of sheep, there is but little need of much other dressing. A large flock is necessary, however, to furnish the needed amount. A ten-acre orchard won't do well unless a liberal supply of fertilizer is applied.

Mr. BRIGGS. Wouldn't it work to give these sheep an allowance of provender?

Mr. WHITTIER. Yes, I would pasture them in the orchard and give them also an allowance of provender and thus benefit both the orchard and the sheep and increase their value.

Mr. BRIGGS. I feed my sheep some provender, as they cannot obtain enough food to sustain them by foraging, and find that it helps them very much. It is well known that sheep are advantageous in an orchard for many reasons. The apples are of very fine flavor and free from worms in orchards pastured to sheep.

Mr. WHITTIER There is no animal that will eat green apples so well as sheep. They will eat them when they are in the blow up to harvest time. There is one thing that should be done. All who have plowed know that there is generally but about two inches of sward; well, if you mow that sward and plow, you will turn that sward eight inches deep. In pasturing all the earth should be in this condition and then it will produce the best results.

Question. Will you please give your experience in mulching?

Mr. WHITTIER. I cut all the way from thirty to one hundred loads of mulch each year and I wouldn't know how to get along without it.

Question. Do you mulch large trees?

Mr. WHITTIER. Yes, very frequently.

Question. Do you use any other mulch besides hay and straw?

Mr. WHITTIER. Yes. I use brakes sometimes, but would use hay when it is in the orchard. Hay used for mulch is worth ten dollars per ton.

Question. Do you have any trouble with the mulch harboring mice?

Mr. WHITTIER. Do not use the mulch too near the trunk of the tree, and you will have no trouble. Spread the mulch on thick so that it will kill the witch grass.

Mr. ATHERTON. Did I understand you to say that hay was worth ten dollars per ton for mulch? If good would you let the stock have it?

Mr. WHITTIER. I should use it on the orchard if it grew in the orchard. It will pay, however, to feed it to the stock and use the manure for the orchard. There is always plenty of material for mulch.

Question. Does it make much difference what you use?

Mr. WHITTIER. There are two things I would not use under any conditions, and those are green sawdust and apple pommace.

Question. Have you tried muck?

Mr. WHITTIER. Yes, I have put it on and plowed it in.

Question. What was the result?

Mr. WHITTIER. I got a good crop of hay and apples.

Question. What is the value of ashes as a mulch?

Mr. WHITTIER. They are good and will make nice fruit. I have not used ashes much, but like them as far as known.

Question. Have you used commercial fertilizers?

Mr. WHITTIER. No, not for trees.

Mr. BRIGGS. Have you ever made apple jelly?

Mr. WHITTIER. I never have. I have made many inquiries, and have nearly always found that those who have undertaken the business have failed. It is only the sour fruit that is used for making jelly, and it is unfit for such a purpose. If sugar was used and there was a good market for it, it might be made to pay pretty well.

Mr. BRIGGS. If we sort and sell only No. 1 apples, we must use up the other apples either by evaporating or by some other way, and if we can make a profit on jelly, why not make them into jelly? Many apples are not fit for evaporating and could be made into cider and then into jelly, and we could thus dispose of considerable second quality fruit.

Question. What kind of trees would you recommend planting?

Mr. WHITTIER. I have not used many other kinds than the Baldwin. I think the Baldwin the most profitable and best market apple for general use.

Question. How small should a perfect apple be to be classed as No. 1?

Mr. WHITTIER. I make three grades. The smallest I evaporate, the next go as seconds, and the rest as No. 1 apples.

Question. Would an apple that would go through a two-inch auger hole be classed as a No. 2 or 3? How about keeping apples?

Mr. WHITTIER. I should say an apple of that size would be about right to evaporate. In keeping it makes a great deal of difference in the kind of apple. Russets will keep well when kept in a tight place. Cover them well with paper to keep the air out, and then they will not wither and wrinkle. I should barrel them, if possible. For Greenings I use an open shallow box. Otherwise they will change color. I have kept some in bins and have now about six hundred barrels of my best apples in the cellar in bins. In regard to evaporating apples I would say further, that I evaporated last fall twenty-one hundred barrels of apples which yielded over six tons of evaporated fruit of very choice quality, samples of which are on exhibition here. This was all sold in one lot at 12 cents per pound, the order for its sale being sent to me by telegraph.

Question. How deep was the bin in which you had the apples?

Mr. WHITTIER. Two feet and one-half deep. Set in the bottom one tier of barrels, then floor over the top and lay in the apples three feet deep, in bins partitioned from each other.

Question. Is the cellar wet, or dry?

Mr. WHITTIER. Wet. The water runs into it in the spring.

Question. Do you use any other method?

Mr. WHITTIER. Yes, I store some in barrels.

Question. Do you ever store in bulk?

Mr. WHITTIER. Yes, I store in large bins partitioned off as before stated.

Mr. NELSON. I have always put my apples in large bins, and have taken three hundred barrels from one bin. I do not believe in having them too near the ceiling. The larger the bin the smaller the number of poor apples. I have often found the best apples nearest the bottom of the bin.

Question. What is the disadvantage in having them deep?

Mr. WHITTIER. It makes too much pressure on the apples at the bottom.

Mr. NELSON. I believe the less surface exposed the better.

Mr. WHITTIER. I never have any trouble with that.

Question. Do you carry them nearly to the floor?

Mr. NELSON. Yes.

EVENING SESSION.

A very large audience was present in Music Hall at the evening session, and at 7.30 the meeting was called to order by President Pope. Previous to the opening of the literary exercises the audience was favored with a piano duet, finely rendered by Mrs. Frank McLeery and Miss Agnes Allen. The first essay was on Floriculture for Children, by Mrs. Sarah B. Purington of the State Normal School, Farmington.

FLORICULTURE FOR CHILDREN—FLOWERS IN HISTORY, POETRY AND SONG.

By MRS. SARAH B. PURINGTON.

The little gardener whom I have in mind was three years old, a sturdy little boy in a gray Mother Hubbard, not taller than the garden gate through which he trotted, with a box of morning-glory seeds in his baby hand.

Walking the length of the garden, he soon returned to the house and scattered his seeds under the dining-room windows. He had been examining seeds, had watched the vigorous growth of a handful of beans under the tall leaves of a calla lily, and was interested in a very young apple-orchard and orange grove. Whatever seeds he had planted, had rewarded him with a most gratifying development.

He did not remember the flowers of the morning-glory, but he felt sure that the tiny black seeds, after lying a few days in the ground, would come up, fresh and green, and be more and more beautiful every day.

There is a lesson of faith as well as of patience in the planting of a seed.

One of the little gardener's vines was the first in the neighborhood to bloom, and a shout greeted the crimson flower. Other flowers soon gladdened the eager eyes, and there were exclamations every morning, "O, see! See these white ones! See these purple ones! O, see the bees rolling in the pollen!"

He plucked as many as he liked, to play with, or to give his friends. They were sometimes bells and sometimes umbrellas.

Not far from the morning-glories, he had two hills of squashes. Each pair of seed-leaves was welcomed with a burst of joy. Every morning the growth of the previous day was noted; and when, at length, the soft yellow bloom appeared, the child's eyes were large with wonder, and his "O, see!" brought the whole family out-of-doors. What would the magic vine do next?

In a few days one of the flowers left behind it a pretty green ball, which was soon large enough to take the place of one of the lost rubber balls, and it went flying about the yard till its destiny as a giver of knowledge and pleasure was accomplished.

At the end of the doorstep, the little gardener had his crowded hill of beans,—"little trees," he called the separate plants. These, too, were watched with his customary interest. Some of the blossoms were plucked, and only three pods ripened in the autumn. But these were a sufficient conclusion to the story of plant-life which he had been reading all summer.

He had regarded these pods as especial treasures, and when they grew yellow, he presented them to his dearest young lady friend.

Early in the following spring he began taking lessons in color, form and numbers from the geranium blossoms. He also learned some botanical terms. It is easy for a child, with his quick perceptions, bright imagination and unfailing memory, to learn even difficult technical terms. He likes the sound of a long word, and smilingly repeats it to himself again and again, for its very music, till it is his own both in sense and sound. Many things in education which are burdensome to boys and girls in the High School are mere play to a child. At four years of age the little gardener began to have his own house plants, six or eight young geraniums in one broad flower pot. This was his window garden. "Mamma, here are some stumps," he remarked one day.

The word had been explained to him not long before, and he had just been illustrating it. With his scissors he had felled his entire geranium forest, and there remained only the bare green stumps, about two inches high. His little brother soon uprooted these, and the desolate flower pot was ready for a new supply of plants.

There was too much regret for the lost plants to allow any repetition of this experiment. The little gardener became so fond of his plants that he tried to be very careful of them, and rarely broke a flower pot. One day, however, some sudden motion of his was followed by a crash. Looking seriously down at the uprooted plant, and the earthen fragments upon the floor, he said, quietly inverting a sentence from Hawthorne, "I am more like a physical reality than a beautiful thought." But the accidents were so few that they are not worthy of mention, compared with all the pleasure that sprang from the little gardener's efforts.

The next year he had quite a collection of house plants. He liked to carry them from place to place in the yard, and sometimes across the street to show to a friend. So some strong, light flower pot seemed desirable. To meet this want, two or three rainy days were delightfully spent by himself and a few friends in the stable, painting some tin cans and decorating them with bronze grasses. These proved very satisfactory.

One morning a lady invited the child into her hot-house, and showed him more flowers than he had before seen growing together. As she watered them, she remarked, "It is a great deal of work to take care of these flowers."

"O," he replied, "I will tell you how we do it at home. We just plant the seeds and water them, and God does the rest. And they grow and bloom."

A young girl who taught a small school in a lonely place told me how much her scholars enjoyed a flower-bed which she assisted them to cultivate in their play hours.

A little neighbor of mine derived great pleasure last summer from a small package of mixed seeds. The furrows in which he sowed them formed his initials, and he was very happy when his autograph appeared in small green leaves. The personality of the little plot was lost, however, in the summer growth, but there was abundant compensation in the number and variety of the flowers.

It is but a step from the garden to the fields. Children like to go with older friends to the woods in spring, and bring home ferns and wild flowers for shady places about the house. They are thus unconsciously cultivating an accuracy of observation upon which the telling of the truth greatly depends. They are learning to name and classify objects, to have many thoughts instead of few, to love Nature and reverence a Creator.

The little gardener soon becomes a little botanist. In his rambles he becomes interested in birds and insects, and so begins the study of natural history. Pebbles, bowlders and river-terraces have their stories to tell, and in listening to them he becomes a geologist. Sitting in winter before the blazing coals, he likes to hear something of the wonderful coal forests, and if no fossils are at hand, to see pictures of the fern-impressions, the sculptured lepidodendrons and sigillarids, and strange animals of those gloomy tropical swamps. A bit of marble possesses new interest to him when he knows it was once alive. He laughs to hear the long names that scientists have given to the great sea-monsters of the fifth day of creation, and has no difficulty in remembering them.

"I wish I had brought my microscope," said a little boy, looking at a flower one day last week. He knew there was a great deal in a flower that his eyes could not see. The same far-looking instinct may lead us away from living flowers to the fields of history, art and literature in which they have had their part. Kings have always surrounded their palaces with gardens, and heroes and poets have been crowned with myrtle and laurel. There was never a banquet without flowers. They have always been a social necessity. In battle they have marked contending armies. When Napoleon returned from Elba, all France wore violets. The Irishman loves the shamrock, the Scotchman the thistle, and proud is the story of the fleur-de-lis, the white lily of France, presented by an angel to Clovis at his baptism. A line of English monarchs is said to have derived its name from the broom plant, *planta genista*, used in penance by an ancestor.

Fascinating to the flower-loving child—who is usually himself a tasteful builder—is architecture, with its order, symmetry, its manifold transformations of the most obdurate materials, and the transfusion through all of a subtle element in life. Long stories may be told over the engravings of Karnak and its lotus columns; over the acanthus-wreathed temples of the Greeks and the doors of cedar, the gold and silver leaves, the sculptured lilies and pomegranates of the Jewish temple. Moorish architects wrought delicately in leaves and flowers, and the grand Gothic builders, in the expression of religious faith and aspiration, sought all their designs in nature, as if they had the feeling of the Swedish poet Tegner: "We thank Thee, O God, that we are permitted to think thy thoughts after thee."

There is no literature without flowers. Many of our words have been suggested by plant-life, and writers are lovers of flowers. Chaucer loved best the blooming month of May. Spencer sang,

"Strew me the ground with daffodowndillies,
And cowslips, and kingcups and loved lilies."

The daisy, the cowslip, the daffodil, the lily and the rose have been sung over and over again by the English poets, and not a voice among them all would we like to miss. Sweet peas and poppies have not been forgotten. All the dear common flowers have their places in our literature. Every one is familiar with the

"Flowers purple, blue, and white,
Like sapphire, pearl and rich embroidery,"

that grace the wisdom of Shakespeare, and adorn the stately verse of Milton.

Cowper, who lived very near to nature, has given warmth and color to one of his winter poems by a few lines on the brilliant summer flowers, that were missed from the landscape.

There are sweet flower-passages from the Lake poets. Mrs. Browning writes of

"A thousand flowers each seeming one
That learnt by gazing on the sun
To counterfeit his shining."

Tennyson so loves the violet that he can find it in the dark. With the rose and the lily, it blooms beneath the cypress shade of "In Memoriam." He associates a beautiful truth with the thistle.

"Not once or twice in our rough island-story,
The path of duty was the way to glory.
He that walks it, only thirsting

For the right, and learns to deaden
  Love of self, before his journey closes,
He shall find the stubborn thistle bursting
Into glossy purples which outredden
  All voluptuous garden roses."

He seems to have embodied the universe in six lines.

"Flower in the crannied wall,
 I pluck you out of the crannies,
  Hold you here, root and all, in my hand,
  Little flower—but if I could understand
 What you are, root and all, and all in all,
 I should know what God and man is."

Shelley and Moore, Tennyson, Browning and Mary Howitt have written of the "light-enchanted sunflower." Here are three lines that can illumine a cloudy day:

"Miles and miles of golden green,
 Where the sunflowers blow
 In a solid glow."

The best American writers have said beautiful things of the flowers that grew in their mother's garden, or the wild-wood blossoms of their boyhood. Holmes loves morning-glories and damask roses, and Emerson the rhodora. Bryant wrote of the yellow violet in spring, and the fringed gentian in autumn. Whittier draws from field and forest beautiful lessons of faith and trust. Thoreau takes us into the heart of the woods. Mrs. Thaxter has given us a picture of the golden-rod with an ocean background.

"Graceful, tossing plume of glowing gold
  Waving lonely on the rocky ledge;
Leaning seaward, lovely to behold,
  Clinging to the high cliffs' ragged edge."

There is a sweetness in Longfellow's allusions that is almost better than the flowers themselves. Hawthorne added beauty to whatever he touched. We all remember the scarlet flowering-beans in the old Pyncheon garden, and Phoebe's crimson rose that, for a moment, brought back his youth to the sad ruin of a man. Nothing can be more charming than the description of his garden at the Old Manse, and the cardinal flowers and pond lilies along the Concord river.

In our churches we still preserve a relic of the ancient floral offerings. Religion has been associated with flowers in sacrifices, in decorations, in emblems, and in the words of divine teachers. The prophets often borrowed their imagery from the vine, the oak, the olive, the fir and the cedar. Daniel walked beneath the Hanging Gardens of Babylon. He who said, "Suffer little children to come unto me," gave from the fields the parables of the fig-tree, the mustard seed and the sower. Looking up from the blossoms at his feet into the faces of his disciples, he said, "Consider the lilies how they grow; they toil not, neither do they spin." "If God so clothe the grass of the field, which to-day is, and to-morrow is cast into the oven, shall he not much more clothe you, O ye of little faith?" Paul taught the resurrection to the refined Corinthians under the figure of the sowing of a seed, and the beloved disciple saw in the vision on Patmos, "the tree of life, which bare twelve manner of fruits, and yielded her fruit every month: and the leaves of the tree were for the healing of the nations."

Our race was born in a garden, "to keep and to dress it." We are making a garden of the world, and to paradise, the garden of God, we are destined.

To his inheritance in the world's wealth of thought, and to a true, ever-radiating life, I know of no better introduction for the child, than his own little garden.

After the reading of this essay a fine musical selection was rendered by a male quartette, consisting of Prof. George C. Purington, Rev. C. H. Pope, Mr. C. A. Allen and Mr. H. H. Rice. Following this a sketch showing the influence of flowers in the home, written by Mrs. Addie S. B. Weston, was, in her absence, read by Mrs. Love N. Ames of Farmington.

INFLUENCE OF FLOWERS IN THE HOME.

By Mrs. Addie S. B. Weston.

"Were I in churchless solitudes remaining,
Far from all voice of teachers and divines,
My soul would find, in flowers of God's ordaining,
Priests, sermons, shrines!"

Deacon John Thompson owned the largest orchard of small fruits and the most beautiful flower garden in town. Every one admitted that, and also, that it was all the work of his wide-awake, ambitious daughter, Huldah, who had brought about this desirable transformation within the once neglected, old garden, with its rows of straggling currant bushes and rank stretches of parsley weeds and witch grass.

Huldah's influence, Huldah's orders and Huldah's strong, willing hands had brought it all about, the beds of bright flowers, the mats of strawberry vines, the pretty bordered walks and rows upon rows of thrifty young fruit trees—plum and apple and cherry, which black knot and curculio pests vainly tried to molest.

The south end of the Thompson garden skirted the road that wound over and around the hills that lay between two country villages; but the white pickets of its high, trim fence could not shut out from the view of passers-by, the beautiful blossoms and vines and ripening clusters of fruit therein.

"Huldah's garden is a living reproach to me, because we haven't a bit of a flower patch at our house;" or, "I never see Huldah's garden but I am tempted to lay out grounds just like it for our women folks;" or, "When I'm grown up, I'll have just such a garden as Huldah's, see if I don't! Flowers and berries and grapes and plums.—grists of 'em to eat and give away just as Huldah does; see if I don't!" were the thoughts that the beautiful, thrifty garden, with its wealth of color and fragrance, lying close to the country roadside, set stirring in the minds of old and young passers-by.

Voiceless yet earnest sermons are such grounds, waking into life warm inspirations and ambitions in those who will notice them, to go and do likewise. Who of us would dare measure the length and breadth of the influence such a garden carries, especially with the little children who longingly peer through the pickets, or, when permission is given, go eagerly tip-toeing along its walks, gazing with admiration and keen interest on this and that flower and plant, and stowing away in the active, retentive mind earnest resolutions and purposes to have just such beautiful blossoms and fruit and neatly kept flower beds and walks, when that long dallying ship comes in—"when I am grown up."

Little Edith Quint, on her way to and from school, always stopped to run to Huldah Thompson's garden fence, to peer through its pickets and take note of the opening flowers and ripening fruit.

Rain or sunshine, it was the same, and Huldah often gave the little girl, who so eagerly watched her at her work, whether it was picking luscious fruit or weeding garden paths, handfuls of bright blossoms and red ripe berries. But to give her a budded cutting or a flower root she had not thought to do, not knowing but that the child had an abundance of such plants in her own home.

But Edith had not. Her mother had never tolerated even one house plant, because "they are nothing but weeds, anyway," she declared, "darkening the windows and littering the house." And Edith's father as stoutly opposed an out-door flower garden, because "good land that would grow potatoes and corn shouldn't be thrown away on a mess of prosy weeds!"

Acres and acres of land Edith's father had in his homestead farm; land enough to grow all the corn and carrots and cabbages he cared to raise; time enough to set onions and plant fodder corn and kidney-eyed beans, even to the sill of the house door that opened into the back garden, but no room or time to be given to the dear flowers whose fragrance and beauty helps so much in making life cheery.

So the Quints' front yard had grown up to briers and sapling lilacs and rank witch grass, slowly choking out the life of the brave, old snowball bush and peony roots that a busy house mother, years before, had taken from her butter-making and dish-washing to plant; but, now, for thirty years, the witch grass and the lilac sprouts had had their own way, and the old flowering plants, after such a brave but bootless struggle, had succumbed and all that remained of Grandma Quint's flower garden was a rank swamp in one corner of "Bouncing Bet" and "Butter and eggs." *They* wouldn't die.

"Please, Miss Huldah, please may I have just one of these pretty plants you have piled against the fence?" a child's shrill voice piped one October morning, and looking up, Huldah saw Edith's round face peeping through the pickets, while she eagerly pointed to a heap of thrifty petunia plants that she had uprooted for lack of garden room, and that they might not sow the ground with ripened seeds. The topmost plant on the rubbish heap she had piled for removal—seedling though it was—had put out a single bright crimson blossom, with plenty of buds promising more.

"It's such a pretty little red trumpet of a flower, and you've thrown it away: please, Miss Huldah, may I have it?"

"Bless you, dear child, yes. Just so many of the plants as you like." And the rejected petunia with its root ball of earth and healthy, green top crowned with a flaring, flaunting, crimson blossom, was carefully lifted, wrapped in damp moss, and given into the eager, up-stretched hands of the little girl.

She scampered home with her prize as fast as her little, racing feet could carry her. When she reached the shed door, she hid the brown parcel under its sill and went foraging round for an old tomato can she had seen in the rubbish of the back yard.

When Mrs. Quint laid down her sewing that October afternoon, and went into her kitchen to prepare tea, what do you think she found cosily perched on the broad ledge of its south window? A thrifty petunia plant nodding its green leaves, and saucily leveling two crimson flower trumpets at her, as though heralding: "We've come, and we've come to stay!"

And stay they did, and hundreds of other blotched and mottled and striped and streaked and clouded blossoms that put out through the long, cold winter their crimson and white flaring flower lips on that sporting petunia, that seemed trying for the very fun of the thing, to throw out as many strange markings and shadings of color in its flower blossoms as possible.

"It's clean, Isaac; there isn't a bug or a spider on it from root to top, and Edith has set her heart on having the plant this winter; supposing we keep the thing?"

"Well, then, keep it; keep the posy weed for all I care!" was the ungracious welcome Edith's parents gave the little seedling, whose mission was to brighten their home and whose influence would be felt through more than one generation.

The petunia grew as petunias will when given the right soil and atmosphere and a sunny south window over which it can throw its green arms, clambering right and left as it goes up, up, covered with scores of bright blossoms. Mrs. Quint thought well of the plant when she saw passers-by turn their heads to get a long, full view of her window with its beautiful curtain of crimson and white and green, and heard exclamations of admiration and covetousness from her neighbors. She thought still better of it when ladies from town called to beg slips of her sporting petunia, that came out with new markings of blotch and stripe with every flower opening; so odd and rare, that even Judge Davenport's wife drove out to ask for a cutting from her plant.

"I don't know whether it's the rinse water I give it, or the hot steam from my bilin' dinner pots, or, maybe, it's the winter sunshine that makes our petunia blow and grow so, but grow and blow it will," Mrs. Quint said complacently, as she snipped generous cuttings, here and there, from the plant for her distinguished guest.

Edith overheard that—"*our* petunia." It used to be "that thing," and "*your* posy weed," and she knew that house plants had come to their house to stay. Slips of ivy, rare geraniums, begonias and a host of other plants were brought and offered in exchange for those of Mrs. Quint's petunia. She could not well refuse them, and Edith had such a "knack" of getting them to root and thriftily growing in her pretty papered and netted cans and disabled crockery, almost before she knew it, Mrs. Quint had her window ledge full of plants, and was just as eager and ambitious as any of her neighbors to have the best variety of house plants in the community.

Some one has said that when a woman takes a new tack. she never goes it by halves, and Edith's mother was no exception. She subscribed for a leading floral magazine that she might wage war against red spiders and rose bugs, plant lice and scales, understandingly and with sure destruction. Indeed, she became such an authority on the subject of insect extermination, and in the ready recognition and correct naming of rare plants, by the help of her well studied journal, she became a subscriber to other standard floral and agricultural periodicals, that she might keep fully posted and her reputation might not suffer from any mistakes.

Edith and her brothers also read this new literature that had come into their home, and enjoyed it. Wide-awake growing boys will read something, and if interesting. pure matter is not furnished them they are apt to turn to that which is entertaining and unclean, thus staining their minds and hearts. The Quint boys were just at that age when yellow-covered, "blood and thunder" literature creeps in. but their mother's beautiful floral magazines and fresh, breezy journals, coming into their home every week or month, headed it off and filled their minds with a real love and zeal for better things. The clean, bright pages illustrated the making of rustic shelves and seats, hanging baskets and other ingenious designs. The boys read, thought, planned, whittled, sawed and hammered, and pretty brackets, rustic trellises and swinging plant rests, "just like those in mother's book," grew under their busy hands, all helping in the good work of making home beautiful and the children happy and contented in it.

One article on "Window Shelves" sent them clattering round in the garret, till they had unearthed from a pile of rubbish two old bedstead head boards of bird's-eye maple, richly stained with age and past all warping with their seventy years of seasoning under that same house roof. The boards were cut down to the right length and width, and mounted on stout, iron brackets before upper lights of a south window. When Edith's thrifty seedlings and clambering vines had been placed on them, filling the window from sill to top with beauty, and the neighbors came in to admire and approve with hearty words, there wasn't a woman amongst them but that went home to forage over her own attic in search of an old, disabled head-board of oak or cherry wood, to oil and polish for a plant shelf.

These same live floricultural papers, full of breezy instruction, opened the eyes of the Quint children to the possibilities coming from odd, beautiful growths in their father's woods—moss-grown old knolls, richly stained half circle shelves of fungus formation, queer knots and quirls of deformed limbs and the twisting, coiling stems of the bitter-sweet vine. In the search for such growths, they woke to new interests in the fields and woods.

An out-door flower garden followed naturally and readily in the wake of Edith's house plants. Geraniums need good bedding through the summer months, drooping coleus and roses quickly take on leaves and hardiness when given a foothold in out-door soil, and they got it and they kept it in the Quint garden. Sods of witch grass were first broken in little patches, here and there, just to make room for the budding annual or brown bulb some friend had given, but not long was it before the sods between the patches were upturned, the soil cleared of grass roots and a goodly part of the wide old garden laid out in pretty flower beds with rows of thrifty fruit canes and vines, of which the boys had learned and been filled with ambition to raise, from careful reading of the healthy journals that now came into their home. The dimes and quarters which, doubtless, would have been exchanged for tobacco, had the Quint boys, when a little older, followed their father's example, were spent for choice varieties of fruits; and which, think you, was the wiser investment?

Years ago, we of the "Fifth Reader class" used to stand in a long row on the dingy boards of the school-room floor and repeat in concert, with more force than eloquence, Mary Howitt's beautiful poem:

> "God might have bade the earth bring forth
> Enough for great and small,
> The oak-tree and the cedar-tree,
> Without a flower at all."

Yes, God *might*, but glad and grateful are we that our Creator saw fit to give us, and so lavishly, beautiful flowers. With their help we may make our homes so full of cheeriness that the children will not be tempted from them by outside impure influences. Any resource within our reach that will help develop purity of thought, and recognition and love for God's beautiful creations in the hearts of our little children, is a resource we should not slight. Then, will any of us refuse to give in-door room and out-door room to these beautiful plants and blossoms that God gave

> "To comfort man,—to whisper hope,
> Whene'er his faith is dim,
> For whoso careth for the flowers
> Will care much more for Him"!

By birthright a little child loves bright things,—color, light, sunshine and gay flowers. How the little busy-bodies love to toddle round mamma's flower beds, snapping off the bright blossom heads till their aprons will hold no more, or till they are discovered in their mischief. How their sweet baby faces dimple with smiles, and the wee, dainty hands eagerly outstretch for the proffered gay blossom! What a pity to make of such beauty-loving little folks prosy, short-sighted men and women whose thoughts have grown so fearfully practical, that the sunshine to them means only so much growth or curing of their crops, and "daises and buttercups, sweet-wagging cowslips" and "brave marsh Mary-buds, rich and yellow" that star their meadows with golden blossoms, simply as desirable feed for their cows, whose "baitings thereon will insure gilt-edged butter!"

Snubbing, cramping and crushing every timid or brave effort that the children may make to bring a little beauty into their bare homes, may kill out, in time, the desire for anything outside the hard old ruts in which their fathers travelled so long. How much wiser to encourage everything in our children that tends to fill the busy brain with pure thoughts and so head off those that are bad! The culture of flowers will help. The sunnier, the happier our childhood's home, the stronger its influence for good over our after life. Do you believe the grown-up children, out in the world for themselves, will stray very far from their mother's teachings, when the sight or fragrance of flowers like hers cause a rush of memories so sweet and precious, there is a longing for home and her presence?

"I never see a bed of the lilies of the valley, or smell the breath of their spicy white bells," said a grey-bearded man who had made his home in a foreign clime, "but that I am carried back to my boyhood's home, with its plot of sweet lily sprays by the door, and memories of mother, her wise counsels, come fresh in mind, though she has been in Heaven this fifty years."

Knowing this, that every green cutting, or flower bulb or root that we may send out into the world, or give culture in our own home, may carry an influence for good long after we have done with earth, shall we not do all we can to secure foot-holds in every home within our reach for these plants, "Whose voiceless lips" are "living preachers, each cup a pulpit, every leaf a book?"

SECOND DAY. FORENOON.

The convention was called to order at 9.30 A. M., President Pope in the chair. The attendance was much larger than on the opening day; and the large display of fruit arranged on tables running the entire length of either side of the hall, formed an attractive feature. The first exercise was a paper by Mr. L. H. Blossom.

DEFECTS IN ORCHARD MANAGEMENT.

By Leander H. Blossom.

What are some of the chief defects in our present system of orchard management?

First and foremost, in starting an orchard that will in the future be an honor and a profit to the owner, it must be started right. And just here we are met with the question as to what is right. This point wants to be carefully studied, for if we make a mistake at the beginning it will be a mistake all through the life of that orchard. If the start is intelligently made then the success of the orchard is, generally speaking, assured.

LOCATION.

For a moment let us look at the best location for an orchard. What is it? Why a north or a westerly cant. Why? First, because the land on the north or west cant is less liable to a drouth than land on a southerly cant. Second, an orchard on a northerly cant is far less liable to winter kill than one on a southerly cant. In fact, I have never seen an orchard planted on the north cant, no matter how bleak and exposed the situation, but the trees were sure to winter all right.

How often do we see, in riding through the country, an orchard planted on the south side of some high hill. The orchard has been planted in the best manner, all the care and attention that are possible had been given to the orchard, the land had been highly enriched, the soil thoroughly pulverized, in fact everything had been done to make it a model orchard. It was just getting well into bearing, and soon would have been a source of profit as well as pleasure to the owner, when lo! and behold, he awoke one fine spring morning to find that his trees were nearly all winter killed. A sudden cold wave had come down on them in March, after a long spell of very warm weather, and in one short night that beautiful orchard was ruined. Brother orchardists, let us take a lesson from this, not to plant on a south cant, no matter what the inducements may be.

Again, what shall be the height of our trees, from the ground to the limbs; or in other words, shall we have a high-headed, or a low-headed tree? Both have their advantages and disadvantages. Long-bodied trees will admit of working around them with a team better than low ones, but they are more exposed to the winds than the low trees, the trunks are more exposed to the burning suns of summer, thus causing sun-scald, than low ones. I think the tendency with too many of our farmers is for the high-headed tree. I think many times they come from the nursery trimmed too high.

DRAINAGE.

Another mistake is in the proper drainage of orchards. Let us remember the old saying that "what is worth doing at all is worth doing well." This applies more especially to the orchard not only in the preparation of the soil but in the drainage. I believe we should drain deeper for an orchard than for any other crop. I recollect draining a part of one of my orchards one fall. The trees in that part of the orchard had never seemed to thrive and grow as well as I wanted them to, so I put an underdrain between every row of trees, digging the drain three feet deep; and the next summer it was surprising to see the change in the trees on the drained land, over those on the undrained land. The foliage was of a darker hue, the trees made a better growth, looked healthier, came into bearing younger and bore better, in fact, were better in every respect and have already paid the cost of drainage.

I believe almost any soil is better for being drained, especially if we intend to plant an orchard upon it.

PRUNING.

Perhaps a few words in regard to pruning at time of transplanting may not be out of place just here.

My rule has been to prune the top in proportion to the amount of roots cut off at the time of digging, thus preserving the natural balance of the tree. Should the roots be dry, cut the top out rather more. In pruning at this time I prefer to cut out all unnecessary branches; then, if the tree needs any more pruning, I cut back those that have grown the most. This will probably be all the pruning necessary.

I prefer this mode of pruning to that of cutting the top back, as is practiced by many at time of planting, as it makes less wounds to heal over. Now, don't think that this is all the pruning that your trees will need; you must prune every year, so that when your trees come into bearing you will have no trouble in passing through the tops of your trees to gather the fruit.

How many have not had their clothes as well as their patience most sorely tried, in crawling through the tops of their trees after the fruit; and when they got it, it was of a poorer quality both in flavor and color—for certainly an apple grown in the shade is not to be compared for a moment with one grown in the sun. While the well-ripened apple fills all the demands of the market, the poor, unripened, shade-grown fruit is neither fit for the market nor for home use. Brothers, let your light shine—let in a little more sunlight.

I worked for a Lewiston firm some four weeks this winter, packing apples for the foreign market, and I have about come to the conclusion that I could tell what kind of a farmer a man was by his fruit. If his apples were large, smooth and handsome, free from worms and bruises, I put him down as a good farmer. If, on the other hand, his apples were small, pale in color, poor in quality and all covered with dents and bruises, I marked him down as a poor farmer. While in the first case the apples were mostly No. 1's, in the second case about half would be No. 2's In the first case there was a profit, in the second a loss. The first man would tell you that orcharding paid, the second, or No. 2 man, would tell you there is no money in the business. But I am sorry to say that we have too many like the second man in every town and neighborhood in the State. We find them everywhere. No, not everywhere—they are never found at the Pomological meetings, for they can't get time to go; "it don't pay."

TOO MANY VARIETIES.

One more suggestion, and then I am done. That is in regard to the multiplicity of varieties. It is certainly one of the greatest evils that can befall the orchardist to grow too many sorts. I noticed in my work this winter where there were twenty-barrel lots, ten of them would be Baldwins, the other ten would comprise from eight to ten different varieties. Now, all the profit in that lot of apples was in the first ten barrels.

And now, if in preparing this paper, I have offered one thought or suggestion that will be of any benefit to any one here present, I shall feel well repaid for preparing the same.

The following essay was then read by Mr. D. H. Knowlton of Farmington, Treasurer of the Society.

NOTIONS—POMOLOGICAL AND OTHERWISE.

By D. H. Knowlton.

Several influences have been at work in Maine during the last thirty years, which have resulted in largely developing our fruit productions. Previous to that time there were many notable failures in certain lines of fruit culture, but true, earnest pomologists had established the fact that Maine possessed certain natural conditions of soil and climate, particularly favorable for the production of the very best fruit. This fact was believed by many, previous to that time, but somehow the farmers generally did not imagine that their own farms were adapted to the production of fruit. Nor did they realize that fruit growing for the market would ever become a very important feature of our agricultural industries. Our natural conditions having been found to be favorable, the work began. There was much to do, for although the conditions referred to were favorable, there was little knowledge of varieties and their adaptation to these conditions. The State Board of Agriculture, through the medium of its excellent reports, was one of the earliest organized efforts to promote the interest of fruit growing. Several local societies were organized and by their public discussions were very valuable aids to the farmers among whom they were held. It was about this time the Maine Pomological and Horticultural Society was organized. It numbered among its members some of the most successful fruit growers in the State, and during its existence rendered most valuable service to the State. For some reason the Society ceased to exist and its records were lost, after a few years of active work. It was not till 1873 that the Maine State Pomological Society was organized and fully equipped for active duties. Under the leadership of Secretary Gilbert, its first president, the Society entered upon its career of usefulness. Since that time it has held annual exhibitions and annual winter meetings without interruption. In hastily examining the reports of the Society during these years I recognize the unselfish work of those who identified themselves with it. Our State is large in area and the climatic conditions vary greatly in different parts, and many fruits thriving in York County would perish in Aroostook snows. The published reports show what has been done by the Society from year to year. The ground covered by the doings of the Society may be summarized under four general heads, *culture*, *varieties*, *marketing* and *esthetics*.

THE CULTURE AS TREATED IN THESE REPORTS.

In many parts continuous cropping has exhausted them of those elements essential to the growing of the best fruit. The raising of good stock from the seed, the preparation of the soil for setting, the fertilizing, the pruning, the protection of the trees from mice, the borers and other enemies, these and other matters connected with the culture of fruits of all kinds may be found in these reports. It was a notion of our fathers that only the most valuable tillage land was adapted to orcharding, but the teaching of Maine fruit growers today leads us to the conclusion that upon a large part of our rocky hillsides apples of the best quality may be raised. Moreover, that when raised in these localities the fruit is much less annoyed by insects, while the trees are hardier from their exposure, the fruit more highly colored and having far better keeping qualities than apples growing in more sheltered spots. This fact is an important one, for a knowledge of it enables the farmer to retain for tillage the land best adapted to it.

There are several notable instances in Franklin County where individual farmers have increased the value of their farms by orcharding, and to a few of these I invite your attention:

On a rocky side-hill with northwesterly slope, in the town of Chesterville, is a tract of land covered with fruit trees, some 4,000 in number. The hill is so steep and the outcropping boulders so large and plenty that a man can hardly drive a sheep among them. Mr. Whittier in his excellent paper has told you how much he paid for this tract of land. Sixteen hundred barrels of apples on paper does not look very large, but when these apples put $3,000 into the farmer's pocket-book, there is a substantial commercial value in orcharding. This is about what these trees have done the past three years. Many of them have not come into bearing yet and they are all young. Upon our exhibition tables Mr. Whittier has kindly placed an exhibit of his evaporated apples, from which he tells you he has netted this year over $1,000. Doesn't this evaporated fruit suggest to you that our fruit has a market value not yet appreciated by our farmers? There is no danger that evaporated apples like these will not sell for a fancy price, and Mr. Whittier has no monopoly in their production.

Some twelve years ago, Mr. Nelson Libby purchased seventeen acres of land in the town of Temple, upon which a gentleman had set a fine lot of apple trees. A set of ordinary farm buildings was erected, and twenty-five acres of pasture land was purchased upon the other side of the highway. The first purchase cost $500. A little over a year ago he was offered $5000 for his fruit farm, and he was unwilling to sell for less than $7000. The past three years this orchard has averaged some over 600 barrels each year; besides, the last year he raised over 100 bushels of pears. The pasture land, I will add, is just as good for orcharding as the orchard itself.

In the northern part of Phillips, Mr. Silas M. King & Son have developed a fine fruit farm. A meadow has been converted into a cranberry bed, where as fine berries are grown as anywhere in Maine. Apples, pears, plums and grapes here thrive wonderfully well, and yet the entire farm without the fruit planted upon it would be worth no more than pasturage or timber land in the same locality.

Last spring, Hon. R. P. Thompson & Son of Jay purchased an upland farm for about $2500. The farm cuts some thirty tons of hay, and is well divided into tillage and wood land. The original owner set in one pasture 300 native apple trees, and set them to Baldwins. This man, strange as it may seem, is driving a truck team in one of our cities. But the orchard this year produced some over 300 bushels of marketable apples. After fencing the lot, pruning and mulching the trees for an undivided half of the orchard, a reliable party offered one-half the price paid for the entire farm only a few months earlier. Thus it is, thousands of acres of our rocky, unprofitable hillsides could be economically converted into profit-paying orchards. All it needs is the intelligent, wide-awake farmer to take advantage of the situation. There are others here who have made equally as good records as those referred to, but enough to show how orcharding enhances the value of these lands has been said.

BEST VARIETIES DETERMINED BY EXPERIENCE.

There are thousands of varieties of apples and pears, known and described in Downing's great work on "Fruit and Fruit Trees of America." Strange as it may seem, a large part of the trees planted in Maine have been grown in nurseries outside of the State, and sold to our farmers by the tree agent. The model tree agent, as you all know, is a well-dressed gentleman of fluent speech, and, equipped with his beautifully-colored plates of fruit, he has been known, even in our own county, to sell crab apple trees by the dozen to a single farmer. The best fruit growers in the State have long ago learned that many of the apples known to be good in New York State, and farther south, are worthless here in Maine; and the words of these fruit growers recorded in the reports of the Society, have kept many a man from buying inferior varieties. I remember attending an exhibition of fruit not long since where our friend Bennoch had a remarkably fine display of apples consisting of 114 named varieties. I asked him how many were of value in Maine, and he replied, "Not more than a dozen." The Society has repeatedly said to the farmers of Maine, "too many varieties for profit." At the same time it has encouraged people to provide for home use the best they could raise. The other day one of our farmers told me he sent to a nurseryman for a hundred Tompkins King stock for his orchard; the nurseryman wrote him back advising him to set a different variety, but one which has no market reputation at all, while the King is near the highest in the markets. The fruit growers of Maine who have read and studied the doings of our Society, or who have attended its meetings, know better than to plant new and untried varieties for profit. The frequent fruit lists published by the Society are of great value to our fruit interests, and show what fruits are successful in Maine. My own notion is that we should revise this annually, and if the catalogue could be classified under such titles as "Apples for Family Use," "Apples for Market," etc., it would aid some of us very much in understanding more fully the facts we want to learn from it.

A lecture recently delivered before the Massachusetts Horticultural Society on the "Degeneracy of Fruit and Vegetables" said upon this subject:

"Pears are comparatively short-lived in southern climates, and varieties imported from France to this country are not as a rule long-lived. Grafting the pear tends to shorten the life and impair the vigor of any variety, and since all varieties are multiplied in this way, it becomes a question of time as to how long any variety can be expected to live. Fifty or sixty years ago the St. Michael was justly esteemed the best pear grown ; it is now entirely abandoned. The Flemish Beauty is another excellent pear of twenty or thirty years ago, but is fast going out of use.

In 1838 Mr. Wm Kenrick published a list of twelve old varieties of pears, none of which are grown to-day ; and eighty-seven new kinds, of which seventeen are now occasionally seen, four of these still survive as valuable pears, the Bartlett, Bosc, Seckel and Duchess. In 1839 Mr. W. R. Prince of Flushing, L. I., published a list of three hundred and sixty-seven varieties of pears ; of these thirteen now survive. There have been many hundreds of new varieties imported since then, of which less than twenty are retained as worth cultivation ; many of these, of course, were rejected for various other reasons, but many would still be in cultivation, if they were not degenerated.

Of sixty varieties of apples cultivated fifty years ago, forty now remain. Among good varieties that have failed recently, are the Early Harvest and Newtown Pippin, but the Rhode Island Greening is as good now as one hundred and fifty years ago, and in England the Costard has been a favorite apple since the thirteenth century.

Cherries and plums do not seem to degenerate at all ; the same varieties are grown now that were well known one hundred years ago, and are quite as good as ever.

The strawberry, however, seems not to be a long-lived fruit. At best it seldom exceeds thirty years in valuable condition, with the single exception of the Alpine variety, which seems as good as ever. Of those popular now, most are new kinds, very few are over twenty years old. Currants are all long-lived, and the old kinds seem as good as ever."

This affords another illustration of the importance of our work to the people of the State. Every man cannot afford to spend his time and energies in ascertaining the value of individual fruits. Life is too busy and too short for this, and there is no need of it ; for from year to year, as we meet together, the papers and discussions before the Society are very likely to point out the defects of varieties, as well as to bring before the public the value of the new ones. In this matter the experience of successful fruit growers may be accepted as a safe guide in the selection of new stock for replacing the old, or in setting out new orchards and gardens.

MARKETING THE FRUIT CROP AN IMPORTANT QUESTION.

Not many years ago the apple growers in Maine who were fortunate enough to have a few apples for sale took them to the village store in bags and baskets, but now so great has the country become in the production of apples that Maine fruit not only goes from State to State in search of consumers, but in immense quantities is shipped by ocean steamers to foreign marts. The apples have to be properly picked, sorted and packed if they are to sell for the highest prices. Only a few years since an apple grower not a thousand miles from here sent some laborers to gather his fruit. You ought to have seen them do it. A long pole was used to beat the apples from the limbs they could not reach and in this bruised condition the apples were put into barrels and placed upon the market. Another man handled his apples as carefully as he would a nest of fresh-laid eggs, and for his trouble received nearly a dollar extra on each barrel he sold. Both men were raising apples for profit, too. The supply of barrels is another matter often discussed at our meetings. The time has come when Maine needs more flour barrels than its people can empty during the year. During the fall an apple buyer said he had a car-load of barrels shipped from Boston to his railroad station, on which the freight was fifteen cents per barrel. On investigating the matter it was found the Boston and Maine Railroad received four cents of this amount and our enterprising Maine Central the balance. More barrels were needed from the same source and a special rate was secured after a good deal of difficulty—but even then the Maine Central got the lion's share, for it carried the barrels a less distance and received six cents and the Boston and Maine the same as before. This, too, for empty barrels that must go back over the road again when filled. It may be time for us to say something as a Society upon this matter of freights. Again, I notice that it costs one-half as much to send a barrel of apples from here to Boston as it costs to send them from that point by steamer across the ocean. So rapidly are our fruit-growing interests increasing that all these matters connected with marketing should receive in the future even more careful consideration than the Society has given them in the past. At several points in Maine parties are making barrels for orchardists and some are making their own. This is likely to become still more important in the future as there is greater demand for shipping purposes.

THE ESTHETIC WORK OF THE SOCIETY.

Thus far at all the exhibitions of the Society it has been my privilege to attend, the fruits and flowers have been well displayed. Several exhibitions of the Society have been especially fine in this respect. The influence of a beautiful array of fruits and flowers is far-reaching, especially when visited by thousands from different parts of the State. I do not think we spend quite enough now, however, in this direction. I have visited exhibitions of fruit that were massed together in such a rough-and-tumble way that no good impression whatever was left. There are many smaller exhibitions of fruit in the State and ours can but make its impress upon them, particularly when it is notably attractive. The esthetic idea does not end here, for upon hundreds of tables in our State, could we look in upon them, we should see fruits more attractively arranged and more invitingly served. Then, again, the flowers are carefully studied and every new design of floral beauty is remembered by hundreds of flower-loving people, and who does not love and enjoy flowers when in their innocent beauty they tastefully adorn our homes? Let us continue this good work by making our exhibitions more esthetic in their arrangement, while in our winter meetings we may be able to do in the same direction even more than we have done in the past.

EDUCATIONAL WORK OF OUR AGRICULTURAL ORGANIZATIONS.

This leads me to suggest several ways in which we may increase our usefulness in the State, in fact I am not quite sure but it is our duty to do very much more than we are doing. I have endeavored to show that our Society in its work is a public educator in the State and country. It is well for us to recognize our attitude towards the public in this respect, and to the extent we may have influence call to our aid the other organizations and institutions in the State. It is encouraging to note that there is a demand among our more intelligent people that our agricultural organizations shall become more useful by more fully occupying their respective fields of labor. The Board of Agriculture being at the head of all these bodies should always be in advance of them. The Board is doing a good work but we should like to see it do better. Perhaps it may be visionary but we maintain that every farmers' institute should be a model of excellence, that the programme should be so made up and advertised that the farmers and others in the locality where held will anticipate the pleasure of attending the meetings, knowing from previous announcements that they will be of a high order. If this cannot be done with the present appropriation, would it not be better to hold less institutes and make them of a higher order?

I notice with satisfaction the talk made in and about our Legislature relative to making it the duty of the agricultural societies to do more educational work for the farmers. Some of them do too much educational work now but it is not the right kind. From some cause, many immoral features seem to have entrenched themselves within the exhibition grounds and halls. It is difficult to remove them and put something better in their place. There has been great progress, however, and it is with special satisfaction that I have noted the improvements in the Maine State Fair. The evils are not all gone yet, but we believe the future will see still less of them.

FARMERS' MEETINGS DURING THE FAIRS.

For several years there has been more or less talk about farmers' meetings on the fair ground during the exhibition, but as yet I have not known of any body of farmers who cared to hold such meetings in the open air, especially when surrounded by bawling medicine men and hawkers. The idea, however, of such meetings is a good one and if a suitable place was provided for the purpose, say a wing of the exhibition building parted off and furnished with comfortable seats and lights, there would be no difficulty in holding such gatherings. The State Society would require it one or more evenings, the Pomological Society could arrange a programme for another evening. There are several other State organizations such as the Bee Keepers' Association, the Stock Breeders' Association, the Patrons of Husbandry, the Board of Agriculture and others,—enough in fact in a few years, by holding single meetings each, to have something of public interest transpiring during the entire fair. The annual business of these various organizations could be more cheaply transacted during the State Fair than at any other time, papers could be read, discussions introduced, and a vast amount of agricultural information could be imparted to the public. The horse trots and other attractions outside the building might draw the crowds, the Lewiston *Journal* might have to issue a larger paper and employ a few extra reporters, but I see nothing so far as the interests of the State Agricultural Society and the public are concerned that would not make these annual gatherings within the Society's grounds more popular and vastly more educational. I have read the doings of various national gatherings during the American Fat Stock Shows in Chicago. Can any one doubt the value of the work done by them? So potent are they that the direct influence of these meetings is felt from the Atlantic to the Pacific, on the Maine farm, the western cattle ranche and even in the halls of Congress.

SOME ONE NEAR TO EXPLAIN.

The exhibits may be made more instructive in many instances, if there could be some one near at hand familiar with them to explain them to the crowd. One of the most valuable exhibits of the last fair in Lewiston was a fine display of the various ingredients of which commercial fertilizers are made. The exhibit was made by our State College at Orono, and had there been at hand a professor or a corps of students to have explained to the farmers the exhibit in detail, it would have been an excellent advertisement for the College and a grand opportunity of helping the farmers. This is no more than one of our western agricultural colleges is doing. We can do a little more in our department in the same way, though I think exhibitors for various reasons are likely to be found near their own fruits a large part of the time, and so far as it has been my privilege to meet them they are always ready to give any information in their power.

MORE AGRICULTURAL TEACHING NEEDED.

The larger part of our people are engaged in agricultural pursuits, and it is a lamentable fact in view of this to know how little agricultural teaching is done in the public schools. There are studies with reference to future industrial pursuits, but agriculture is not among them. There would be no difficulty in introducing the study of natural history, which would include our domestic animals, the birds, reptiles and insects. Among these are found the enemies to fruit culture, and their habits once learned in the school-room would the more easily enable future generations to prevent or in a measure control their ravages. Children are naturally very fond of flowers, and will enjoy their study. This study carried a little further covers the entire production of the soil. It would help the farmer and the fruit grower alike, besides, the knowledge of plant life would always be a source of pleasure and satisfaction to its possessor.

ARBOR DAY AND ITS OBSERVANCE.

I like very much the idea of an Arbor Day in Maine, not that I have any great fear from the depletion of our forests during the present generation. For, aside from their destruction by fire, I think there is no great depletion in them not fully made good by growth from year to year. It may be that in our southern counties it is not true: it may not be true in Aroostook County, but in most others I think it is. The doctrine of protection here, however, is a good one, and I believe there should be no unnecessary waste of our forest trees. Arbor Day, however, has immediately rather to do with the beautifying of our homes and our public places, and as such ought to be generally observed. Suppose our school teachers should plan for Arbor Day, and set a few trees about the play grounds. The old school-houses would not look quite so lonely, and the new ones would be less conspicuous in their nakedness. A very interesting programme could be made up, giving all the boys and girls a chance to take some part. A little care should be exercised in setting the trees so as to secure the best effects possible. The outlook, if there happens to be one from the school-room, should not be obstructed. A clump of evergreens in the corners, and sometimes elsewhere about the premises, is far more beautiful than long rows of deciduous trees. They should not be planted so as to shut out the sunlight, for this we all need to make our rooms light, pleasant and healthful. There is one tree we rarely see in Maine as an ornamental tree, and yet there is none more graceful or more easily grown. It bears pruning well and may be grown successfully singly, in clumps or in hedges. The hemlock, *Tsuga Canadensis*, deserves a place among our ornamental shade trees, and we are glad to notice that gardeners are using it more. Its beauty is not alone during the summer months, but all the year. The poet says:

> "O hemlock tree! O hemlock tree! faithful are thy branches!
> Green not alone in summer time.
> But in the winter's frost and rime!"

There is a custom here of which I do not know the origin, but I think it is entirely wrong. Before setting out the sugar maple, which is one of the best shade trees, the top is cut back and only the side branches are allowed to grow. These limbs grow rapidly and in a few years it is found necessary to cut them off because they are too low. The wounds caused by this do not heal readily and in consequence many of the trees thus treated slowly decay. Reverse the order and trim off the low side branches and let the tree grow tall as it may It will make a graceful tree and grow to a ripe old age.

Yes, let us have Arbor Day, but let us observe it with public exercises by our schools and churches. And why not go further still and observe the day in planting trees about our homes, making the event notable in the family history by some social or literary gathering that shall give special interest to each tree as it is planted. There is not nearly enough of this sort of thing in the State, and we may profitably observe the day.

GIVE THE SCHOOLS A PREMIUM FOR FLORAL DISPLAY

One more recommendation and I am done. It was long a custom of Mr. James Vick, the well-known Rochester seedsman, to offer free all the flower seeds the school children would plant upon the school grounds. The idea was a beautiful one, but I never knew whether many or few seeds were called for. Few of our Maine school grounds, however, are cared for as they should be. It would be an easy matter to make them beautiful and attractive by devoting to them a little care. We have known a lady teacher to successfully handle a school containing a lot of unruly troublesome boys, by simply interesting them in making flower-beds in the school yard, where a few hardy annuals were planted. The flowers were well cared for by the boys, who during the school not only took special interest in them, but, as a matter of fact, became studious and cheerfully obedient to all the rules of the school. The flowers in the school yard did it, and this sweet influence is felt throughout the land where the cultivation of flowers is permitted, whether in public grounds or in the private garden of the humblest tiller of the soil. The cultivation of flowers should be encouraged still more by this Society, and I would recommend that one or more liberal premiums be offered to the schools in Maine that will make the best display of flowers grown by the children within the school grounds. It will not cost the Society much, and the influence would be permanent. I do not imagine there would be a crowd of competitors the first year or two, but in future years it would become more general.

Our various agricultural organizations are intended for the dissemination of knowledge among the people of the State. The public funds to a large extent maintain them, and it is time for a closer union among them. They have also the right to expect the aid of our public schools. The future development of our great natural resources must largely be the result of the combined educational work of all. There is no occasion for other than cordial feelings among these organizations. We must show the public that we are worthy teachers, that we are deserving of confidence, and convince the people, moreover, that our object is above all things to make true, useful men and women, by placing within their reach a knowledge of the means by which the goal is reached.

DISCUSSION.

The remainder of the forenoon was occupied with a discussion of the papers read, the main features of which are presented below:

Mr. T. M. Merrill, New Gloucester. Last year I had trees that were all matured and seemed to be full of apples, but when picked they would average only about half a bushel to a tree.

Mr D. H. Knowlton of Farmington. The King of Tompkins in this county, though not a very large bearer, produces an average crop as good and marketable as that of any other variety raised.

Mr. Merrill. It must be that the King of Tompkins does well, according to the amount of this variety exported. I would like to ask those who have grown this variety, how they regard it and what kind of fertilizer they use for the trees?

Mr. Atherton. I have had some experience in growing the King. I do not like the idea of pitching into anyone, but I sometimes get a misapprehension of the meaning of a writer, as I have the one who read the first essay. The trouble came when he laid considerable stress on planting trees on land sloping in certain direction, afterwards saying that under no considerations should an orchard be planted on a southerly cant. What is a man to do when he has no northern slope upon which to plant his trees? I want to say to such, don't be discouraged; plant on a southern slope and observe the rules and you can succeed. Some of our best orchards are planted on a southern or eastern slope. During one time I had the privilege of visiting the farm of T. B. Hunter He showed me an old orchard on a hillside, having a steep slope to the south, planted with native fruit, and the orchard succeeded well. There was something about it that made the fruit hardy. Then, take it in Hallowell. We have there nothing but southern slope, and we have splendid orchards of New York stock. Mr. G. H. Wingate from only one acre gets most gratifying results. From sixty to one hundred barrels are grown in his orchard and it is situated on a southern slope. Not far off is another orchard on the same slope, productive and healthy. While I agree with the writer that a northern slope is the best, I believe that other slopes will also do extremely well.

Drainage is an all-important feature in successful orcharding. When an orchardist doesn't have his orchard well drained he will have trouble from the effects of the snow in winter. If we haven't confidence in nursery stock grown outside of the State, let us grow our own trees and when they are first set out mulch them well and keep the frost under the mulching. When this is done they are better able to stand the thawing. I believe we ought to be interested in forestry. I remember of being at a meeting of the Board of Agriculture in Augusta and advocating forestry, but I was sat on by the fat member from Washington County. I have seen a good deal of danger to our forests. Farmers are exceedingly to blame in the matter of forests. How many are there among the farmers of the State who protect the forests? Not one out of ten ; I know that. They cut down the trees and let in the cattle, which is a most injurious practice. I have seen acres entirely ruined by having been browsed by cattle. It can't be done. I have seen where a forest was cut off forty years ago, now looks nicely from the very fact that no cattle were allowed to run in it. I endorse the appointment of Arbor Day as suggested by Ben : Perley Poore, and think it a subject well worthy of our consideration.

Mr. Nelson. I would like to know Mr. Blossom's reasons for prefering a northern cant.

Mr. Blossom. My reasons are that the trees are not so liable to winter-kill, and that all of our best orchards are planted on any other cant than a southern one. I don't say but what there are good orchards on other land.

Mr. Nelson. I fully agree with Mr. Blossom in the general points of his essay. There is one thing further, however, that he hasn't alluded to in relation to the Baldwin. On a northern slant they did not do as well as on a southern one. However, I think the best cant for an orchard is the barn-yard cant.

Mr. BLOSSOM. This winter I have had a little experience in relation to position. The apples in my town, on the River Road, about forty barrels of nice fruit were grown on a hill. Across the river are apples grown on a westerly cant that are better.

President POPE. There is something else besides the cant which must be considered in choosing a slope. Our orchard slopes north and in the winter of 1855 and 1856, the trees on the northern slope were all killed, while those on the southern slope remained uninjured, so you see it is not all slope.

Mr. BRIGGS. This matter of setting fruit trees is important. The Northern Spy will do best on bottom land, but plant them on a high hill and they will suffer from many causes. We must study both the nature of the fruit and the nature of the soil and their adaptability to each other. When we know these points we can raise good fruit on all lands. The Baldwin is at home on hilly land. The King of Tompkins is not so well grown for profit on high land, unless provided with suitable protection, on account of its being a large apple and easily injured by the high winds. They are a profitable apple for us to raise in Maine and when we raise more than we want for our own consumption we are raising what some one else wants and will try. We know the King is fine grained and handsome, and if it is productive why not grow it. We want to grow what brings us the most money. We can produce apples on almost all soils in the State of Maine. I am not so familiar with pears, but I think they can be grown with profit. In Massachusetts they raise fine pears.

President POPE. Some soils are better adapted for certain varieties than others.

Mr. TRUE of New Gloucester. Can you raise from two to four barrels of Baldwins where you can only raise one of Kings?

Mr. BLOSSOM. Yes, I can raise many more. I cannot raise the King as I can the Baldwin. The King is handsome and can grow it anywhere. I have them growing in a moist soil and doing well. In fact, I don't know where I can't grow them.

Mr. BRIGGS. I can raise good Russets. Mr. Ricker tells me that he would give most anything if he could raise Russets. We should study our locations and then we can find one suited to every variety of fruit.

Mr. ATHERTON. What do you want Russets for when you can make more money out of Baldwins?

Mr. BRIGGS. I would have the large bulk of my apples Baldwins, but I also want some other varieties. I do not like to eat one kind all the time.

Mr. LELAND. For the last five or six years if my Russets had been Baldwins it would have made $1000 difference with me each year. If I could get $8 a barrel for Russets by keeping them, it would pay, but it will not now, as they are only worth a trifle more than Baldwins. There is not such a market for Russets as there used to be. I would give $1000 if I could change my Russets to Baldwins.

Mr. NELSON. In my soil Baldwins have been a success, and I can raise all varieties of apples except Bellflowers and Roxbury Russets. I would like to ask Mr. Whittier if he considers the Russets a worm gatherer? The Baldwin with me is quite free from worms.

Mr. WHITTIER Yes, sir, Russets may be more liable to be attacked by worms than the Baldwins, but I think not to any great extent. They are both worse than the Northern Spy and Bellflower.

Mr. NELSON. What is your idea of the Hubbardston Nonsuch as an apple for profit and as one which is free from the ravages of the codlin moth, in comparison with our present standard varieties?

Mr. WHITTIER. I have never raised enough of them to judge competently.

Mr. NELSON. My experience is that the Hubbardston is free from the ravages of the codlin moth.

Mr. LELAND. Mr. Blossom referred to the matter of drainage. How dry must the land be in order not to necessitate drainage? Will land on a side-hill with gentle slope which is sufficiently dry for tillage have to be drained for orcharding?

Mr. BLOSSOM. It makes a difference in the situation of the land. The piece spoken of was formerly cultivated and sloped gently to the north with the trees sixteen by twenty-six feet apart. I have never drained much land that was dry. I don't know as I care how wet a piece is, if it is good strong land and I can drain it.

Mr. ATHERTON. What kind of drain do you use?

Mr. BLOSSOM. I build my own drains out of boards

Mr. ATHERTON. Why not use a rock drain?

Mr. BLOSSOM. Because a rock drain fills up so fast, and a board drain will last so much longer.

Mr. BRIGGS. There is one point in relation to raising Russets. They must be carefully protected so they will not shrink and wrinkle.

Mr. TRUE. At what distance apart do you set your trees?

Mr. Whittier. I consider this subject one of vast importance to orchardists. I would put them thirty-five or forty feet apart each way. A distance of twenty-five feet will do very well at first and until they commence to shade each other, when it will be found insufficient. The apples will be small and poorly colored. The limbs will die and when cut off the trees will just that much lessen their supply of sap toward the ripening of the fruit. When set forty feet apart and well taken care of, the trees will grow the nearest to perfection. The lower limbs will grow well owing to their being well supplied with sunlight. An acre set in that way will give more sunlight and surface to the apple and tree than when only twenty-five feet apart, and will, therefore, produce much nicer fruit.

Mr. Nelson. My experience has been different. I would not set over-apart and I think I get the best results from trees set from twenty-two to twenty-five feet apart. The trees when forty feet apart are not neighbors; the wind will blow every leaf away, and you can keep no mulch around them. I have heard that trees set twenty feet apart would in twenty years give as good a money return as the same number of trees set forty feet apart. I have an orchard of sixty trees set twenty feet apart which came into bearing in 1856 and have borne immense crops of apples ever since. In 1871 I sold the apples raised in that orchard for $410. That orchard will mulch itself and keep the ground mellow.

AFTERNOON SESSION.

After the meeting had been called to order by the President, Mr. S. R. Leland of Mt. Baldwin Farm, Farmington, was introduced, who read the following paper:

HOW I HAVE PROTECTED MY ORCHARD FROM THE RAVAGES OF MICE AND BORERS.

By S. R. Leland.

I think pomologists agree that there are more fruit trees destroyed by mice and borers in Maine than by all other causes combined, and any methods that tend to prevent or even diminish the destruction of our orchards by these pests, from whatever source obtained, is perhaps worthy of a careful trial. In relating my experience in protecting trees from mice and borers, and the marked success I have met with, I by no means claim that the same methods would be followed by the same results in all soils and situations, particularly in relation to the borer. I shall be compelled to use the personal pronoun in this paper oftener than I like, for which you will please pardon me, as it is unavoidable in describing my own doings.

My orchard is situated on a ridge running north and south, and extends down to wet land to the west and through the easterly part of it is a narrow swale that drains a muck swamp lying in the N. E. corner of the orchard. These wet lands are just where mice delight to live. When I commenced setting trees the land was newly cleared, in grass, covered with decaying stumps, lots of stones, uneven, with knolls and hollows, and seemingly a more inviting home for mice could not exist. I commenced my orchard in the spring of 1869 by setting one hundred trees. In the spring of 1870 I set more and in the last week in October of the same years I set eighty-five trees, of which I lost nearly all. In 1871 and 72, I enlarged my orchard to three hundred and fifty trees. Up to this time I had done nothing to protect my trees from mice except an application of ashes once a year, as I will explain later on. The year 1872 was what is known in this section as the "sorrel year." My land, having been newly cleared, bore an immense crop of sorrel, with so little grass with it that I didn't esteem it worth storing for fodder, so I mowed it and raked it around my trees, which gave them a bountiful mulching.

After doing that I became frightened for fear the sorrel might contain too much acid for the good of the trees, so wrote to the venerable S. L. Goodale, at that time Secretary of the Board of Agriculture, for his opinion. He answered that I need have no fears on account of the acid in the sorrel, but it would make a good harbor for mice next winter and I had better rake it away in the fall. Either from want of faith in Mr. Goodale's judgment or lack of time I failed to rake the sorrel away from my trees. The following winter there were more apple trees killed by mice in this vicinity than any other winter since I commenced setting my orchard. A neighbor had thirty-five trees in the spring of 1872, the sorrel year, near my orchard, and in the fall to protect them from mice had hauled out well rotted manure and heaped it around the trunks of his trees from 12 to 18 inches high. After there had been some thawing weather the next spring, and a funnel-shaped hole had thawed around the trunk of the trees, he came into my store one day and said that the mice had girdled every one of his trees, and inquired about mine. I had not been to my orchard since the fall, and you may imagine my feelings when I thought of the advice Mr. Goodale had given me. I hastened to my orchard and went over it. The snow had thawed around the body of most of the trees so I could see them to the ground or nearly so, and I found no work of mice.

After the snow was gone, I visited every tree and found, perhaps, half a dozen that had been barked a little but not a single tree materially injured. But the sorrel! Imagine a nest of straw on which a number of pigs have lain a long time and you have a good idea of the condition of that sorrel—thoroughly cut and fined up and almost innumerable nests in it made by mice. I have every reason to believe, and do believe, that the sorrel seed saved a large proportion of my three hundred and fifty beautiful young trees from destruction.

After looking the situation over leisurely and thoroughly, I seated myself on a bowlder to reason, and came to the following conclusions:

First. That mice never eat the bark of an apple tree from preference but as a last resort to sustain life.

Second. If there is grain or seed of any kind within their reach sufficient to sustain life, they will never molest an apple tree.

Third. That I had got to winter more or less mice each winter and I could do it cheaper on grain than on apple trees. I have seen no reason yet for changing the conclusions arrived at while seated on that bowlder, and have acted accordingly.

Knowing mice prefer oats to any other grain, I have supplied *my* mice each fall with the amount my judgment told me would be sufficient to winter them, and that is the principal protection I have given my orchard. My method is to carry oats into the orchard late in the fall, take a bailed basket full on one arm and drop handfuls in the hollows and along the edge of the wet land alluded to above, and where the snow drifts on. A little observation in spring has shown me where the most mice winter and there I leave the most feed. I have used tarred sheathing paper around trees to a limited extent, but if mice are driven to the necessity of living on the bark, they will gnaw the tree above the paper. A little observation during the summer and fall will determine whether there are few mice or many, and I provide for them accordingly. When the mice are thick over winter I seldom see a pile of oats in spring not eaten. When there are but few they are not eaten so clean.

Now for the result of my method of protecting trees from mice. I have now about seven hundred trees. I commenced setting seventeen years ago and have set some every spring since I have probably lost in the time one hundred trees (losing eighty-five fall planted at one time), so I have set out eight hundred trees. In addition to this, I have sowed two nurseries in the time and within the limits of my orchard. The trees in the oldest one are all disposed of, and nearly all in the other. All the trees I have lost by mice in the orchard and nurseries in seventeen years can be numbered on the fingers and thumbs of my two hands. I think no one will doubt the efficiency of my method of protection, but the question of expense may be raised, and in anticipation of such an event I will answer in advance. It is not as expensive as paper or birch bark. The extra time required in putting on the bark or paper in the fall, and removing them in spring, will more than balance the cost of oats above that of the bark or paper.

Thousands of trees girdled by mice are given up as spoiled, that could be saved by timely care.

Visit the orchard often in early spring, and if trees are found gnawed, immediately apply mortar made of clay and horse manure, and wind with woolen cloth. Trees with the bark removed to the wood, treated in this way, before they have been exposed to wind and sun long enough to sear the wood, nine times in ten, will form a new bark and come out all right.

THE APPLE TREE BORER.

Saperda candida, Fabr.

Of this species of borer I have not much to say. In fact I don't know as I ought to find any fault with him as far as I am personally concerned, for he has never destroyed a tree for me.

I have learned by observation and enquiry that this species of the borer is much more destructive to orchards on light soil, or soil inclined to a sandy loam, than those on stony, rugged, loam land. My orchard is on the latter kind of soil and that, perhaps, is the reason this species of borer has not given me any trouble.

If any preventative I have used has *protected* my trees it is the application of ashes, for I have used no other.

Each spring after there have been a few thawing days and a tunnel-shaped hole thawed around the body of the trees I take the advantage of the snow crust and with a basket of ashes in one hand and a small scoop in the other I pass from tree to tree and throw a pint or such a matter directly around the trunk. If there is snow around the trunk, when it thaws the ashes follow down and more or less adhere to the bark. Equally as good a time to apply them is immediately after the snow is gone and when the trunk of the tree is wet. The ashes are visible on and around the trunk of the tree during the early part of the season when it is supposed the beetle deposits her eggs, and are particularly offensive to her. Ashes applied as above early in spring are also quite a protection against depredations by mice.

Another species of borer called the trunk borer is giving me more trouble. The first ten years of my orchard experience I hardly found a trunk borer, but the past five years I have had to wage war upon them continually. Their presence is easily detected by a slight discoloration and depression of the bark.

Alkaline washes have been highly recommended as a means of keeping away the beetle, but I have never practiced it. I carefully examine the younger portions of my trees, in which they work the most injury, once or twice during the summer and with a sharp knife remove all the affected bark and wood, if any, and apply a thin coating of grafting wax.

Many trees look, after I have been over them with the knife, as I imagine the rods of green poplar and hazel looked that Jacob piled, white streaks in them, and set in the gutters in the watering-troughs where Laban's flocks came to drink, but they will soon heal and come out all right. Instead of cancer-like affections that are continually spreading broader and deeper, and over which nature has no healing power, we have smooth, fresh wounds which nature will hasten to heal.

TWENTY YEARS EXPERIENCE AND WHAT I HAVE LEARNED.

By William P. Atherton.

From twenty years experience in the introduction and propagation of some of the newer varieties of apples, I have learned some things that could not have been learned, perhaps, in any other way than by experimental knowledge and which may serve as a safe guide to future operations in my own orchard if they are of no value to others.

THREE LESSONS.

First. Not to introduce into my orchard any new variety on a large scale until it has been thoroughly tested in a small way. This statement implies that the best descriptions and recommendations of the very best authorities upon the subject of fruit-culture should be taken with many grains of doubt, not as to their truthfulness or correctness in general, but only as applied to one's own individual case; and it implies, furthermore, that the testimony even of those in your own immediate neighborhood is not wholly reliable, because soil, if not situation, has as much influence upon the productiveness or non-productiveness of a fruit as climate itself.

As an illustration, take the King variety of apple. With my neighbor it has succeeded admirably, in growth, in hardiness and in productiveness; with me the tree has been perfectly hardy, the growth of wood slower than that of many other varieties and the production of fruit almost contemptible. My climate is the same as that of my neighbor's, the situation of my trees neither too exposed nor too sheltered, and I am, therefore, driven to the necessity of ascribing my want of success in producing fruit of this variety to difference in soil, and this more particularly, because I have taken the same pains in the matter of cultivation as with other varieties in my orchard. Perhaps some element, still, is lacking to make them fruitful, but alas! what is it? If a plenty of barn-yard dressing and an abundance of compost made up of muck, manure, ashes, lime and ground bones and applied as a top-dressing every two or three years has failed, what then will avail? Will any of the commercial fertilizers in the market supply the needed want? Or, must I come to the conclusion that the variety is not suited to my kind of soil, and that, therefore, the variety must be changed? It is not a pleasant conclusion to come to after planting, cultivating and taking the best of care of a tree for ten years and when you expect, and it ought, to come into bearing, to have to coax, coddle and wheedle the same tree for ten long years more with no results worth mentioning.

In my orchard there are twenty trees of the above variety which vary in the setting from ten to twenty years and which have produced of fruit, in that time, comparatively nothing, and yet I have been advised by a good orchardist, who also is one of the largest fruit dealers in the State, to bear a little longer with this variety, as it is a good one. Other winter varieties, such as the Golden Russet of New York, the Poughkeepsie or English Russet and the Rambo or English Dominie, which were introduced into my orchard quite extensively, have long ago been discarded, as also other varieties introduced in a more limited way, such as Walbridge and Cooper's Market for winter, Twenty Ounce, Colvert, Plum Cider, Grimes' Golden and Haas for late autumn; while for summer all my Duchess and Tetofsky trees have been reduced to one each, and my Red Astrachans will, next year, be reduced to two or three trees.

Second. In the laying out and planting of an orchard it is more economical and convenient, far more conducive to equanimity of temper, and, consequently, it will tend to greater longevity of life to have as simple an arrangement of the different varieties of apples as is possible or, in other words, to have each variety set by itself. I have learned the folly of having a complex orchard and it has been my desire and effort for the last few years to remedy this great defect which was due more to a want of forethought on the part of my predecessors than to indifference or carelessness on the part of myself. Sometimes varieties will not come true to name, sometimes tags get removed in transportation of young trees from the nursery, and sometimes varieties are misplaced in an orchard through the carelessness or the indifference of the grafter. Every orchardist is liable to such mistakes and no one can be too careful in guarding against them. In this case, as in all others, an ounce of prevention is worth a pound of cure.

Third. I have learned that no exact rules can be laid down either for pruning or training apple trees. In the training of a young orchard something will depend upon location, upon the variety and habit of growth and whether the orchard is to be pastured to sheep or kept in tillage and mowing. In sheltered positions the trees can be trained very much lower than in exposed places where the wind has full power, as on the top of a hill. When sheep are kept in an orchard the trees will have to be trained higher than they otherwise would be on account of their propensity to browse and to pull out young scions; but even in orchards where no sheep have been kept I have learned that some varieties must be trained higher than what we would suppose when the trees are young. This is especially the case with the Yellow Bellflower and R. I. Greening. When these varieties are young and low-headed you will think it nice to train them so and it will be grand fun to stand on the ground and gather nearly all the fruit, but when they are older and the lower branches have extended far out and grown out of proportion to the head and the upper branches, when these same branches are heavily laden with fruit, and a large proportion of the fruit lies upon the ground and mildews, then you will not think it so nice.

PRUNING.

In regard to pruning an orchard, the best principle to be observed is to prune early, often and moderately. Some persons say that all the pruning which is necessary for a young and growing tree may be done with the thumb and forefinger. This is certainly a mistake. It might do in a garden plot or with but few trees, but with a thousand or more such a course is utterly out of the question. When buds will form shoots and grow from three to five feet in one season, they will need pretty constant and sharp watching in order to be removed with the thumb and finger. Moreover, as you cannot tell, always, the ultimate direction of a bud, it is necessary to leave it for a while and ere you know it, it has become a branch too strong for the thumb process and it will require the knife and saw. I used to think that June was the best month to prune young trees, but of late years I have changed my mind, having learned by experience that early spring—say the last of March and first of April—is the very best time. It is before the sap begins to flow much; there are no leaves to obstruct the sight; in a few days the cut will harden a little and when the sap does begin to flow, new wood will begin to form almost immediately and the wound will heal over quicker and better than at any other time of the year. This was the practice and experience of the late Hon. Robert Hallowell Gardiner, one of the most zealous, enthusiastic and devoted pomologists in the State.

Having adopted his practice, I am free to say that I have been benefitted by his experience in this direction. Of course, rather than not prune at all, I would recommend to prune at any time when the saw and knife is sharp Old trees that are full of suckers and dead branches had better be pruned in October or November rather than in the spring

DISTANCE APART.

Twenty years or more of experience has not only strengthened my belief, but it has fully confirmed it, that thirty feet apart each way is none too far for most varieties, and especially for Baldwin, Roxbury Russet, R. I. Greening, Bellflower and Northern Spy.

DRAINAGE.

My experience has been that where there is not natural drainage sufficient, artificial drainage must be given, and that it always pays. In one portion of my orchard there is a plat of ground three-quarters of an acre in extent, which in years past has been thoroughly underdrained. To look at the land you would never think that once it was nothing but a morass or quagmire, where nothing but quack-grass, polly-pod and mares'-tails grew, but such was the case Now, and for several years past, there has been growing upon it first-class grasses and heavy crops, and there is also a fine young orchard of Roxbury Russets and Yellow Bellflower apple trees. Yes, drainage, and especially underdraining, has paid me more than twenty per cent.

STORAGE AND PACKING OF FRUIT.

My practice has been to store in the cellar in barrels well headed up rather than in bulk, but were all my conditions right I might prefer to store in bulk. I have learned not to put apples in heaps in the orchard, never to carry them into a loft, for there they are sure to rot, and that it is better to carry fruit, if possible, directly into a cool, clean cellar and let them lie there undisturbed till packing and selling time, rather than into barns, sheds or open buildings where they are liable to be more or less bruised in a second handling, and where they are more likely to heat and sweat.

In packing apples we have always taken pains to have a uniformity of fruit throughout the barrel, consequently we have never had any trouble in selling, having sold to one party alone for more than thirty years. It costs something to take pains in the packing of fruit, but carelessness or indifference will cost you more. When once a dealer finds that you have taken pains in packing and that you have put up your fruit honestly you will have no further trouble. In closing, allow me to say that no one can learn all about the fruit business in one year; it will take a life-time to learn many things essential to success, and then there will be something more to learn. But to him who perseveres all knowledge will gradually be unfolded, and with knowledge will come pleasure, if not complete happiness.

DISCUSSION.

Mr. Sweetser. I would like to ask Mr. Atherton if he would recommend setting barrels of apples on the head, in preference to laying them on the bilge?

Mr. Atherton. My practice, after barrelling, is to put the barrels on the bilge, and keep them out of the cellar until the weather becomes quite cold.

Mr. Merrill. I would like to understand if Mr. Atherton thinks that the barrelling of apples is a better practice than storing them in bulk. We all know that it is even temperature that keeps fruit in the best condition. He says in his cellar they keep well in barrels, but had they been stored in bulk I think they would have come out in just as good condition. Cold storage is good, but I don't agree with him in barrelling the fruit. In buying and barrelling apples for market, I have found the best apples in large lots in cool cellars. I buy from lots in large bins in preference to small lots, as my experience is that I get better apples

Mr. Atherton. Did I understand that you wished me to give my opinion as to whether it was better to store in barrels than in bulk?

Mr. Merrill. I presume you intended to give it as your opinion.

Mr. Atherton. I don't pretend to give any opinion. I simply give my experience.

Mr. Briggs. I presume that Mr. Atherton represented his experience.

Mr. Merrill. I understand he is experimenting. He has apples stored both in barrels and in bulk. Now, if he has them stored both ways, and they come out in better condition in the barrels, I admit that I am wrong.

Mr. Atherton. When they were put in in bulk I was away and had nothing to do with putting them up, and consequently could not regulate the temperature, which may have caused the difference in the way they came out.

Mr. Briggs. There is one point in Mr. Atherton's paper which I should like to have explained a little better, and that is in relation to the cultivation of the orchard.

Mr. Atherton. For the first few years I give it the best of cultivation, provided the young trees were uninjured by the means. Take the best land and prepare it well before setting out the trees.

Mr. Briggs. Did you crop the orchard?

Mr. Atherton. Yes, we cropped for several years. Had rotation of crops for about ten years.

Mr. Briggs. What do you call rotation of crops?

Mr. Atherton. By rotation of crops I mean plant corn one year, and beans the next, then potatoes and so on.

Mr. Briggs. Did you ever sow grain in the orchard?

Mr. Atherton. Not unless I intended seeding down to grass.

Mr. Briggs. Would you then?

Mr. Atherton. Yes, sir, and put on lots of manure and extra mulching. After you seed down apply top-dressing and mulch the young trees. If you fear any damage from mice, in the fall remove the mulch and bank up with earth, removing it again in the spring and putting around the mulch again. The last orchard I started was under cultivation three years. It has only been set eight years, and still has produced considerable fruit of the Nodhead, Swaar, Red Astrachan and other varieties.

Mr. Whittier. I would like to hear from Mr. Gilbert.

Mr. Z. A. Gilbert. I would like to add my testimony to Mr. Merrill's in relation to the storing of apples in bulk. I have handled one hundred and fifty barrels stored in bulk direct from the trees. I disagree with Mr. Atherton for two reasons. First, because it saves labor in handling and the damage to the fruit in handling it; and, second, I would store them directly in the cellar because it is best for the fruit. Apples should be placed in as cool a place as possible immediately after being taken from the tree, and hence the cellar is the best place for them. I sort very carefully in the orchard, always superintending the work myself, and always insisting that small and imperfect fruit shall be thrown away. The apples are picked in baskets and drawn to the cellar in bulk, and stored in bulk. In this way I have put three hundred barrels in a large bin five feet deep running through the cellar, with a few left over that I put in barrels, with one end left open. The fruit in bulk came out last week in apparently perfect condition, bright and fair. If any apples had changed it was those on the top; those in the interior being perfect. This, I think, is the experience of apple growers in my own town. Last year they shipped in the cars 12,000 barrels besides those consumed in Lewiston and Auburn, nearly all of which were stored in bulk and taken immediately from the trees to the cellar. I wish to endorse one point in Mr. Leland's paper in relation to mulching. It has been my experience that mulching is a great protection to trees. I have heard arguments against it because it sheltered the mice. The mice are there but they are no more likely to girdle trees that are mulched than those that are not. If it has lain long enough to destroy the grass it is a good protection.

Mr. Atherton. I wish to go on record right in relation to this matter of storing apples. It is my opinion that, on the whole, it is preferable to store apples in bulk rather than in barrels. I consider mulching a protection rather than otherwise.

Mr. Briggs. I wish to say that I never lost but one tree on account of mice, and I never took extra precautions against their ravages. I mulch heavily and find a good many nests of mice but never lose trees.

Mr. Gilbert. I would like to ask whether mulch is of value as regards its efficiency for apple production or not? I have never found it so. It is excellent for young trees to keep them healthy and thrifty, but I have found that mulch, such as hay and straw, does not take the place of manure.

President Pope. I don't know about that point, but if I had large trees and wished to put on a coat of dressing of any kind, I would also put on a good supply of mulch, and for this reason, in applying fertilizer it first strikes the grass and two-thirds of the benefit goes to the grass, but this application when spread under the tree and then covered with a mulch insures that the tree gets all the benefit.

Mr. Nelson. Did I understand Mr. Gilbert to say that he did not believe in mulching?

Mr. Gilbert. I had an orchard and spent twenty years in finding out that mulching will not take the place of manure.

Mr. Nelson. Have you any trees along by the side of double walls?

Mr. GILBERT. I have.

Mr. NELSON. Don't you find them the best bearing trees?

Mr. GILBERT. I can't say that I do.

Mr. ATHERTON. I want to ask as to the respective value of grass as hay and mulch. Had I better mow the grass and let it lie in the orchard as mulch, or cure and feed it to stock and put manure in its place?

Mr. GILBERT. That question can only be answered in a general way. Hay is not worth $15.00 to mulch apple trees with. I would not recommend that course. I make some allowance for extreme statements. A little fertilizer applied often is the best for an orchard. The question of where we shall obtain fertilizers for the orchard is one which this Society should discuss at no distant day. I use ground bone and believe it to be good. Ashes are good, but they are scarce.

EVENING SESSION.

BUSINESS MEETING OF THE SOCIETY.

A business meeting of the Society was held at 6.30 o'clock, P. M., President Pope in the chair.

It was voted inexpedient to change the by-laws of the Society in regard to the fees of membership for annual members. The matter of holding the annual exhibition of 1887 was placed in the hands of the Executive Committee, and by them to be decided as they deemed best for the interest of the Society.

Mr. T. M. Merrill of New Gloucester, from the committee to examine the fruit on exhibition, reported one of the largest displays ever made at a winter meeting of the Society, and presented the following list of exhibitors, with the number of varieties shown by each:

G. K. Staples, Temple, thirty varieties; D. P. True, Leeds Centre, four varieties of pears, six of apples; Wm. True, Farmington; G. Hayes, Farmington; Calvin Chamberlain, Foxcroft, one; B. H. Ridley, Jay, twelve; E. W. Merritt, Houlton, one; Lorin Adams, East Wilton, three; Phineas Whittier, Farmington Falls, twenty-three, and samples of six varieties of evaporated apple; B. Titcomb, Farmington, eight; S. M. Keep, Jay, nine; George Good-ridge, North Jay, nine; Emory Axtel, North Jay, two; Oliver Dunnell, Jay, four; A. J. Linscott, Jay, seven; Wm. Eustis, North Jay; S. H. Niles, North Jay, five; Alvan Currier, Farmington, four; S. R. Leland, Farmington, seven; D. H. Knowlton, Farmington, six; Mrs. D. M. Howe, Farmington, six varieties of apples, two of canned fruits; A. M. Goodrich, Industry; Harry P. Dill, Phillips, eight; Elbridge Dill, Phillips, seven; Ansel Dill, Phillips, three; Silas M. Wing, Phillips, three; M C. Kelley, Phillips, seven; A. F. Hardy, Farmington, twelve; D. J. Briggs, South Turner, ten; Eugene E. Eaton, Farmington, seven; J. S. B. Hunter, Farmington, two; B W. Brown, Wilton, ten; W. W. Rodbird, Jay, twenty-two; E. G. Blake, Farmington, eight; O. C. Nelson, New Gloucester, nine; S. R. Sweetser, Cumberland Centre, eighteen; L. H. Blossom, Turner, two; J. J. Towle, South Carthage, seven, and one sample of evaporated apple; J. Pope & Son, Manchester, fourteen.

Mr. W. P. Atherton, for the Committee on Nomenclature, presented a report. The committee recommended that the seedling apple exhibited by Mr. S. R. Leland be called the "Leland;" "Aunt Mary," a local apple forwarded by Mr. Calvin Chamberlain, of Foxcroft, was pronounced "fine for dessert;" and the "Aroostook Baldwin," forwarded by E. W. Merritt of Houlton, was mentioned as being hardy, and no doubt useful for that high locality, although wanting in qualities which would recommend it for other parts of the State.

Mr. D. H. Knowlton, for the committee appointed to consider the recommendations made by the President in his annual address, presented his report, viz:

Your committee to whom was referred the President's annual address beg leave to report as follows:

1st. The employment of experts to act as judges at our annual exhibitions is deserving of careful consideration by the Society, and though our present finances may not admit of the expense for a year or two, we believe the awarding of premiums would be more satisfactory to exhibitors.

2d. That this Society recommend the setting apart of a day to be known and observed as Arbor Day; and, furthermore, we recommend the passage of such a law by the present Maine Legislature as shall establish the same.

3d Information reached us last night that the Hatch bill "to establish agricultural experiment stations in connection with the agricultural colleges in the several States" has passed the Senate, and that the House committee has voted to report favorably upon the bill in that branch. We believe the fruit-growing interests of this State call for the passage of this bill, and we would assure our members of Congress that its passage would prove of great value to our State, and we would most respectfully urge them to use their influence to secure its passage.

4th. That in accordance with the recommendations of the address we would cordially invite all fruit-growers in the State to inform the Secretary of our Society from time to time of the condition of fruit, of the various diseases affecting it, the progress of the diseases, the causes of the same and any remedies which may prove efficient in treating the same.

Mr. W. P. Atherton then said:—

Mr. President: I hereby tender the following resolution, viz:

Resolved, That the thanks of this Society are extended to the people of Farmington and vicinity, for their cordial and hearty welcome; for their liberal hospitality; for the free use of their beautiful hall; for the fine display of their fruits; for the music which has contributed so much to the evening entertainments, and for their uniformly kind and courteous treatment of all our members.

This resolution was given a passage by a rising vote.

Votes of thanks were then passed to the managers of the Sandy River and Maine Central Railroad Companies, for the favor of half fare rates over their lines to all persons attending the meeting. But for the liberality of the railroads, the benefits of our meetings would be shared by comparatively few of those in our State interested in the work of the Society.

The business meeting was then adjourned, and after a brief intermission, the public session was called to order by President Pope.

PUBLIC SESSION.

The hall was crowded, this being the closing meeting of the convention. Prof. George C. Purington, Principal of the Northern Normal School, rendered a fine musical selection; after which Mrs. Hattie Park Keyes, the gifted wife of Capt. Charles W. Keyes of the Farmington *Chronicle*. read the following essay:

THE VALUE OF A KNOWLEDGE OF THE NATURAL SCIENCES TO THE FARMER.

By Mrs. Hattie Park Keyes.

The subject is so broad and invites thought in so many different directions that, in a brief article like this, one can hope to follow but a few of the possible avenues of consideration, and these only for a little way. It may be trusted, however, that the candid and thoughtful minds of those to whom this topic is introduced may work out for themselves some ideas which, sooner or later, will be of some advantage; and I shall be, indeed, well pleased if calling attention to this matter at this time may, in any degree, assist in the way of greater enjoyment and a more remunerative income from a life on the farm.

One of the great problems studied in agricultural gatherings in Maine of late years is how to keep the boys—and it may be added girls, too—on the farm. The tendency has been so strong the past thirty years to leave the farm for the workshop or the store, or, what is as disastrous to the prosperity of our State, to leave the farms in Maine for a farm, a ranch or a miner's camp in the West, that the rural sections have suffered a serious decrease in population and, therewith, a great loss in the results of the labor which these runaway sons of the farm would have performed had they remained on or near the old homesteads. There is an old saying that times change and we must change with them. This is true in the relative attractions of farm and city life. In former times, when intercourse with the city was less easy and frequent than now, when the opportunities it offered to young people were far less varied and not so well known as at the present time, when the city streets possessed in much less degree the glare and glamour which so delight and dazzle youthful eyes, the contrast in the inducements of the city and the country was not so marked as it appears now to be. If the city is all the time enhancing its claims to favor, the country must look to see what it can do to retain its hold on the affection and interest of the people. Is it doing this most necessary thing? The statistics of New England farming towns indicate that it has failed sadly in this respect. And yet the remedy is plain. Life on the farm must be made more satisfactory and enjoyable financially, æsthetically and socially. Granted that it ought to be, the next step brings us to the question, How can it be accomplished?

I fully believe the possession of a knowledge of the natural sciences by the farmers and the farmers' wives, their sons and daughters, will do not a little in increasing the profits and pleasures of their life on the farm, and for this reason I have gladly chosen this topic for my theme this evening.

The financial benefits which a knowledge of the natural sciences may give the farmer are so obvious that it would seem little, if anything, need be said on this part of the subject. It must be apparent to the most superficial thinker that he whose business is so closely connected with nature and whose income is so largely dependent on the cause and effect of natural principles should, of all men, be well acquainted with those principles, should know how far he must govern and direct them for his own advantage, when to look for exceptions and when to apply the rule ordinary results have established. The need of an acquaintance with the elements of the soil and the additions requisite to bring forth the most desirable and profitable crops is manifest to every one. The kinds of feed most nutritious and which can be most economically combined are subjects of great importance and if only *guessed* at are quite likely to be followed by lean stock and a lean purse in the pocket of a discouraged farmer. To know the right way to manage these things he should have a knowledge of agricultural chemistry. The kinds of insect and other animal life not gathered into barns are matters with which the farmer has constantly to deal. Which are his friends, which his enemies, he surely ought to know; what the nature of this, what the habits of that, are things he certainly needs understand. Here, an acquaintance with natural history will be of great assistance. The varied forms of plant life, the manner in which each species is reproduced, the benefits of some, the injury of others, a knowledge of botany will assist greatly to determine. These and many other familiar but vaguely comprehended objects are governed by natural laws, and the earlier and the more thoroughly the farmer understands these laws the more successful he is likely to be.

Yes, you say, but doesn't the farmer learn all he need know of these things by experience and isn't experience, after all, the best teacher? Experience is a good teacher, but, you know, it has been said for many a year she keeps a dear school, and this we have found to our sorrow in all the walks of life. The lessons the farmer learns there are not only expensive but often they have to be repeated several times over before their meaning is heeded, and some, it seems, hardly learn their significance at all, but go on in the same old blundering way, laying the blame of their want of success at the door of bad luck or something other than the true cause of their ill fortune. Nor is this strange. The person who has not been trained to habits of observation and quick perception can hardly be expected to be anything else than a slow scholar even in learning the habits and nature of objects by which he is daily surrounded. While facts established and theories and opinions advanced by scientists are of great value to the farmer, a spirit of inquiry and an observing, attentive eye are likewise of inestimable worth to him who would have nature lend him the assistance she is always ready to give; and, to possess these qualities in their best estate, he really needs an early training. But as it is never too late to learn, it is better to begin late than not at all.

Again, it may be said, Do not the farmers have an opportunity to acquire all necessary information through the columns of the agricultural papers and the bulletins and reports of agricultural schools and experiment stations? There is an opportunity to learn much, very much, in this way, and I am truly thankful our State is so well favored as it is in this regard. I have felt sometimes the past few years as if such aids and the information and inspiration emanating from well conducted agricultural societies, present company not excepted, were the chief power which is preserving the life and vigor of many a farm in Maine. The reports of the Government Bureau, as well as of the State Board of Agriculture likewise, often contain much of value and their reading is to be commended. But, while I would do all I could to encourage the use of these and similar helps and believe that much may be gained thereby, the fact remains, and I think all present will agree, that much of the interest in such articles is abated and much of the benefit is often lost because more or less of the terms used are not understood. Agricultural writers are sometimes blamed for employing phrases that the common people are not familiar with. I do not think there is just cause for censure. It seems to me that as a rule agricultural teachers make the endeavor to be plain and simple in their language, not to make a show of wisdom by talking in long words and foreign phrases, but simply to impart needed instruction. Yet there are difficulties in the way greater than would seem at first thought. There are many scientific subjects which cannot be treated at all without the use of more or less technical terms, and others where the use of common names in preference to scientific would lead to confusion and perhaps to serious errors. To illustrate: A writer might speak of chickweed and think there was not the least danger of being misunderstood, but to one person here in Maine this would mean one plant and to another another, while if he had lived in the Middle States very likely the name would stand with him for yet a third, for, in all, not less than eight species are called by this word. If, on the other hand, he says *Stellaria media*, we know exactly what he means, or if he speaks of *Cerastium viscosum*, there can be no mistake, for in botany one plant and one alone is given a certain name, while in common language the same name is often applied to several. These are familiar examples and errors in the case cited might be of little consequence, but the same confusion is likely to occur in matters of far greater importance.

We take it for granted that all candid ones will agree at once that some knowledge of chemistry would be an excellent thing for the farmer, that an acquaintance with the elements of natural history in its several departments might also be a convenience now and then, that some familiarity with physics and the allied sciences might likewise prove useful from time to time. Allowed that a knowledge of these sciences, if not absolutely essential to financial success in the business of agriculture, is, nevertheless, a good and desirable possession, the question now arises, is such an acquirement practicable, indeed, hardly possible, for the average farmer who is passing his youth or has already passed it with no other advantages than the district school affords? We admit that only ten years ago the effort would have been somewhat discouraging, but the case is different now: all the new attractions of life are not for city people; the country shares in some of the good things the last few years have provided for favored Americans. One of these is that noble, beneficent institution, the Chautauquan, which, with its thousands upon thousands of students, is doing an inestimable amount of good work in promoting general intelligence and diffusing knowledge of literature, science and art in all places where the English tongue is spoken. Here is a means of acquiring knowledge which every farmer's family, if it has not already adopted, ought, at least, to be considering. I speak of this course first not because it makes a specialty of scientific branches or because it is designed especially for farmers but because it is such an excellent appetizer for all kinds of home study. There have been of late various excellent works arranged with particular reference to farmers' use. Among them the publications of Prof. Fernald formerly of the State College deserve a favorable mention.

The scientific works used in our schools of lower grade than the college will be found well adapted to the general reader. If not familiar with the titles or the place of sale of books on these subjects, a little inquiry will soon bring the desired information. Farmers' clubs have sometimes, among other good things, purchased more or less of a library ; so also have local granges here and there. The practice ought to become universal with such organizations, and such libraries, if well selected, would have a due proportion of scientific works.

These are a few of the helps that may be looked to by those who, from reason of years or other causes, cannot enjoy the privileges of schools ; but we hope the farmers' boys, who are going to be farmers themselves, may have the aid of competent instructors in introducing them to the pleasure and profit a knowledge of the natural sciences surely has in store for them. Happily even our common district schools are often found nowadays with instructors who can teach the elements of some of these branches and, by object lessons or other pleasant methods, educate—draw out—the mind in search for scientific truth. Better still when this early training is supplemented by attendance at some of the higher institutions. A full course at an agricultural college will prove, we believe, a good investment of time and money.

Before leaving this part of the subject I cannot refrain from saying that I hope the day is not far distant when the public schools of Maine will pay more attention to the study of the natural sciences. Thereby they would not only do much to increase the general intelligence but would confer a special benefit on agricultural interests, directly by teaching laws and principles, and indirectly by training the perception and reasoning faculties for better service in the years of later life. A bill is now before the Legislature, I believe, which, if it becomes a law, will require public schools to give instruction in agricultural chemistry. So far, so good.

And now, since a happy life is made up of many things beside financial success, let us pass on to another phase of the subject and see how a knowledge of the natural sciences can aid in making farm life more agreeable in an æsthetic point of view.

There are people who love study for its inherent pleasures, and, if there were no pecuniary or social advantage likely to result, would still give more or less time to its pursuit. Joys which come in this line are of a high order, and will do much to make the possessor content in any place where his lot may be cast. While farm life has some obstacles in the way of such enjoyments, it still has much to aid and assist. Here we are brought near to nature, and, if heart be in harmony with her Maker and mind be trained to discern her marvelous beauties, we shall find an unfailing source of delight in the multitude of wonders on every hand Rocks and trees, forest and garden, the earth beneath, the sky above, furnish an inexhaustible and ever fascinating field for study and recreation. But, as before, the question may be asked, how is this training to be obtained if we have not been so fortunate as to receive it in our younger days? Granted again that there are some difficulties, yet they are not insuperable. In the first place I beg the mothers to be governed by a little common sense. There seems to be no excuse in this late day for a woman to go into hysterics at the sight of a mouse, or turn a whole congregation into a panic stricken mob at the presence of a harmless June bug A slight knowledge of natural history will teach her better, and this she can acquire with as little time and expense as it takes to read some novels, adding thereto just a moderate mental effort. Then such objects of aversion and terror will become matters of deep interest. It would be to her like the vision of beasts to Peter, teaching her that nothing the Lord has made is common or unclean. But the mischief of her ignorance and folly does not, unhappily, end with her own discomfiture. The children of the family catch the feeling and repeat over and over the same ridiculous experiences. Sometimes, alas, this feeling of aversion for living creatures is not taught indirectly but directly also, thus filling little breasts naturally loving and tender with contempt and hatred for things made like them of flesh and blood.

Under the caption "Seeds of Cruelty and Fear," the Christian Union a year or two ago published a story describing a scene the like of which, alas, we have all seen enacted time and again. I will make a brief extract, it is so *apropos*:

"Waiting in a public room in a hotel the other day, I saw a little incident which suggested to my mind the words at the head of this piece.

A little boy, perhaps three years old, a lovely child, ran into the room, followed by his nurse at a little distance. Crawling on the carpet in front of the fire was a large water-bug. The child caught sight of it at once and stopped to watch it. He showed no signs of either fear or aversion, only of interest and curiosity. The nurse, noting his intent gaze on the floor, hurried up and, seeing what he was looking at, exclaimed, 'Ugh, the horrid *thing*! Nasty! Nasty! Come away!' at the same time seizing him by the hand and attempting to draw him away. Her tones and gestures expressed fear as well as disgust. The child took the cue instantly; the expression of his face was transformed in the twinkling of an eye. He screamed, struck out with his fists, stamped his feet, all the time backing away from the poor, harmless little bug. A look of hatred deepened on his features, which one short moment before had been kindled with genuine childlike curiosity and pleasure.

At this moment the mother entered the room. Breaking away from the nurse, he ran to his mother, took her hand and drew her nearer the fire-place, still continuing his expressions of alarm and dislike, and pointing to the bug with his tiny fingers.

The mother echoed the nurse's exclamations of disgust and added, 'Charley, kill the old bug! Charley, kill it!' Upon which, the nurse taking the little fellow's other hand, the two women led him to the bug, he all the while half holding back, half fascinated with the excitement of the attack. They led him closer, the mother repeating, 'Yes, Charley, kill the old bug; it shan't bite Charley;' until, at last, lifting his small foot, the child crushed the bug to death, and then jumped up and down on it with chuckles of delight, saying, in his broken baby talk, 'Bug dead! Bug dead!'"

The writer goes on to say:

"I looked on, speechless with indignation, sorrow and shame. The mother was a person apparently of intelligence and refinement. Her face was a more than usually attractive one. Her dress and

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bearing were those of a woman of the world. The servant was evidently of a higher grade than the average nursery maid. And yet this was the thing they had done in that one short moment to that little child: taught him to fear, hate, torture and kill helpless creatures."

It is needless to say that by indulging such feelings as those exhibited in the scene described, the country is shorn of much of its attraction for mother and children. On the other hand, teeming as it is for a large part of the year with countless varieties of animal and vegetable life, those who know even a little of botany or natural history will find there ample entertainment and instruction. To them the days will not be void or dull or monotonous. In the words of Coleridge, they can say:

> "He prayeth best who loveth best
> All things both great and small
> For the dear Lord who loveth us
> He made and loveth all."

We have all enjoyed the charming descriptions of natural scenery penned by the gifted "H. H." That the common, humbler forms of plants and animals were as dear to her as the grand, inspiring scenery of the Rockies there can be no doubt. Hear how she describes what she would have for her last, long home:

> "Do not adorn with costly shrub or tree
> Or flower, the little grave which shelters me;
> Let the wildwood seeds spring up unharmed
> And back and forth all summer unalarmed
> Let all the tiny, busy creatures creep."

I would fully endorse all that has been said on the cultivation of flowers at home. I would also urge an acquaintance with our native specimens. I have often been surprised and sometimes almost grieved that ladies who devote considerable time to the care of imported plants should appear so indifferent to those of native growth, and yet the real beauty of many such is unsurpassed. No cultivated oxalis I have ever seen can equal the exquisite delicacy of the *Oxalis acetosella* of our Maine forests. Scores of others beautiful and wonderful might be mentioned, but time forbids. There seems of late to be a better sentiment in this respect so that the aster, the golden rod and one or two others have taken their true position in public favor.

While it is to be deplored that so many have lived unmindful of the opportunities for happiness and improvement life on a farm affords, yet it is pleasant to know some have not overlooked them. Especially happy are the children of those families where father and mother or older brothers and sisters have taught them to open their eyes and behold the wonderful and beautiful things all about them. Children are apt pupils in such things and only need a trifle of encouragement and guidance to do very good work as amateur naturalists. I knew a little miss who, long before she could speak distinctly, could tell the names of a goodly number of minerals. A little boy in this town with slight assistance from a judicious mother had made and classified quite a collection of native plants when he was only five or six years of age. I do not believe that boy or that girl when they grow up will *despise a farm*. It may be that all parents are not so well prepared to aid their little ones in these researches as those I have in mind, but all can, at least, give courteous answers and not chill the ardor of young minds seeking after knowledge. Sometimes, I am sorry to say, parents not knowing how to answer the question directly give instead an impatient reply like "don't bother" or some other phrase intended to check further inquiry. Children thus brought up can hardly be expected to take an interest in the old farm. Sooner or later they will be seeking for entertainment and pleasure in some more genial atmosphere.

Lastly comes the question, What can natural sciences do to make farm life more satisfactory in a social way? I would answer, much in various respects. A few of these have been already referred to.

As companionship lends an indescribable charm to study, so, reciprocally, study gives to companionship some of its sweetest joys. A grange or farmers' club whose members are studying the natural sciences will find their organization not only more profitable but far more enjoyable also. And since the grange recognizes the principle of equal rights, the sisters, ever active in preparing good things for the palate, will not be debarred from partaking this rich and wholesome mental food. Securing a competent instructor to give a course of lectures in the winter season would be a wise expenditure, and, as in the matter of books, the outlay falling on so many would not be burdensome.

The pleasures of the neighborhood can be greatly increased by the spread of interest in study. Diamonds cut diamonds, and minds having some store of information cause each other to give out their best thoughts, putting to flight petty jealousies, heart burnings and idle gossip. Might not any community be better by the change?

To speak more in detail, young and old can unite together in a Chautauquan Circle or can enjoy the inexpensive luxury of a circulating library. In summer and autumn geological or botanical picnics may be made a delightful variation from the every-day toil. In winter, if the more abstruse departments of astronomy seem too formidable, a company of country people can pass some of their evenings very pleasantly in learning the geography of the heavens, an enjoyment their city cousins well may envy. The chief pleasure of companionship in study will, however, be found in the family when parents and children are alike interested in something more than their daily round of labor. Young hearts are nearest, perhaps, to the great heart of nature, and their childlike enthusiam will do much to inspire their more weary fathers and mothers. The great benefit, too, of their early introduction to scientific truth will repay their parents for any little sacrifice of time and trouble. The child who is early taught to investigate the truths of the natural world has the double advantage of a great gain in time and, better still, of possessing perceptions well trained from the start.

In conclusion, a knowledge of the natural sciences is of great value to the farmer in making his business successful, his home pleasant, his life happy. This knowledge is most easily and readily acquired by early training at home and in the town school, supplemented by some months or years at one of the higher institutions of learning; but those who have not had these advantages need not, on that account, be discouraged; those who go to it in the right spirit will find a very excellent seminary in the old chimney corner. Mothers and sisters need this knowledge as well as the fathers and brothers. They need it to conduct the household on hygienic principles, to lead the youthful members of the family in the way of usefulness, to give to home and neighborhood life the agreeable and elevating atmosphere it ought to have.

Have the public schools and the agricultural societies done what they ought to do to promote so good a cause? They have done something, but the opportunity has not been fully taken yet. The field is so promising and the results so desirable, they surely warrant a decided effort. We wish the Dirigo State might take a leading step in this direction.

At the conclusion of Mrs. Keyes' essay, Mr. C. A. Mace of Readfield was introduced, who read the following poem.

THE OLD AND THE NEW.

BY C. A. MACE.

The average farmer we have oft been told
Was not a fruit grower in the days of old.
His flocks that roamed the country far and wide;
His herds that greeted him at eventide;
His fields of grain soft waving in the breeze
Filling the air with pleasing melodies,
He loved far more than planted vine or tree,
For these gave quick returns for industry.
And if by chance a fruit tree should be found
So venturesome to occupy his ground,
'Twas there by accident not by design
And yielded fruit fit only for his swine.
Thus years roll on and added to his store;
His earthly goods increased yet more and more.
An honest, kind, hard toiling man was he
And noted far for his integrity.
His home, perchance, may be a mansion grand
On lofty hill, the fairest in the land;
Or yet, perhaps, some cottage by the way,
Around whose walls the soft winds gently play;
And yet no restful shade, whose sheltering arms
Lend to his home its most inviting charms;
No fruitful vines or sweetly scented flowers
Adorn his grounds and cheer his weary hours;
Beauty, with no encouragement to stay
Has spread her wings and silent flown away—
While stern necessity in plain attire,
His only counsel round the evening fire.

The good wife wends her weary, ceaseless way
Through constant, tiresome duties day by day—
Yearning for all that's beautiful and good;
Starving in fact, for need of mental food.
Children, as they grow older, are possessed
With ardent longing and vague unrest,
And soon 'mid other scenes they hope to find
Employment more congenial to their mind.

Pomona and Flora, two sisters fair and gay,
Left their mystic home so far away,
Each laden with their choicest gifts to man,
And their work of love through earth began.
They visited the lowly in their humble home

As well as those to whom great wealth had come.
Pomona there her richest fruits displayed.
Before them, too, her choicest gifts arrayed.
She pointed them to sacred gardens old,
Whose ample fruitage rivaled purest gold—
The source of all she brought to them this day,—
And whose rich tints reflects pure Eden's ray.
This gift was not intended for display;
Its benefit all can enjoy who may.
For the Creator ever had designed
This fruitage for the good of all mankind.
Thus as she proved 'twas not the way to live
To spurn the gifts that nature has to give,
But man should seek to know and understand
The laws that form this good work of His hand.
Forthwith she taught him all her secret art,
A love for all God's works did she impart.
Till man comes forth from this one interview
With ardent hopes and aspirations new.

Meanwhile fair Flora does not idly stand,
But scatters treasures thick on either hand.
Their fragrance fills the humble farmer's home;
Their beauty calls forth praise from every one.
Her mission is to open to our eyes,
The world of beauty that around us lies;
To show to us that God has not designed
His noblest work no rest from toil shall find,
But ceaseless wend his constant, weary way
Through irksome duties, with no cheerful ray
To smile on him and soften daily care,
And fill his life with pleasures rich and rare.
Sweet comforter, a noble mission thine!
To cheer our weary eyes, our thoughts refine.
Thy offerings of purity and love
God's goodness to his toiling children prove.
Although her labors to in-doors pertain
Her form is seen o'er all the farm's domain.
Fair messengers spring sweetly from the ground,
By wayside brook, in forests deep are found,
Reminding us of our Creator's love,
And pointing us to our fair home above.
Yet Flora's presence brings more joy and peace
To weary house-wives in their brief release
From weary toil, who eager seek to find
Some recreation to divert their mind.
To such fair Flora is a cherished friend
As arm in arm through shaded walks they wend

Their way, while on the toiler's weary brow
Sweet rest and peace we find are resting now.
The young are sure to find in Flora a glad friend;
For youth and purity most happy are to blend.
She comes to them a messenger of love;
And future life will full of beauty prove.

As time moves on with its resistless tide,
A change is seen along the country-side.
The husbandman no longer, as of yore,
To flocks alone looks for increase of store.
Although his herds and fields of waving grain
Their proper rank in the year's round maintain,
New occupations of congenial kind
Now interest and occupy his mind.
The lone fruit-tree that in the corner stands
No longer suffers from neglectful hands,
But, pruned and fertilized, it yearly pours
Into his lap its most abundant stores.
We look around; upon the hill-side steep
And meadows broad, with soil both rich and deep,
Are planted fruit trees of the choicest kind,
Whose slender branches waving in the wind,
Bear fruit that in the beauty of rich colors vie
With brightest rainbow tints in summer sky.
We wander now within the garden's bound
Wherein fruitage of choicer kind is found.
Here shrub and plant and every useful vine
To add unto his treasures rich combine,
And pleasure, health, and recreation rare
Are found in training slender tendrils there.

As we approach the farmer's lovely home,
Into a world of beauty we have come.
For flowers reflecting Eden's purest rays
On every hand meet our enraptured gaze,
And looking upward to the heavens above
Teach us the lessons of purity and love.
And now the cheerful voice of song is heard
As sweet and clear as song of woodland bird,
When showers of spring come floating on the breeze
Or summer's sun makes glad their melodies.
This home a type of others in our land
We enter at the housewife's kind command.
The matron's brow may show some signs of care,
And marks of toil perchance are resting there,
Yet by the love that shines forth from her eye
We know her heart is filled with melody.

Intelligence now guides her toiling hand
And drudgery departs at her command,
While pleasant recreation for the mind
And restful pleasures she can ever find.
The house plants that are every lady's pride
In tasteful order ranged on every side,
While luscious fruitage of a goodly hoard
In great profusion decks the farmer's board.
The children of this modern household fair
With their surroundings happily compare.
Reared amid such influences bright
They fill their home with happiness and light.
You hear no longing for more distant scenes,
And they dread not the time that intervenes
Ere they shall leave their childhood's happy home
In other lands, 'mid other scenes to roam.
Home is to them the dearest spot on earth
And sad the day they leave its sacred hearth.

I've held to-night no picture to your view,
And told no tale that one may call untrue.
I look far back upon the page of time;
I see some noble men in manhood's prime
Forming a band of earnest brotherhood,
Working together for the common good.
And soon societies all o'er the land
Originate from this the parent band.
Fruit culture now an impetus receives
And rich returns to thoughtful minds it gives,
While many a name to-day ennobled stands
For choice production by his skillful hands.
I see long trains of loaded cars to-day
Bearing the fruit of your old trees away
To cities, where huge transports waiting lie
To take the products of your industry;
Thence wafted by stern winter's icy breeze
They reach the homes that lie beyond the seas.
I look around upon the grand display
Of apples fair this cold, mid-winter's day,
Bright hue, fair form and tempting as of old,
When Eve's desire to taste was not controlled.
I ask whence cometh this bright, fair array.
The gentle goddess, whose name you bear to-day,
Who hovers ever near with noiseless wings
An answer to our eager question brings:
"It is my work to guide the inquiring mind;
For in my kingdom precious gems you find.

They are but samples of my varied store,
And richer gifts await those who explore."

Again, I turn to scenes of long ago,
A company are battling winter's snow;
Cold and bleak their home on Plymouth shore
Within the sound of the Atlantic's roar.
No outward beauty now adorns their lives
Save only that which stern religion gives.
The spring-time flowers awake no tender thrill,
And slight the joys that in their life instil.

Now this is changed; along your village streets
Many a fair picture now my vision greets.
The changeful lamplight in the evening hours
Shines brightly through a foliage of flowers.
The windows bar the winter's icy chill;
Within is summer sweetness reigning still,
That robs the monarch, ever stern and cold,
Of half his terrors, and breaks his icy hold,
And man now resting from his laboring hours
With ever grateful heart, thanks God for flowers.

In olden days, the Latin term for home
Was an abode, a dwelling place alone.
It might be in the country fair and wide,
Or in the town, washed by the river's tide.
A cave or tent upon the hillside bare;
Or if in town, perhaps a cottage fair.
Where'er a family lodged was called its home.
And thus a sacredness around this spot did come,
For old English laws hold, even to this day,
Man's home his castle is, both strong and gray;
That none may enter there unless he gives consent,
For civil process, or for their own intent.
Our dear word home, round which a halo lies,
Is from the Saxon; and it signifies
An object sacred, and covered from the eyes;
A quiet and retirement, likewise the term implies.
In sunny France this prevalent idea
Is not so prominent as with us here.
Not much of true home life the Parisian enjoys;
The city's gayeties his time and mind employs.
In restaurants, he eats his food with zest;
In lodging rooms, he seeks his needed rest.
In classic days few people owned a home.
A million souls once walked the streets of Rome.
Of this vast number we are truly told
Only two thousand their homes controlled.

In later days we look to English laws;
In Erin's isle we see the wrong they cause.
Where land is owned but by the titled few
Distress is prevalent and riots brew.
In our idea of home the interest lies
In that one owns the home he occupies.
'Tis this that gives each toiler in the land
Courage to labor with an honest hand;
Incites him on in every enterprise
Wherein success and an improvement lies;
While this one thought his hours of labor cheers,
The benefit will come in later years.
His home may be a humble cabin now
On fertile plain or on the hillside brow;
With trusting faith he cultivates his lands
And plants his fruit trees with industrious hands;
Improvement marks his steps where'er he goes,
And all waste places blossom as the rose.
The cabin low, abode of toil and care,
Gives way at last for stately mansion fair,
While soft winds sing among his fruit trees near,
Which pour their offerings grateful year by year,
And flowers their precious perfume freely shed
And fall in showers of sweetness on his head.

There's many a home in our fair land to-day
Such as I have endeavored to portray.
And if I ask, where in our country's bound
Can peace and satisfaction true be found,
You will not turn alone to learning's walls,
Nor yet to pleasure's gaily lighted halls;
Nor will you seek 'mid riches' dazzling glare
For perfect peace and happiness most rare,
But, turning to our humble farmer's home
Reposing sweetly neath high heaven's dome,
You say—this is a life that pleasure gives,
Happy is he who 'mid such beauty lives.

There's many an influence that unbidden comes
From silent objects that adorn our homes.
A lady once lamented even with tears
To one—a playmate of her childhood's years—
That as her boys approached maturity
They had an ardent longing for the sea.
She could not understand the cause, she said,
That they should thus desire to earn their bread.
A beauteous picture hangs within their view,
A noble ship, speeding the waters blue.

The friend then pointed to the picture rare,
Hanging these years in all its beauty there;
"That painting fair an inspiration gives,
And this has influenced your dear boys' lives."

Fathers, plant trees, and interest your boy
In a pursuit that will increase his joy.
Each fruit tree planted by his youthful hand
Binds him more firmly to his native land.
Fitting companion you will ever find
The thrifty fruit tree for the youthful mind,
And lessons true unconscious day by day
They ope to them in their impressive way—
While being trained to stand erect and strong
And pruned of errors that will lead them wrong,
Engrafted with the fruit we know is pure
That to the end shall prosper and endure.
Such occupation to the young mind gives
A virtue that lasts ever while he lives,
And in the coming years will prove to be
A source of pride and noble legacy.

Nations afar reach forth an eager hand
For choice production of our sunny land;
And we shall find an ever open door
For all the surplus of our choicest store;
For England's fog we know can never vie
With the productions 'neath our sunny sky.

Some years ago I saw the refining power
Exerted o'er the young by blooming flower.
I chanced while in a city's busy street,
A group of young and noisy girls to meet,
Ill clad, uncouth, they proved themselves to be
Examples of a low humanity.
Gazing into their face you could not say,
You saw of virtue one redeeming ray.
At last they paused, by mutual consent,
And in low tones gave to their wonder vent.

'Twas then I saw upon the sidewalk there
A lot of potted plants of beauty rare,
Exposed for sale amid the passing throng,
And shedding fragrance as they rushed along.
These children from the homes of want and care
Unconscious gazed upon the picture fair,
While on their faces clouded by unholy blight
There shone, it seemed to me, redeeming light,
As they beheld the silent beauties there

And caught their perfume in the summer air.
And then I thought each being He has made—
In whatsoever guise they are arrayed—
Some portion of divine love are possessed,
And His sweet flowers can make it manifest.

Our homes to-day may be like gardens fair
With nought that is unlovely growing there;
Or yet perhaps they tarnished are, by sin
With weeds of error ever creeping in.
Let us, dear friends, exert the utmost care
That nothing ever thrive that is not pure and fair.
So when the Master walks in cool of day
We need not fear and hide ourselves away.

Mothers, how oft you've trained the household vine
That gracefully about your homes entwines—
How oft in gardens fair the beauteous rose
More sweet and lovely by your guidance grows;
And lilies fair in all their purity
Grow fairer still beneath your watchful eye.
And yet in these fair homes of yours to-day—
When you may turn from outside scenes away—
And when those little arms in tenderness
Cling round your neck with their sweet child caress,
A rose, more sweeter far than earthly garden flower,
A lily, fairer than e'er those in Eden's bower,
This earnest, toiling life work beautifies,
And makes your home an earthly paradise.
May you have grace to guide with loving care,
Until they bloom in Heavenly gardens fair.

This exercise closed the evening's programme, and the annual winter meeting; although for a half hour afterward most of the audience remained in the hall and spent the time in social intercourse. All pronounced the meeting a very successful one, the several papers and discussions having contributed largely to promote the objects, and help carry forward the work of the Society.

ORIGINAL PAPERS.

Three of the papers given in this division were prepared for the winter meeting, and announced in the Programme. But as it was impossible for their authors to be present, they were simply read by title, and are here published in full. It is manifestly unjust to a person to have his essay read by another in his absence, when such paper contains opinions, statements or experiences which the writer is not present to explain or support, should his ideas draw out a discussion, as is usually the case. This has occurred once or twice at previous meetings of the Society, and it has seemed unfair to the Secretary to bring such essays as a target for criticism, in the absence of the writer. He has therefore deemed it best to take them from the order in the Programme in which they stood, and present them in the form here given. The other papers were especially prepared for the Society, one of which was intended to be read at the Farmington meeting, was addressed to the Secretary at that place, but did not reach him until after the close of the meeting. All the papers are not only interesting, but valuable; and some of them are important contributions to the local history of fruit growing in our State, especially as regards varieties for particular sections. The thanks of the Society are due the several writers for their contributions.

ORIGINAL PAPERS.

A CHAPTER OF REMINISCENCES.

By Calvin Chamberlain.

As the time of the winter meeting of the Pomological Society approaches, we who cannot be with you physically can very properly extend to you the assurance of being with you in spirit. I fear Piscataquis will not be represented at your meeting in any other way. While you are preparing for that event, I have nothing to send through you that now presents a special claim,—perhaps nothing that might not as well or better be omitted. But I am rather inclined to send you a box of apples if I can seasonably see a favorable break in this Arctic weather. I have ever hesitated long before deciding to call general attention to a new variety of fruit, as we are always heavily loaded with such claims.

I have a fair apple of medium size, green in color, a native in an orchard in this town, that I helped my father set, beginning about the year 1820, and adding thereto in the few succeeding years. My attention was first directed to this apple by the circumstance that a business man at Milo came to me at harvest-time in several successive years for a load of apples. After he had become acquainted with the orchard, at each visit he looked first at a particular tree, and if it had produced, his load was largely made up from that. From this hint I put some in the cellar for winter trial. About that time, my wife was transplanted from the county of Worcester to Piscataquis; and one of the small comforts that helped to make the removal tolerable was the finding this apple better suited to her taste than any she had before met. The children of our relatives and neighbors soon introduced a household phrase—"Aunt Mary's tree," "Aunt Mary's apple." I speak of what was passing forty years ago. Since then, I have many times presented a dish of apples mixed—

Nodhead, Fameuse, Hubbardston and others well known,—with the "Aunt Mary," and on trial the preference is very generally given in favor of the last named. Its fine, tender, juicy flesh is peculiarly refreshing, and appears specially agreeable to persons of weak digestion; for which real or fancied merit it presents a claim for further trial. It retains its sprightly qualities remarkably long; usually extended to one-third of the year. The tree forms a round, thick head, rather drooping, requiring care in thinning. Branches slender but strongly set, so as to carry safely its enormous crop which comes in alternate years. If thought worthy of place, please call it "Mary" or "Aunt Mary."

I will send you a sweet apple from an old tree of my own growing, which I suppose to be grafted, but cannot say how I obtained it. Perhaps some one may recognize it. The tree is a good bearer, fruit always fair; larger than Talman, more juicy, better when baked, and keeps as well.

The market for Piscataquis apples has recently been opened a little by a trading firm at this village taking them in exchange for goods, and they have handled two car-loads or more, paying $1.00 per barrel delivered at the store; they transferring to their own barrels. These have been taken from a few cellars within easy distance of the village. This party came to my cellar for a few barrels of Talman to fill an order. My other market, and the one to my taste quite as satisfactory, is in the daily ration that goes to the faithful old horse, the pet Jerseys, and the quiet pig. When I was first planting trees, my thoughts sometimes found expression through the types of the old *Maine Farmer*, to the point of crowning our hill-tops with sweet apple trees to an extent to fill the market and leave a possible surplus for our domestic animals. I have since taken satisfaction in that my practice was then made to run so nearly in accord with theory.

While we are together we may properly indulge a little in a brief retrospect of the interest we represent, and especially *now*, from the circumstance of the recent removal of our good and great leader and teacher, Marshall P. Wilder.

The first attempt to promote the interest of fruit culture in this country through a general, comprehensive organization appears to have been made in the year 1848. There was at that time a large number of local organizations active in the good work. The management of the State Agricultural Society of New York in that year caused a meeting of delegates at Buffalo from fifteen States and the

Canadas. That convention resolved itself into a permanent organization with the name of "North American Pomological Convention," and the first meeting held under that title was at Syracuse in 1849.

Another movement of analogous character was made the same year (1848) by a meeting of fruit growers at New York City, which meeting organized itself into a permanent association under the title of the "American Congress of Fruit Growers." These two organizations were subsequently amicably merged in one, with the name of the "American Pomological Society."

I was at the meeting in Syracuse in 1849,—went there as a silent pupil, representing only myself. None other there from Maine. I there met for the first time many active workers whose names are well preserved, whose works have been approved, and the most of whom have now closed their record. The assembly was mostly made up of citizens of New York,—a small delegation from other States and Canada—more from the West than from the East or South. From the workers of whom I retain the clearest recollection of person, manner and matter presented, I will name J. A. Kennicott, C. Downing, P. Barry, C. M. Hovey, David Thomas; J. J. Thomas, L. F. Allen and J. J. Mapes. Dr. Kennicott was a young, active enthusiast in the orchard interest of Illinois, and was chosen president of the convention. Mr Mapes was then publishing an agricultural paper at New York City. Mr. Hovey was publishing a magazine at Boston, devoted mainly to horticulture. Mr. Barry then, as now, located at Rochester, New York, was engaged in one of the most extensive nurseries in this or any other country. Mr. Mapes also had a nursery in New Jersey, and Mr. Hovey one at Brighton, Massachusetts. It was not convenient for me to attend the meetings of the consolidated society until 1856 at Rochester. I there met my young friend, John W. Adams, then conducting a nursery of a few acres at Westbrook. We were there as the sole, self-appointed delgates from Maine.

I have attended none of the meetings of that organization since, except one holden at Boston. From the many citizens of our State whose names I can easiest recall as my associates and teachers in this special interest, are those of Holmes, Benson, Foster, Fairbanks, Sears, Little, Noyes, Carr, Weston, Rogers, Adams. I do not repeat for the purpose of saving them from oblivion, for these with many others will be retained while the industrial literature of the age shall exist.

Of the men with a wide-world reputation, active in the earlier years to which I refer, with whom I can claim some personal acquaintance, I can name none now remaining in the world but P. Barry, J. J. Thomas and our own S. L. Goodale. Of our great and good teachers, Charles Downing and Marshall P. Wilder, I would on this occasion give you words expressive of my appreciation of their individual characters and their acquittal of assumed obligations in life's mission, but my impulse is checked by inability to express a tythe of what I feel. Their contributions to the well-being of the race are rarely, if ever, excelled in individual endeavor at any era in man's history. Each in a life well extended through careful compliance with physical laws—each in early life devoted to a special pursuit of vast importance to mankind—each lived to accomplish that for which we, with a united humanity, will hold them in perpetual remembrance. It was my privilege to receive favors from their hands; and no gentleman was more prompt and painstaking in private correspondence than they were. It was once naively remarked of Mr. Wilder that "wherever he steps, flowers bloom around him; and whenever we meet him, his hands are full of richest fruits."

In and through their unselfish works in disseminating life-giving fruits, these model men builded wisely and well their homes, and planted their choicest fruits in that *real and perfect world*—separated only by a vail from this—where they may enjoy without limit, where blight and insect pest may never enter. We miss them here, and where will be found those worthy to take their places?

Foxcroft.

FRUITS IN AROOSTOOK COUNTY.

By E. W. Merritt.

As I attempt to write on fruit culture in Aroostook County I feel my incompetency, although one might suppose that nine years ought to acquaint me with the facts ; but please bear in mind, the county is large, the soil varies greatly and conditions which are favorable in one locality are detrimental in another ; also different treatment is required on these diverse soils and localities, and while we may start at the southern boundary of the county (which is seventy-five miles north of the fruit-growing belt) with a list of thirty-five varieties of apples, it rapidly diminishes as we proceed north. In order that you may better understand this, I will say that the catalogues of Massachusetts embrace some three hundred and fifty varieties of the choicest apples, which is only a small part of all grown, our friend Bennoch at Orono has one hundred and forty, while at Houlton not more than twenty can be successfully raised, and the list will run down to four or five kinds at Fort Fairfield and Caribou. There may be an occasional place in this county where the number may be slightly increased.

SOILS.

In this county there are (according to Colby's Atlas) one hundred and seventy-five sections of about six miles square. Fifty of these are settled, twenty-five more partially settled, and the remaining one hundred have but few, if any, settlers. The principal settlements are on the east side of the county and embrace a comparatively narrow strip running north and south for a distance of one hundred and twelve miles, Houlton being thirty-four miles north of the south line. By this you will see I am able to speak of only this small portion of our county. This area is cut still smaller by the fact that low, frosty ground, also land where there is a loose subsoil and intervals, are not adapted to orcharding. Yet, in spite of this, a large portion of the southern part of the county is as good orchard ground as any part of the State (aside from the fact that we are restricted to a few of the choicest varieties).

In most of the clay and slate, and all of the granite soils, apple trees will flourish and become a profitable orchard with the proper care and protection. Orcharding is yet in its infancy, although a great outlay and effort has been made, which has been but a partial success owing to these causes:

1st. A want of care and judgment in selecting hardy varieties, the buyer not knowing what to buy and the agent not understanding his business.

2d. A want of care and protection from cattle, mice, caterpillars, etc.

3d. Trees raised in New York are not so good as those raised here, for, the soil being alluvial and light, it makes the growth light and spongy; the soil is deep, allowing the roots to run so deep that a large part of the roots have to be cut off in raising the tree when shipped; and then, again, it is too great a change in climate, and the tree cannot be depended upon to make a healthy orchard.

Those who have orchards of grafted fruit find it a very profitable investment, and there will soon be apples enough raised in this vicinity to supply the home demand. A large number of choice varieties are set out here each year, as the apples raised here are of superior flavor and will keep longer than when raised south of here. I think that eventually apples will be shipped from this county; they may not go to England, for we have a great country north of us which will always want them. Every one that has an orchard in bearing is well pleased and wishes he had more trees. What I wish to emphasize is that orcharding is a success in this part of Aroostook and will be more so as the people learn to take better care of their trees. These conditions, however, cease at forty-five miles north of the south limit of the county, which is at Bridgewater. It is no use for any one to think of raising an orchard above this line except of a few early and fall apples and these only in isolated localities. This may seem strange, yet it is a settled fact in my mind, for the following reasons: 1st. In parts of Blaine and Mars Hill the soil is four feet deep; 2d, The subsoil has an excess of lime, resting on a rotting lime ledge; 3d. The snow comes on before the ground freezes and being a light, loose, warm soil, the trees start early in the spring and are killed by late freezing. These conditions reach as far as Fort Fairfield, where the subsoil is fine gravel. If these hindrances did not exist the climate is now too cold for orcharding.

Some of the above difficulties may be partially remedied on young trees by treading the first snows about them, allowing the ground to freeze, but this is not practicable in a large orchard or around large trees. If the above alleged facts be true we are led to conclude that most of the southern third of the county is well adapted to orcharding, while north of that it cannot be made a success.

NURSERIES.

The nursery business has been repeatedly tried here and as repeatedly failed. Out of seven, five have been closed or abandoned. One nursery of sixteen thousand trees set out in the spring of 1887 has been able to raise not more than one out of ten to what might be called a tree, and probably not half of these can be made salable. The last one of thirty-two thousand trees set in the southern portion of the county lost one-third of their trees the first winter. Young and tender trees and extreme cold, coupled with other difficulties too numerous to mention, make the losses too heavy for an inexperienced person. It costs twice as much to raise a tree here as in New York, it grows slower, looks scrubby and has not their glossy appearance ; but being raised on a hard, granite soil they are well supplied with roots and a solid, firm wood. Mr. Sharp of Woodstock, N. B., is the only one in this vicinity who has been able to surmount these difficulties, and his success has been attended with considerable loss.

SMALL FRUITS.

Please bear with me when I make the seemingly extravagant statement that there is no place on the face of the earth better adapted to small fruit culture than Aroostook County. The soil is good, while the climate could not be better. Here is their home. My nursery consists partly of cambrian, slate and alluvial soils, and the fruits seemingly do equally well on each. The snow comes on before it is cold enough to do any harm and keeps the bushes and vines housed all winter ; preventing all freezing, thawing and heaving of the soil. When the snow has gone in spring it is warm and they will start forth with all their vigor, not having lost any of their strength by repeated attempts to start before it was safe to do so. Any tree or bush exposed to the cold of our winters and the drying wind and sun of March sustains no inconsiderable loss, hence the benefit of snow. Our most serious obstacle in gooseberry and currant culture is the currant worm, which will strip a currant bush as quick here as anywhere. A limited home market is also a hindrance.

Gooseberries make a strong, healthy growth. From seven hundred and fifty Houghtons set out in the spring of 1885 we gathered ninety pecks this past summer, some bushes yielding as high as two quarts. I consider two thousand pecks a moderate yield per acre for this variety. I sold most of mine at $1 per peck, and they will pay well at half this price, but the demand is limited unless they can in some way be preserved for winter use at a moderate cost.

Currants. With currants as well as gooseberries there is no hot sun here to curl the leaves, stint the growth, and injure the fruit; most of the shoots making a growth of from two to three feet each in one season. I think there are fortunes for those who may engage in currant culture, making them into jelly for the outside market. The most of mine are the Red Cherry variety, yet I think I shall hereafter set mostly Fay's Prolific and White Grape.

Strawberries are a goop crop here and may be held back in the spring, making the fruit late, ripening after the wild ones here are gone and outside markets bare, when I think they can be shipped at a profit. I have the Bidwell, Jumbo, Finch, Piper, Daniel Boone, Sharpless and Manchester, which have all done well, none winter-killed; the last two named varieties take the lead.

Raspberries are right at home here, and, there being so many wild ones. I have as yet done but little with this fruit. The Herstine and Crimson Beauty are perfectly hardy, and have stood up during the winter uninjured.

Blackberries have received but little attention: I do not know of a blackberry hardy enough to stand up during the winter.

I have in my experimental grounds Smith's Improved gooseberry; Victoria and Fay's Prolific currants; Parry, Jewell and Belmont strawberry; Gregg, Cuthbert, Marlboro' and Golden Thornless raspberries; Agawam, Wilson, Jr., Staymen's Early and Snyder blackberry; and all of the above have done well so far but have not been thoroughly tested yet. I intend to add, the coming spring, Russian mulberry, apricot and pear with some choice varieties of apples and small fruits. My nursery being nearly one hundred miles further north than any other in the United States, I have been able to profit but little from the experience of others. The modes of treatment used to advantage by those farther south are not safe here. Should any one of this Society have a choice fruit and wish to have its hardiness tested, if they will send it to me in the spring it shall receive my personal attention.

Houlton.

SOME ASPECTS OF FRUIT CULTURE IN SAGADAHOC COUNTY.

By J. W. Lang.

Sagadahoc County lies in the southern and consequently the best fruit belt of the State. It has its territory pierced by the lower Kennebec, with its branches of Sasanoa and Back rivers forming the island towns of Arrowsic and Georgetown; and its south is bounded by the Androscoggin River near its confluence with the Kennebec, through the medium of Merry-Meeting Bay. Its geography is further diversified physically by the Abagadassett, the Cathance and the Muddy rivers, all flowing into the great common water of Merry-Meeting Bay. It will thus be seen that we have considerable climatic modification and conditions dependent upon and caused by influence of these waters. One of these conditions is a considerable humidity. The county borders upon the ocean, and ocean waters, in the towns of Woolwich, Arrowsic, Georgetown, Phipsburg, Bath and West Bath.

The apple is particularly at home on our rocky ridges and lighter clay loams. There is considerable gravel loam and the heavier sands, where orcharding thrives quite well. Being so easy of access by water this county was early settled, and many of its towns have now already celebrated their centennials. The early settlers planted seeds of the apple about their dwellings, and there are many vestiges of these first orchards. The generations succeeding also planted orchards, and these, before the art of engrafting became known and practiced by the people, while they bore abundant crops from the strong and unreduced soil, were in many instances fit for little else than feed or cider, and were mostly used for the latter. The best were used for food, but for time out of mind great quantities of cider have been annually made, and this has had its influence on the temperance question of the section.

The younger or later orchards are of improved fruit; but enough of old natural trees are left to supply several cider mills in nearly every town with a good fall's work, and enough cider is made to keep a great many of the boys and young men in the downward road, that for too many of them can end but in a drunkard's grave. The product of cider is far greater than any demand of market, or promise of profit for working into vinegar. The writer conceives that he has done some effective work the past season for the temperance reform by cutting down and clearing up a large number of these old "naturals" that were beyond the redemption of the graft, and yet too tenacious of vitality to die of their own accord, and which annually persisted in bearing their annual crops of gnarly apples not worth picking for feeding to stock or swine. These trees were near old cellars and cumbering the best of soil, showing they were planted about the early farm-houses of this section.

More care is taken in planting out trees than formerly. The ground, as a rule, receives a previous preparation, and the trees are carefully selected and carefully handled and planted. They are usually well managed by manuring and cultivating the land between the rows, and if on sward ground they are kept well mulched.

The borers with us are on the increase, and require vigilant looking after twice a year at least. Bark lice are far too common, and the caterpillar and web-worm more or less troublesome every year. There are many other drawbacks, so the life of the apple man and the fruit grower is not one of an all intense delight. On the other hand, good care, careful attention and judicious cultivation are duly rewarded.

There is more attention given than formerly to pears and small fruits each year. There is no rapid growth or marked excitement, but a slow, careful, increasing attention. One of the lecturers at our Farmers' Institute next week will treat of strawberries; another of raspberries and blackberries, and we venture to say of their remarks that they will be listened to closely and their teachings carefully treasured up in earnest and interested hearts, and in years succeeding their good points will be woven into practice. These two lecturers are practical men in the subjects they speak about—the one from Knox, and the other from Waldo counties.

There is a tendency to grow more winter apples. Our local markets are over-stocked with early fall, fall and late fall apples. There is also a tendency to grow a better supply of greater variety of fruits for home use, and home sale—for supply of the raiser's table, and that of the village and city resident. There is more studying up the subject, consulting the reports of this Society, and interest in the fruit exhibits at our fairs. It is found that the Maine-grown strawberry always brings a good price, as most of the crop comes after the western supply is stale or out of the market. Our Maine berries, fresh from the vines, must always bring a fair—even large price, and who dare imagine when there ever will be an over-production of good strawberries and cream?

The gooseberry and currant are two of our neglected yet highly meritorious small fruits. Since learning how easily they may be met and fought with a two gallon sprinkler and a teaspoonful of white hellebore stirred in the sprinkler full of water, there can be no good reason why their cultivation will not increase. While Maine may never grow grapes for market, there is no reason why every farmer and every villager may not raise an abundant supply for their own use.

The cherry of the "Black-Heart" variety is as easily grown and as hardy as the wild cherry of our waste lands. They are easily and rapidly grown from seed, come into bearing in a few years, and the child always closely resembles the parent. The trees live to a great age, and continue bearing annual crops generation after generation. The Rev. Charles A. Cone brought the "Black-Hearts" into this vicinity, from the Vaughan estate at Hallowell, years ago, and has some splendid trees, and there are also some grand trees on a place here where he formerly lived. Others incited by his precept and example have raised and are raising fine trees. The "Black-Heart" grafts kindly into the wild cherry, and forms a very good tree if grafted in the limbs.

Altogether the present condition and future prospect of fruit culture in Sagadahoc is encouraging. Each bearing year larger quantities of winter apples are called for and sold out of its borders, and car load after car load is loaded at our stations and shipped to England, some of which doubtless find their way to the Queen's table, by the way of Queenstown.

Bowdoinham.

ORCHARDING IN SOMERSET COUNTY.

By Frank E. Nowell.

Has the Maine State Pomological Society given any force to fruit-raising in our county? I think it has, for in travelling over Somerset County we see signs of marked improvement in fruit growing during the last twelve years, not only improving and caring for old orchards, but also in the planting of young trees. You can see fine fruit in the southern half of the county of both fall and winter varieties. This is in part, I claim, due to the advanced markets, and in part to influence of the Pomological Society, although there are not as many members as there should be in the county, still I am glad to say its reports are read by the firesides of many of our orchardists, and the future will show that its recommendations are silently working an influence for good. It is a fact there is a decided improvement in growing apples for profit in this county. You will find orchards set out of our native stock where the tops have been properly grafted, are yielding good, paying crops. One great trouble is, we see too many varieties in small orchards, and generally too much fall fruit, for profit. Another misfortune is in having two and three varieties on one tree. This should be avoided. A chief objection is, it makes a great trouble and extra work at gathering time.

I believe in Maine-grown trees for Maine orchards You can buy trees to-day that are grown in native nurseries at less price than the Western trees can be bought for, and it is my idea they are far superior for the cold hillsides of central and northern Maine. Another thing. In buying Western trees of agents one is apt to get duped sometimes. To illustrate: Four years ago one of my neighbors bought seventy-five western trees from an agent. The varieties bought, as he supposed, were Baldwin, Russet, Talman Sweet and Nodhead. I helped him set them out in checks twenty-four feet apart. They looked first-rate and grew well, as they all lived. Of course he was much pleased with his trees. Well, the next year ten of them bore apples of the crab variety. The second year more crabs appeared and the third year they *all* bloomed with crabs. So much for buying fruit trees of travelling men recommending stock from firms we have never heard of. This, I grant, is an exceptional case, for I have had some experience with western trees in the last twenty years, and am willing to admit I have some good trees of the hardy varieties, such as Northern Spy, Talman Sweet, Rhode Island Greening and Yellow Bellflower; but at the same time I have set native trees in the place of the lost westerners and top-grafted them, and to-day they are bearing more apples than the western trees in the same row. So I will repeat again, I believe in Maine stock from Maine orchards.

The shipment of apples to Europe is quite a business, and evidently a growing one. That the foreign demand for shipping varieties of Maine apples has increased at a rapid rate in the past few years we can all testify. Why is it so? In my view it is because of their fine flavor and good keeping qualities, if carefully picked and packed. Some have said apples should be handled like eggs; I don't think they are quite so tender, still, they need very careful handling to put them in the market in good shape, so as to receive the high prices we all like to obtain for our fruit.

Somerset County so far has been noted more for its sheep and fine wool than for fruit. Still, it has taken some part in our annual State shows in the past, and I think it could have done better, had the orchardists fully understood the pomological merits; but we hope as the years roll by to see a greater advancement in fruit culture—for our old sheep pastures on the rocky hillsides make fine places to set our native trees and graft them to Baldwins. And just here let me say a word as to the importance of setting out orchards at once. Do not wait until everything else is done, and for the convenient time as you think, for on a farm there is always something to be done. One of my townsmen, over twenty years ago, thought when he had a leisure time he would set out an orchard, but that time never came and the consequence is, he only raises a few apples from some old trees that were on the farm when he took possession of it. I know from experience it takes both care and time to look after trees and keep them in order: but it pays every way to do so. And my advice is, take the time now and set out trees. They will grow while you are doing your other work, and in a short time you will feel well repaid for your time and trouble by the fine returns which the trees will make.

Now, in regard to the different kinds of fruit, I will give you a list of nine varieties for home use, lasting the entire year: Red Astrachan, High-Top Sweet, Winthrop Greening, Nodhead, Tompkins' King, Talman Sweet, Baldwin and Northern Spy. I find these give good satisfaction in my section. Of course people have different ideas about fruits. Some think the Spy a better apple than the Baldwin, but to my mind the Baldwin is still chief of the winter market, although the Spy is a fine apple. Some object to them on account of being slow bearers; however, it is proving a profitable apple on high ground for Somerset County.

I cannot say much in regard to pears in this county, as they are rather hard to raise. I have noticed that where they do succeed in raising them it is on a rather dry subsoil on slaty ground. I have some trees that have been set out for twenty years and they have never borne twenty good pears in that time. The Flemish Beauty cracks badly with me, while a neighbor of mine raises very fine ones, as his soil is different from mine.

We hear but little said about plum trees in this county, yet they are easily grown, and I think it would be safe for me to say the fruit is a favorite with every one. I have noticed in riding over the county horse-plum trees in clumps in door-yards and orchards. They can be easily grafted to Washington, McLaughlin or any of the Gage family. They are all good. Last fall I sold Red Gage at $3.20 per bushel, and if a large amount had been at my command could have sold them all. Later I learned parties sent to Boston for them and paid $4.00 per bushel; so it is evident plums can be grown in Somerset County at paying prices. All it needs is a little care and enterprise to grow them anywhere in the old "Pine Tree State."

Fairfield.

WHAT SHALL WE DO TO INCREASE THE PROFITS OF FRUIT CULTURE IN MAINE?

By Henry A. Sprague.

I can think of only two ways to do this: First, to grow more or better fruit; and, second, to get a better price for our fruit.

To raise more and better fruit would not increase our profits, unless the increase be raised at a cost which will leave a margin for profit; but if we can secure a large increase both in the quantity and quality of our fruit without any additional expense, an increase of our profits will evidently follow.

And this I think we can do, if we will. A large proportion of our fruit is either destroyed or injured by insects. There probably are no insects in the world which are not preyed upon by bird, beast, reptile or insect enemies; and where human agency has not interfered to destroy the balance between the different classes, insect injuries are few. To take away the cause—or possibly to assist nature, in some instances, to restore equilibrium—is all we can do, and will in most cases be sufficient. What we farmers should do is to come to the front, as our leaders in the grange tell us, and assert our rights and demand greater protection for our purely insectivorous birds and other animals. The grange has been successful in some of its demands on the Legislature; why should it not in this?

In regard to the price of fruit, what can we do to make that any better? Nothing, unless the grange helps us, but through that we should demand as much import duty on Canadian apples as the Canadian Government charges us, when our trees yield a better crop than those of the Dominion.

And now, perhaps a few notes on the progress of fruit culture in this county will be of interest to some. All varieties of apples and pears at present under cultivation wintered safely, and would have produced a fair crop of apples but for the extreme dry season of 1886, which reduced the apples in size very much. A few pear trees produced a little fruit, making it appear probable that when full bearing age arrives pears may be a profitable crop in this county. Four Shaffer raspberries, all I had of that variety, wintered perfectly without protection, while two Nemaha growing beside them were practically destroyed. From my limited experience with the Shaffer, I think it will prove a valuable fruit for this section. Its fruit is not as rich as Brinckle's Orange, but is good and in size surpasses Dolittle, Ohio, Nemaha and Cuthbert. In flavor and color it stands intermediate between the blacks and the reds. Fruit of all kinds produced a light crop this year, but the fruit crop was better than most other crops, as it seems to withstand dry weather better.

The cranberry crop in this section was almost entirely destroyed by early frosts. I should have said that over a hundred young Shaffer raspberry plants raised from the four which I bought in the spring of 1885 all wintered beside their parents without loss, and without winter protection. I have just read President Pope's address of last winter, and would like to ask whether the apples which were sold for five dollars per barrel were those of our common varieties, or some rare, fancy apple sold for ornament rather than use; and how many such apples could be sold at such a price?

With regard to the discussion on short-jointed trees, I would say that about twenty years ago I bought scions labeled Drap d' Or which had buds closer than usual, and none of the scions lived long enough to produce any fruit; and I now have a variety (Early Colton) which have the buds nearer than any other variety which I have seen. It has not fruited with me yet, and is not perfectly hardy.

In regard to some of the varieties of apples in the last publication of the Society's list, marked (?) for the Central Division, and the varieties of which my experience has led me to regard them differently from the description given, I would say:

Fall Jenneting has not yet fruited with me. Moses L. Damon of South Charlotte speaks highly of it, but says it is only a biennial bearer.

Foundling. My experience is very limited, but I think it is hardy when grafted in limbs, but not always so when grafted on young stocks.

Gravenstein. The scions which I obtained under this name were grafted in young trees, and all winter-killed or became black hearted and died without producing a single specimen of fruit.

King of Tompkins County. About twenty years ago I set eleven trees of this variety, produced by splice-grafting young seedlings with scions obtained of Calvin Goddard of Portland. The trees made a rapid growth, and every fall promised an abundant crop of apples for next season; but the buds always winter-killed, and the wood was more or less discolored. I succeeded in getting perhaps a dozen very nice apples in all. Some of the trees died; but I grafted most of them to other varieties to save their lives.

King Sweeting. I obtained scions under the name of High-Top Sweet, but by description of the late Joseph Taylor they are King Sweeting. A nice apple, but the trees are often injured in winter.

Large Yellow Bough. Nice when fully ripe, but a thin bearer and not as early as some other apples.

Porter. Scions obtained of C. Goddard for Fameuse produced some nice fruit, which appeared to be Porter. The trees were very tender. A neighbor also had some Porters which killed badly.

Primate. Very nice, but too tender for profit.

William's Favorite. Very nice and fruit buds not so likely to kill as those of the Primate, but bearing trees sometimes wholly kill.

Charlotte, Washington County.

LETTER FROM HON. HENRY E. VAN DEMAN.

MR. SAMUEL L. BOARDMAN,

Secretary Maine State Pomological Society.

My Dear Sir: I have this day the honor to acknowledge the receipt of the programme of your Society at Farmington, next week. It would be a great pleasure to me to be present on that occasion, but as I have only to-day returned from an official trip which has taken two weeks of my time, you can easily imagine the work now awaiting my attention. But it is in my mind to meet with you at some future time. Let me assure you of the interest that Commissioner Colman and myself have in the prosperity of your Society, and the culture of fruits in your State.

As the Pomological Division has but just been started, let us hope that it may be made a means of assisting the fruit growers of Maine in more successfully and intelligently pursuing their work, and let us work hand-in-hand to that end. If you see any way in which this Division can aid you, do not be backward in calling on me.

Yours Fraternally,

H. E. VAN DEMAN,

Chief of Division of Pomology.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF POMOLOGY,
Washington, D. C., Jan. 29, 1887.

PROPAGATION AND CULTURE OF THE PLUM.

By J. E. Bennoch.

Plums for the past few years have not, in my section of the State, been on the increase, but rather sadly on the decline ; and I think, with the exception of some few localities, it has been very generally so. With me the fruit has been scarce for the past few years, but previous to that I have usually raised fine crops of this fruit.

My experience with plums—which has been extended over quite a period of years—shows that after a certain age they become shy bearers, owing, no doubt, to the fact that they have performed the offices of their nature and are no longer useful. On the whole the plum tree is of short life, especially on the plum stock, or on its own roots. The trees also show decay very rapidly. I find my best plum trees are upon the pomegranate stock or roots. I also find that I gather larger and fairer crops and of larger fruit in most if not quite all cases, and that the tree is also of longer life. What plum orchards I call to mind at present are from the Woodstock, N. B., nurseries and I am very sure their roots are the pomegranate. One very bad fault with the pomegranate is that it throws up large quantities of suckers from its roots, which I have noticed is not entirely so with stocks raised from the stone-seed but generally so with suckers that have been apart from roots ; and these sucker very badly and at long distance from the mother tree. My last grafting and setting of trees are strictly from seed growth, and in fact all grafting of whatever sort or variety of tree growth should be from seed growth and on such.

The best soil for the plum is that of a clay nature, and to insure good crops the strongest and best manures should be used. Dressing from the hog-pen and poultry houses is the best that can be used ; also a yearly ration of salt must not be forgotten. Poultry and pigs should be detailed as policemen in the plum orchard to arrest the grower's enemy and the plum destroyer, the little monster curculio. The pig and the poultry will leave none to tell the tale the next year ; and in cases where there are no plum orchards in close proximity, one year, or rather one season's work they will not show up, for three or four years, to do but little harm. I think as a general thing plum trees are not so well understood as are other fruit trees. I am of the opinion that plum trees need and should have an annual fall top-pruning, the same as the pear for instance, I think in the month of October. What is meant by top-pruning is the cutting or nipping back of the present year's growth to from two to six buds all through the tree, which tends to strengthen and develop the fruit buds, while in a year of heavy growth of wood the buds would not develop, as in many cases fall pruning lessens wood growth and develops fruit growth. Where a tree is backward in wood growth, and it is wanted, cut back from the terminal bud in the spring, and if the ground is in fair condition you are quite sure to get it.

I have known some plum trees to be quite a number of years developing their fruit buds, and making also but very little wood that is of strong growth, but rather short and quite plenty; when, if this growth had been nipped back and about one-half of such growth spoken of had been entirely cut out of the two years' wood, I think the tree would have set a crop of plums the next year.

To meet with success in plum raising the trees should be set in orchards by themselves. In this case they can be cared for more easily and with less trouble than by being grown here and there with other fruit trees. In starting stocks for the plum I should use pomegranate stone-seed stock to graft upon and graft on the collar for the plum. In the pursuit of new varieties I should use plum seed, and it is the only way for experimental purposes. The stock for grafting upon should be worked at two years' old growth; the next year from the pip the stock should be nipped back so as to give a strong growth on the collar for purposes of grafting. This should be done from the last of June to August. Seed for testing purposes should be from large, fine varieties, such as McLaughlin, Smith's Orleans, Washington, Coe's Golden Drop, Duane's Purple, and other good varieties; the large fruit of the plum in all cases bring the best prices.

Plum trees as a general thing are quite hardy, until old age arrives with them, and then their infirmities only end with their death. When they begin to show signs of feebleness it is time to replace with younger and more vigorous trees. Of the fine and valuable varieties there are many to select from—those above mentioned being among the best. There are some diseases peculiar to the plum tree, such as black knot, oozing of what is called gum, which last shows the tree to be in a diseased condition of the stock. Black

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knot has not, I believe, been fully defined as yet; the only remedy I know is to cut off the affected branches and burn them; and I think it is the only safe cure. One thing that the plum demands with good care and dressing is its most favorite natural soil, clay, to insure good crops and bring the longest life and health to the tree. Why I have said this much about the plum is because it is a fruit of so much value and character, and so little has been written about it that I wanted to bring it to your consideration, that it might take its place as equal to other fruits of our State; for we all know the fruit of the plum is much sought after and in numerous localities can not be had at any price.

Orono, Penobscot County.

FRUIT CULTURE IN PISCATAQUIS COUNTY.

Letter from MR. H. L. LELAND.

MR. SAMUEL L. BOARDMAN,

Sec'y of Maine State Pomological Society.

My Dear Sir: I am sincerely obliged to you for the invitation to be present and take part at the winter meeting of the Pomological Society to be held at Farmington. It would give me much pleasure to meet friends who, like myself, are interested in fruit growing. I must, however, deny myself that pleasure, although realizing that much might at that meeting be learned that I feel myself very much in need to know.

Of the present condition and future outlook of fruit growing in Piscataquis County there is not much to be said that would be of general interest to those outside the limits of the county. Our farmers have not generally shown any special interest in fruit growing beyond the planting out of trees that the persistent western tree vender has cajoled them (too often through misrepresentations as to merits of new varieties) into giving orders for. It has too often been stated to need repeating that as a rule western fruit trees are a failure in Piscataquis County. Exception can be made of several of the extremely hardy varieties among which are the Duchess of Oldenburgh, and of more recent introduction the Haas and Wealthy. While the tree venders are pushing these varieties and other iron clads our villagers and to a considerable extent farm orchards are being filled with these to the exclusion of other well-proven and much more desirable varieties.

The old, well-known desirable varieties that succeed perfectly in Piscataquis County are the same as those in the central counties of the State, except the Baldwin which in Piscataquis matures only into a fair cooking apple. Our present needs in fruit production are:

(1). Properly grown home grown nursery stock would be in the line of economy and an assurance to the purchasers of future success.

(2). Our people need to learn that a tree is a living thing, and like all other living things demands attention.

(3). We need more knowledge of varieties adapted to our climatic conditions and such as are called for in the markets.

(4). We propagate far too many varieties. Our agricultural societies encourage this error by offering premiums for the largest number of varieties shown by exhibitors.

Finally we need just that sort of practical knowledge which it is the province of the Maine State Pomological Society to disseminate.

Thanking you for copy of Transactions of the Society for 1885, I remain,

Yours Fraternally,

H. L. LELAND.

EAST SANGERVILLE, Jan. 24, 1887.

LETTER FROM MR. PATRICK BARRY,

President of Western New York Horticultural Society.

MR. SAMUEL L. BOARDMAN.

Secretary Maine State Pomological Society.

Dear Sir: I have just received copy of Transactions of the Maine State Pomological Society for 1885, for which accept my thanks. You have made up an excellent volume. Success to you!

Respectfully,

P. BARRY.

ROCHESTER, N. Y., Feb. 15, 1887.

LETTER FROM MR. W. S. DEVOL,

Secretary Columbus Horticultural Society.

MR. SAMUEL L. BOARDMAN,

Secretary Maine State Pomological Society.

Dear Sir: I have received your reports, and from a hasty perusal of them I think you must be doing much good in Maine. The catalogue and descriptions of fruits are valuable above the most of such. I hope in this time of reviving interest in horticulture, with a Division of Pomology in the Department of Agriculture, &c., that you may have still greater prosperity.

Yours Truly,

W. S. DEVOL,

Secretary.

COLUMBUS, OHIO, May 24, 1887.

SELECTED PAPERS.

The sketch of Hon. Marshall P. Wilder, late President of the American Pomological Society, given herewith, has been made up from an obituary which appeared in the Boston *Journal*, from a memorial in the report of the Michigan Horticultural Society, and from the funeral discourse of Rev. Edward N. Packard. The dates have been carefully collated with records, and are believed to be correct. Following this a few extracts are made from reports and transactions of kindred societies to our own, on subjects of interest to Maine fruit growers, florists and horticulturists.

Marshall P. Wilder

SELECTED PAPERS.

MARSHALL PINCKNEY WILDER.

1798–1886.

"The man of all others whom the pomologists of America respected, admired and loved." These are the words of Hon. Charles W. Garfield, Secretary of the American Pomological Society, in announcing the death of Col. Marshall P. Wilder, which occured at his home in Dorchester, Mass., on the morning of Thursday, December 16, 1886. "One of the most noted men in the science of pomology of the present century," is the language of Mr. S. D. Hillman, Secretary of the Minnesota State Horticultural Society. Similar expressions have been made by the officials of every horticultural and pomological society in the country, and by the press generally, especially by the agricultural and gardening journals. It seems eminently fitting that we should preserve upon the pages of our Transactions some memorial of Col Wilder's life and services; and, accordingly, the following sketch is published. It has been chosen from several sources, all of which are believed to be trustworthy, although we have deemed it best to omit many details pertaining to his political and business career, and to give prominence to that which pertains to his love for and devotion to pomology and horticulture.

The death of Hon. Marshall Pinckney Wilder occurred at his home in Dorchester, Thursday morning, December 16, 1886. Mr. Wilder was at the breakfast table as usual, and died about half-past nine o'clock. His death will occasion a widespread feeling of regret. Though he had attained an age beyond fourscore years, he had by no means outlived his usefulness. For many years Mr. Wilder has been honored in this community as a man who was living with the most unselfish aims. While he appreciated the respect shown to him by public honors and private acts of kindness, he was never happier than when it was in his power to make others happy. The accumulation of large wealth was not within the scope of his ambition. His love of horticulture and of genealogical pursuits gave ample occupation to his active mind. His promotion of pomology has been of benefit to the people of the whole country.

Col. Wilder was born at Rindge, N. H , September 22, 1798, coming from an old Massachusetts family. His father, Samuel Locke Wilder, removed to Rindge from Sterling, Mass., and engaged in mercantile pursuits there with a brother. He became an honored citizen of his adopted State, serving in the Legislature thirteen years, and holding other important positions. Marshall was the oldest son. Placed in school at the early age of four years, he continued his studies until sixteen years old, becoming a pupil in the New Ipswich Academy at the age of twelve. When ready to enter college he was allowed by his father to choose between continuing his education, entering the store or becoming a farmer. The taste for husbandry which has been the prominent characteristic of his life led him to choose farming as his occupation, and he went to work on a farm. But his father's growing business soon demanded his services in the store, and, forsaking his chosen calling, he assumed a subordinate position under his father and uncle. Industry and faithfulness marked his course here and he rose step by step until finally, on attaining his majority, he succeeded his uncle in the firm, which became S. L. Wilder & Son.

BUSINESS LIFE.

The partnership with his father continued about four years. In 1825, his ambition for a larger field of operation led him to remove to Boston, where he began a wholesale business in West India goods as head of the firm of Wilder & Payson, locating on Union Street, removing subsequently to North Market Street, when the firm name was changed to Wilder & Smith, and finally taking the entire business in his own hands and locating at No. 3 Central Wharf. In 1837, he changed his line of business, becoming a partner in the commission house of Parker, Blanchard & Wilder, rising eventually to the leading partnership in the concern. As a business man he attained and held a high position, and was honored with a number of important trusts. One of the original directors of the Hamilton Bank and of the National Insurance Company, he held his position in each many years. He was a director of the New England Mutual Life

Insurance Company more than a score of years and also held directorship in other institutions. Strict integrity in all his transactions, gentlemanly manners in all his intercourse with others and faithful attention to every duty made him both popular and successful as a business man, and no chapter in his history is more creditable to him than this.

Col. Wilder was a most successful pomologist as well as floriculturist, and after retiring from the presidency of the Massachusetts Horticultural Society began to work for the promotion of education in the matter of fruit raising. He had done a great deal in the way of improving fruit culture on his own estate, and was widely known both in America and Europe as an ardent student of pomology. He succeeded in securing the organization of a "National Congress of Fruit Growers," but at the same period a "National Pomological Convention" was organized in New York. Of course there was no necessity for two similar societies, and steps were taken for securing a consolidation. This resulted in the formation of the "American Pomological Congress," of which Col. Wilder became President soon after the consolidation, retaining the office to the time of his death.

The United States Agricultural Society was another result of Mr. Wilder's labors. In 1852, as President of the Massachusetts Board of Agriculture, which board was formed during the previous year, he called a National Convention of Agriculturists. The convention met at Washington and the Society named was organized with Mr. Wilder as President. He retired from this office in 1858, on which a silver tea service valued at $250 was presented to him.

Col. Wilder, in addition to his membership in the societies we have named, has also been connected with similar organizations in other lands, such as the Royal Horticultural Societies of Paris and of Frankfort-on-the-Main, and the Pomological Society of Van Mons of Belgium, by which he was appointed a Commissioner for America. The fact that his reputation is not bounded by his native country has been shown in various ways, but in none more complimentary than in the publication a few years ago of a sketch, with portrait, in the London Gardener's Chronicle. We quote the following from the sketch:

"We are glad to have the opportunity of laying before our readers the portrait of one of the most distinguished of transatlantic horticulturists, and one who, by his zeal, industry and determination, has not only conferred lasting benefits upon his native country but has by his careful experiments in hybridization and fruit culture laid the horticulturists of all nations under heavy obligations to him. The name and reputation of Marshall P Wilder are as highly esteemed in Great Britain as they are in America.

Mr. Wilder was President of the Massachusetts School of Agriculture, incorporated in 1858, and has been a trustee of its successor, the Massachusetts Agricultural College, since its establishment. To the latter he gave a collection of more than 1000 valuable plants. He was one of the prime leaders in the movement which gave to Boston the Natural History Rooms and the Massachusetts Institute of Technology, has been long a member of the Massachusetts Agricultural Club, has been a member of several commissions appointed in connection with agriculture, and has been an industrious writer on subjects connected with his favorite pursuits."

HORTICULTURE AND AGRICULTURE.

The varied interests which during his busiest years demanded his attention did not withdraw Col. Wilder's mind entirely from the consideration of matters connected with the calling to which he was inclined early in his life to devote himself. Horticulture and agriculture have had few more devoted students than he has been, and perhaps no other person has ever done more to advance these branches of industry toward perfection than he has. The garden and the field were his places of recreation, and he studied much and went to great expense to develop them. Not only did he endeavor to improve the native products of the soil, but he imported trees, plants and seeds, and tried in every possible way to add dignity and worth to the profession of husbandry. His library was enriched by whatever valuable works on his favorite studies were to be obtained, and he has been regarded for many years as a leader in all matters relating to the field, the garden and the conservatory. His studies in connection with pomology have been especially valuable. His labors have happily met with wide appreciation, and it was both a pleasure to him and an honor to the various societies that have shown tangible recognition of his merit that none of his efforts in the direction of making "the wilderness to bloom as a rose" were allowed to expend themselves fruitlessly. One of the earliest members of the Massachusetts Horticultural Society, which was formed in 1829, he was associated with the late Dr. Jacob Bigelow in the movement which resulted in the purchase and laying out of Mount Auburn Cemetery, and it was to his good management that the amicable separation of the society and of the proprietors of the cemetery, accomplished in 1835, was due. He was elected President of the Horticultural Society in 1840, which office he held eight years, securing within that time the erection of a fine building for the society on the present site of the Parker House. This building was occupied until the need for more commodious quarters became pressing, when it was sold at a considerable advance on its original cost, and the corner stone of the present building was laid in 1864. Mr. Wilder declined another re-election as President of the Society in 1848, and his retirement was the occasion of some very flattering tributes to the efficiency of his administration, one of which was the gift of a silver pitcher valued at $150. Since that time he has maintained an active connection with the Society and has always been ready to work for the advancement of its interests. His studies and experiments in floriculture have been interesting and have gained him a wide reputation. He was especially successful in the cultivation of the camellia, and in his honor two seedlings of that flower raised by him have been named by the Horticultural Society the Camellia Wilderi and the Mrs. Abbie Wilder, respectively. He was also awarded a premium of $50. The Camellia Wilderi was sold to J. L. F. Warren of Brighton for the extraordinary sum of $1000. In 1853 he was honored by the Society by the placing in its hall of a fine marble bust.

VARIOUS PUBLIC SERVICES.

As a presiding officer Col. Wilder has always been regarded as the possessor of qualities which made his presence in the chair a matter of satisfaction. He was frequently called on to officiate as President of the Day, notable occasions being in Boston, Oct. 29, 1852, and the celebration of the 225th anniversary of the settlement of Dorchester, July 4, 1885.

A visit to Europe in 1867 was a pleasant event in his life. He went to represent the United States Agricultural Society, and while abroad he was appointed United States Commissioner at the Paris Exhibition of that year. He returned Sept. 1, and immediately went to St. Louis to attend the meeting of the American Pomological Society. During his visit to Europe he devoted much of his time to investigating the condition of pomology and horticulture in England and on the Continent, and received very kind attentions from the leading pomologists of Europe, to whom his labors in that science in this country had made his name familiar.

In January, 1868, Mr. Wilder succeeded the late Hon. John A. Andrew as President of the Massachusetts Historic Genealogical Society. His election was unanimous, and he has been re-elected every year since. The funds for the purchase of the premises on Somerset Street were secured by his personal effort. At each annual meeting he had delivered an interesting address, and in view of his death so soon after the last was delivered, we cannot refrain from quoting the following significant paragraph therefrom:

"Human life is changing and transitory! A few more days, a few more months, and this tired brain and this languid tongue will have cast off their threadbare, worn-out covering; but the spirit shall continue to praise God for His wonderful works in this Western World, and the blessings which have flowed from the influence of New England character. We shall pass away, and the dust of past and future generations shall be commingled with ours in one common grave. But more and more appreciated for the work it has done and is doing, so that the record of our own New England and its families may be perpetuated with historic continuity while the Anglo-Saxon race shall have a place in the annals of time."

INTERESTING EVENTS.

On September 22d, 1877, Col. Wilder completed the 80th year of his life, and the event was made one of very pleasant moment by his many friends. A banquet was given at the Parker House, ex-Alderman Chas. H. Breck presiding, and many prominent gentlemen honoring the guest by their presence Col. Wilder made a speech full of reminiscence, and was followed by Hon. Charles L. Flint, Charles M. Hover, Esq., Rev. J. H. Means, and a number of others. In 1883 a banquet was given in honor of his eighty-fifth birthday, at which a number of ex-Governors of New England States were present, and in 1886 his eighty-eighth birthday was celebrated by a dinner.

WRITINGS.

We have already stated that Col. Wilder has been an industrious writer. From 1835 to the time of his death he published more than sixty pamphlets, mostly addresses which he had delivered on agricultural, horticultural, pomological or historical subjects.

DOMESTIC LIFE

We come in conclusion to that chapter of personal history which, in the case of such a man, is most sacred. Col. Wilder was a man of the purest character and of domestic habits. Such tastes as his were when cultivated are certain to develop the home instinct, and it was therefore natural that he should have a happy home. He was married on December 31, 1820, to Miss Tryphosa Jewett, daughter of Dr. Stephen Jewett of Rindge, N. H. Six children were born of the marriage. Mrs. Wilder died during a visit to Rindge, July 31, 1831. Col. Wilder married a second time, Abigail Baker, daughter of Capt. David Baker of Franklin, Mass., becoming his wife August 29, 1833. Six children were born of this marriage, also. Death again left him wifeless April 4, 1854, and he married on September 8, 1855, Julia Baker, a sister of his second wife, who has borne him two children.

The many friends of Col. Wilder honored the anniversaries of his birth in late years by pleasant reunions and congratulatory calls. A friend who sent kindly greetings in September, 1886, received the following reply, which is characteristic of the man:

DORCHESTER, September 23, 1886.

My dear old friend: Your kind notice of me and your still kinder letter are in hand. Words cannot express my gratitude I feel for the congratulations I am receiving on the return of another anniversary of my birth. I am not worthy of such affectionate regard, for I have only been following the instincts of my nature and the convictions of my conscience in much of what I may have done for the great interests which I have tried to promote; and so I shall continue to labor while life and strength shall last. But ere long all of us must pass over to that better land where the proofs of life shall be finally set up and the types of earth be exchanged for the types of blessed immortality in Heaven.

As ever yours,

MARSHALL P. WILDER.

1798–1886.

A PERSONAL TRIBUTE.

The memorial discourse at the funeral was delivered by Rev. Edward N. Packard, pastor of the Second Congregational Church, Dorchester, with which Col. Wilder had maintained an active connection for upward of half a century. The closing portion of the discourse is here given:

The remarkable successes of this long life have been largely due—shall we not say?—to qualities of heart. This large assembly to-day, representing so many of the departments of his beneficent activity, will, as individuals, remember the man as a friend. He lived in his friends. With his friends he worked for great objects; for friendship's sake, nothing but honor was too dear to be withheld! He "loved the praise of men"—we all knew that—but it did not lower him in our thoughts, for he sought the approbation of the best by no sinuous processes, surrendering nothing, losing nothing. His heart was an open fire, around which men gathered instinctively. We may well question whether there has ever lived in this State a man who has enjoyed more friendships and more worthy ones. Gather the foremost men of the whole region for fifty years past in the walks of trade, of art, science, politics, jurisprudence and the so-called learned professions, and how few among them were not personal friends of our departed brother—a brother indeed to them all!

They have sought his counsels, received his encouragement, and the best men were his best friends! He seemed to say to all who were worthy of his confidence, "If thy heart is as my heart, then give me thine hand!"

His domestic life, extending over a period of more than threescore years, has been singularly happy, although its very happiness has opened the door to the sorrows inseparable from the mortal lot. He has survived his three wives and nine of his fourteen children. Yonder cemetery, to which we are about to wend our way, contains what he used to call his "garden of graves." He has said during his past year in terms of reverie, "I shall be with wife soon." Old age has its pleasures, but the sadness of frequent partings is mingled with them, and these impressed themselves deeply upon his heart. He lived to see generations of the good and noble with whom he had been intimate pass beyond his touch and sight; and as I have heard him at times speak of this and that one, to whom his soul had been grappled with hooks of steel, who had laid down to sleep first, I have recalled the lines of the poet Vaughan, as expressive of his feelings about the host of the departed:

"They are all gone into the world of light,
  I alone sit lingering here!
Their very memory is fair and bright,
  And my sad thoughts doth clear,
It glows and glitters in my cloudy breast,
  Like stars above some gloomy grove,
Or those faint beams in which the hill is dressed,
  After the sun's remove."

In the narrower circle all these gracious and winning traits had full play. He loved his neighbors and, in turn, was loved by them. For fifty-four years he was a member of this parish, and for fifty, at least, there were few Sundays that did not see him in the family pew a reverent listener and worshipper. He was a most generous supporter of the Gospel and promoted all the good works to which the church lent her hand. To say that he has contributed thousands of dollars for these interests beyond the merely business claims of the parish, would be but a tame statement. He has been a most faithful worker, presiding for years at the annual parish meetings, giving dignity and stability to the whole course of things in which he has taken a conspicuous part down to the last days. It is only a few weeks since he brought his check to the treasurer for $500 toward the renovation of this house of worship. For fifteen years he was the valued friend of the first pastor of the church, Dr. Codman, and, when death terminated that long and good ministry, he joined in calling his successor—Dr. Means—who, in a pastorate of thirty years, had no firmer supporter nor more generous helper. And when the day came for another to take that place, he entered vigorously into the plans and correspondence necessary, signed the call as chairman of the parish committee and greeted me, when I first descended from this pulpit, eight years ago, with a cordiality and kindness I can never forget. That old-time courtesy, that delicate consideration, that freedom of conversation on the deepest themes, at all times; the hours of bereavement and sickness in which we have been drawn peculiarly near to each other—the last Thanksgiving remembrance from his orchard—these will always be among the choicest treasures and best honors of my life.

He inherited a strong religious bent from his godly ancestry, and was brought up under the old regime of faithful instruction and implicit obedience. Around him the most helpful influences have always been thrown, in the innermost circle of his life. The prayers of the now sainted women, whom Providence gave him as his wives, have girded him for the toil and conflict of his long day. Nor have his own been wanting. It has been his custom for 34 years to ask a blessing at his meals and gather his family around him every morning, down to the very last, to hear a portion of the Word of God, to sing some familiar hymn—his favorites being sung to us to-day, the "Sweet Bye and Bye" being his hymn above all others—and then to kneel and seek the favor of God. He invariably offered an earnest petition for a "heavenly inheritance," and that "we may be led in the paths of salvation for Christ's sake." This last was his last petition on the morning of his death. To one of his family he said not long ago: "I tremble when I think of the temptations to which I have been exposed; but God has kept me from yielding to them." To me he said within a year: "I am sure that my life has been a selfish one. I do not know that I have ever done anything from the best motives. I have no claim save on the mercy of God. If I am permitted to enter Heaven it will be as a little child to learn His will."

The greatness, the incomprehensibility of the Deity, were frequently in his thoughts. He said recently that all he could do was to throw himself upon the mercy of God, and that he believed in Christ. In the midnight watches, during the past year, he has been overheard praying, and only on the last night of his life he was heard to say, "O Lord, have mercy upon me."

His sun sank serenely to the west. Old friends passed on, but younger ones filled their places and thronged his path. He could say with Job of old, "I washed my steps with butter and the rock poured me out rivers of oil; when I went out to the gate through the city, when I prepared my seat in the street, the young men saw me and hid themselves and the aged arose and stood up; the princes refrained from talking and laid their hand on their mouth. The nobles held their peace and their tongue cleaved to the roof of their mouth. When the ear heard me, it blessed me; and when the eye saw me it gave witness to me. I put on righteousness and it clothed me; my judgment was a robe and a diadem. I was eyes to the blind and feet was I to the lame. I was father to the poor, and the cause that I knew not, I searched out. My root was spread out by the waters, and the dew lay all night on my branch. My glory was fresh in me and my bow was renewed in my hand."

On the morning of his sudden departure he rose as usual, took breakfast, led in devotions, dictated a letter and signed it in his bold but trembling hand, and as he turned to greet his physician with a word of good cheer he pressed his hand upon his heart, fell back in his arm-chair to breathe out his spirit without a sigh or a groan.

Fortunate in his death as in his life. We shall see him no more, and the world which he has made a different one to us will be different to us with his departure.

THE ROSE—ITS CULTURE AND INSECT ENEMIES.

By John Poste.

[From Journal of the Columbus, Ohio, Horticultural Society, 1887.]

When seeking to adorn our gardens and we are selecting from the extensive and varied assortment of floral beauties from which, in this day, we are privileged to choose, the rose will at once occur to us as entitled to pre-eminence, combining, as it does, in one "charming whole, those features which singly characterize our most popular flowers, viz., beauty and variety of form, rich colors and delicate tints, with the most delightful perfumes." With such characteristics it has been rightly called the "Queen of Flowers."

Now, as true lovers of floral beauty can for themselves select their ideals of excellence in shape or color, from any well-assorted collection, I will leave them fancy free to select from the numerous varieties and classes, and rapidly passing along will only point out, here, the delicate bud of the tea rose, which in its maiden modesty charms one with its non-expanding coyness, and there, of the hardier constituted Remontant, with unblushing consciousness of purity, invites you to look into its richly perfumed heart of hearts. Deeply impressed with the exquisite gradations of form and color, having finished our selection, we are in a frame of mind to quickly pass from the sentimental to the practical, and to receive hints as to the necessary *conditions of culture* to secure the best results. It is upon this branch of the subject, I presume, that I am desired to give any information I am able to offer.

When you plant roses, you desire an abundance of blossom and luxuriance of growth; to produce these results, you must give the necessary conditions of soil, judicious pruning, climate and location.

Your soil, if not naturally so, must be made as nearly as possible a deep, porous loam; on the one hand, not too light and sandy, nor, on the other, too stiff and cold a clay—as nearly the happy medium as possible—a retentive but thoroughly drained soil Almost any soil can be brought to proper condition by spading to the depth of fifteen inches, and incorporating with the natural earth well-rotted manure and sand if too heavy, and of well-rotted manure and clay, and perhaps wood ashes, if too light and sandy. The rose is a hearty feeder, therefore will bear annual manuring, and as results are desired to follow annually also, none but *well*-rotted stable manure or sod should be applied, or such other stimulant as can be readily assimilated with the soil.

In planting in such a prepared bed, make your holes large enough to place the roots so as not to cramp them, then press well to the roots the earth first put in, but leave the surface dirt loose, so as to admit rain or such artificial watering as may be necessary in a dry time. An excellent liquid manure for watering the soil in immediate proximity to the roots can be made by soaking the scrapings of the chicken house in a barrel of water a few days before using.

Now as to pruning. Since the rose bears its blossoms only on the young shoots of the current year's growth (as with the grape), therefore in the spring cut back the last year's wood freely, entirely removing any dead and half dead branches, and cutting back those you leave to the strongest buds; cut the unbranched shoots or canes to such height as the bush is desired to be; each bud left will make a blossom-bearing branch, so don't be afraid to cut back, as from them you will get your finest blossoms if so treated. Roses that bloom more than once during the summer, such as the Tea, Noisette, Bourbon, China, and the Hardy Monthlies, so-called, or Remontants, should be pruned back after the first blossoming to a strong bud, then a vigorous new growth will start which will bear the next crop of blossoms. Never allow haws, or seed capsules to mature on your bushes, for in bringing the seed to perfection they will so far sap the vitality of your plant.

Of the insect enemies of the rose I will first mention the slug, which by skeletonizing the foliage destroys nature's well devised economy of atmospheric absorption through the leaves and their adjunctive assistants—the very lungs of the plant—thereby preventing that vigorous new growth which we have seen is absolutely necessary to the production of blossoms. Any dry dust or powder coming in contact with their slimy bodies will destroy them; having thoroughly applied your dust, whether it be road dust, lime, or any of the powdered insecticides of commerce, after the lapse of a few hours thoroughly syringe off the foliage and restore it to its normal condition of respiratory organs. The green fly, which, however, is most likely to prove troublesome in the conservatory, or to house plants, readily succumbs to tobacco, water or smoke, or to immersion of the affected limbs in water as hot as the hands will bear. The red spider is easily routed by systematic watering alone.

The bug which attacks the opening bud fortunately is comparatively rare; it is best removed by hand picking or eradicated by persistent syringing with any insecticide, or even pure water; but recollect that bushes from which dead and half dead limbs and rubbish have been seasonably removed, and are getting proper food, are rarely much affected by any insect pests. Imperfect blossoms, stunted growth, a general consumptive appearance, are a mute appeal to you for better soil, more food, and the removal of superfluous wood—the incubus of an unhealthy past—the prompt cutting loose from which we will all acknowledge as necessary for human reform. Then realizing that the main essentials of plant life are identical with those of animal life, if you will take your garden pets into your family, do unto them as you would be done by. My long acquaintance with her majesty, our queen of the garden, enables me to promise you right royal favors in return for the tender treatment you will accord her.

LIST OF BEST ROSES FOR BEDDING.

CHINA.—Agrippina—crimson; Douglass—cherry red; Madame Jean Sisley—white; Eugene Beauharney—crimson.

Bourbon.—Hermosa—rose; S. de la Malmaison—blush; Queen Bedders—dark crimson; Mad. Bosanquet—flesh color; Louis Margottin—rose; Alfred Aubert—bright red.

Hybrid tea.—La France—silvery pink; Duc de Connaught—crimson.

Tea.—Duchess de Brabant—rosy salmon; Duchess of Edinburgh—crimson; Etoile de Lyon—light yellow; Bougere—bronze rose; Bon Silene—deep rose; Catherine Mermet—pink; Mme. Welch—amber yellow; Mme. Rachel—yellowish white; Maria Guillot—white; Devoniensis—creamy white; Sunset—light amber; Souvenir d'un Amie—rose.

Hybrid perpetual.—Gen. Jacqueminot—crimson; Coquette des Alps—white; Captain Christy—flesh color; Victor Verdier—cherry; Magna Charta—clear pink; La Reine—deep rose; Sydonia—light rose; Anna de Diesbach—clear rose; Jules Margottin—deep rose; Giant of Battles—crimson; Gen. Washington—crimson; Paul Neyron—deep pink; one of the largest roses, if not the largest.

SEEDLING AND RUSSIAN APPLES.

By Peter M. Gideon.

[From Report of the Minnesota State Horticultural Society, 1887.]

It is with pleasure that I comply with your request to give my views on Russian and seedling apples. The seedling has been my hobby for the last sixteen years, and the success attained gives me hope that not far in the future the cold Northwest will be one of the leading apple-growing districts of North America.

Twenty-three years ago I planted a few cherry crab seeds, obtained of Albert Emerson, Bangor, Maine, and from those seeds I grew the Wealthy apple; in seven years it fruited, and that fruit convinced me that the true road to success was in crossing the Siberian crab with the common apple, and on that line I have operated ever since, with results surpassing my most sanguine anticipations. I did not suppose that in the short space of sixteen years, the time since the Wealthy first fruited, that I should have more than twenty first-class apples—as good as the world can produce—in succession from the first of August to March, and in hardiness of tree surpassing all known varieties of the common large apple. But it is done, and in the doing the problem is solved, as to what to do and how to do it, with the material at hand with which to attain yet greater results. At the outset, it was test and try; but now that the problem is solved, it is onward, with great results certain.

When I say we have twenty first-class apples, that does not include all that are worthy of cultivation, by any means. And now, with such results, and only a few thousand trees fruited at the end of sixteen years, what may we not expect at the end of the next sixteen years, with twenty or thirty thousand choice, selected trees from the very best of seed, which are not yet fruited, and the seed of over 100 bushels of choice apples planted this fall, all to fruit in a few years. Then on, on, planting the seed of the best each year; soon the choice varieties will count into the hundreds, and the great Northwest will be the fruit paradise of America.

To get the desired cross we plant the selected varieties in close promixity, so that the natural flow of pollen will the more surely do the desired fertilizing, and the seed thus produced is planted, the most promising of the seedlings selected and set in orchards for fruiting, and, after fruiting, the best in tree and fruit is selected from which to grow seeds to try again, and so on, at each repetition I find there is a gain. The young trees that fruited this year for the first, gave a larger percentage of first-class apples than any lot ever fruited before.

By crossing and judicious selection we retain the hardiness of the crab in the tree without the crab thorns, and on top grow large apples without the astringency of the parent crab. And yet, by the commingling of the two natures, we get an exquisite flavor not found in any other class of apples, especially so when made into sauce. But our triumph is not yet complete; we must, we can, fill up the balance of the year with a continued succession of luscious apples. There is no question as to the certainty of such a result; the past is a guarantee that it can be done.

But the proper cross can't be got in Minnesota, a fact clearly demonstrated in the extensive and expensive trials that have been made in the last nine years in the State orchard. And here let me state, that the seedling is inclined to ripen its fruit at or near the time the parent apple did, from which the seed was taken, hence the need of seed from long keepers to grow the same. There are no long keepers of the best quality yet found that are hardy enough to fruit in Minnesota, but we can take our best hardy seedlings further south, where the long keepers can be grown, and there get the cross and then bring the seed here to grow and test the hardiness of tree and quality of fruit. We want first-class apples, and to get them we must use first-class parentage. And even then scullions will be numerous, from the fact that all varieties of apples are mongrels of many degrees of crossing, and the various relations will crop out in a multitude of forms. But past success is a guarantee for the future, that out of the many some will be good. Our seedlings will average in quality with Hyslop and Transcendent; but those of first-class, such as we propagate, stand about as one to five hundred, as hardy Duchess and Wealthy, and of the extreme hardiest about one to one thousand five hundred.

SEEDLING TREES FOR DISTRIBUTION.

Two years ago this winter was the first time the Duchess and Wealthy were seriously hurt, and a like fate befell all the Russians on our grounds, so that not a Russian set an apple on our grounds last year, whilst alongside of them our seedlings carried a fair crop, some of them profuse, and this year all bore heavy crops; showing beyond a question, that the crab infusion is to be the foundation of successful fruit culture in the Northwest. The State orchard yielded about one hundred bushels of apples this year, all of them being of our own seedlings; all else of value failed two years ago this winter. This fall we planted the seed of over one hundred bushels of choice apples, to grow trees for trial purposes. We now have thousands of choice trees on hand for distribution to those who want one, two, three and four-year-old trees from seed. Those who come and dig the trees will get them free of cost, others will have the cost of digging and packing to pay; and, unless otherwise instructed, will ship free of cost, except as above stated, to any one in the Northwest who may so order. The great bulk of the trees are two years old. The cost of digging, boxing or bundling would be about one dollar per hundred. All who get trees will be expected to take good care of them until they fruit, and if any prove of extra value, so report, but the trees and the profits thereof belong to the cultivator. We only ask the report, that we can note the progress. The trees which produce poor fruit can be top-grafted with any good variety that the owner may select, and thus make permanent trees of value. Those who want large trees had better come and do their own digging and thus save a large bill; the trees are large for their age and a more promising lot of seedlings I never saw.

PLANT VARIOUS KINDS.

Though we have a good collection of hardies, and in succession from the first of August till March, yet, I would not discourage the planting of Duchess, Wealthy, and some of the best of the Russians. Their value is too great to be rejected on account of one partial failure. after over twenty years of uninterrupted success, for such a winter as that of two years ago may not occur again in a lifetime, if ever. If those varieties should stand only ten years, they would be the most profitable crop a land owner could plant. Therefore, I advise to mix them in with our extra hardies, especially if you have a clay soil, for in such they do best. A north, northwest or northeast exposure is the best for the apple, and, indeed, for any fruit except the grape—give that all the sunshine you can.

While on the subject of apple culture, let me state a few facts in regard to root-grafts. The so-called crab roots are not all hardy—none are pure crab, all are mongrels—and where the crab predominates the graft that is not a crab mongrel does not take well, neither on root or stock. The mongrel root and mongrel stock are only preferable when a mongrel graft is to be inserted, but as all such are not hardy, a good mulch is needed, of some coarse litter, to make sure against root-killing under certain conditions, as not all winters will kill even the most tender roots.

The common apple will not make a smooth junction on a stock where the crab predominates, and, consequently, will not make a lasting tree, and a hardy variety grafted or budded on the common apple stock is worthless, as the stock below the junction of graft or bud is sure to winter-kill the first hard winter. You can protect a tender root, but you cannot save a tender stock, so avoid the tree agent with his budded trees.

NURSERY FRAUDS.

And, lastly, it matters not where a tree is grown—whether east, south or north—that tree is best that comes to the planter in the best condition, if true to name; but, with the great mass of tree planters, the smooth-tongued agent with his rubbish and frauds is the one thing needful. Though fleeced a score of times, they patronize him the twenty-first time as freely as ever, and the bigger the price of the fraud the more greedily they swallow the bait. The fact is notorious that tree agents have sold one hundred trees of the Gideon apple, at one dollar per tree, where I, the originator, have been able to sell one at twenty-five cents. They have been swindled so often, and paid so dear for it, that they have come to love to have it so. They are wedded to the agent: it is love's union, and dead trees, plants and grape vines cannot separate them.

EXPERIMENTS WITH KEROSENE EMULSION ON THE APPLE-TREE APHIS.

By Charles Little, Rochester, N. Y.

[From Proceedings of the Western New York Horticultural Society, 1887.]

The summer of 1886 was, in this vicinity, an unusually severe one for nursery stock, particularly cherries and apples; the black aphis on the cherry and the green one on the apple-trees being unusually numerous and persistent, and of course they gave us nurserymen a great deal of trouble.

The cherry aphis appeared first, but, fortunately for us, were not so numerous on our trees as on those of some of our neighbors. We went over the trees two or three times with the old remedy of whale-oil soap and tobacco-water, but found it of comparatively little use, as a solution strong enough to kill the aphis was also strong enough to affect the trees injuriously; and, as our trees had made a considerable growth before the appearance of the aphis, we did not pay much attention to them afterwards.

The apple aphis appeared about the usual time, and, at first, we were not much concerned about them, expecting that they would disappear, as usual. But for some mysterious reason of their own they did not take their departure, and began to increase alarmingly fast. On our yearling trees we tried dipping in whale-oil soap and tobacco-water with success, but to dip a large tree was a slow and costly operation. We then began to look about for some cheaper and quicker method. We found, by experimenting on a small scale with kerosene soap, that it was sure death to the aphis, but this soap was open to the same objection as the other remedy; it was too costly.

About this time there was published by the Department of Agriculture, at Washington, a receipt for killing the hop-louse, which was making such ravages in the central part of the State. As the principal ingredient was kerosene, we determined to try it on our apple-trees. It was a decided success. After going over our blocks twice there were few or no aphides left, and the expense was trifling in comparison with any of the old methods, both as regards the cost of materials and the labor of application.

The receipt is as follows: "Spray the trees with the following mixture: Kerosene, two gallons; one-half pound common soap, or whale-oil soap; water, one gallon. Heat the water, and dissolve the soap in it; then add it boiling hot to the kerosene. Churn the mixture by means of a force-pump and spray nozzle for ten minutes, when it will form an emulsion. Dilute before using one part of the emulsion with nine parts of cold water. This mixture will kill every louse that it touches, and the good accomplished depends only on the thoroughness of the application." It will be seen that two gallons of kerosene and one-half a pound of soap make, when diluted to the right strength, thirty gallons of wash.

We have found that, in using this receipt, two precautions must be carefully observed: first, and most important, the oil and water must be thoroughly mixed; soft water is preferable. With a little experience it is easy to tell when the mixture is complete, as the fluid becomes a milky white, and all globules of oil disappear from the surface.

Second: The mixture should be applied to the trees in the form of a fine spray from a force-pump. The nozzle we used was simply a deflector; the mixture left the mouth of the nozzle in a solid stream, then struck against a tin disc, which flattened the stream into a fan-shaped sheet.

To illustrate my precautions: We made some experiments on a small scale with dipping, but found that unless the mixture was most thoroughly made, the young leaves would turn brown by coming in contact with the globules of kerosene which would rise to the top. The use of a force-pump obviates this difficulty, as, in the first place, the pump draws the mixture from the bottom of the vessel, and, secondly, the fine spray in which it is applied to the trees tends to divide into minute portions any kerosene that may be left unmixed.

Our method of handling the emulsion is quite simple. A small force-pump is fastened to a good-sized pail, which holds the liquid. On the front and rear of the pail two pieces of leather are fastened (like trunk-handles). The front handle and nozzle of the force-pump are held by one man; the back handle is held by a second, who, with the other hand, works the pump. In this way three men (one to make the emulsion and two to man the pump) can go over two to three acres of four-year-old apple trees in a day.

The pumps we used were very simple, costing only $10 a dozen, and they answered the purpose as well as a more expensive article. There is one little bit of tinkering to be done, however; there is a rubber valve in the pump which soon gets soft and worthless; this should be replaced by a common marble, and the machine is perfect.

As regards the effect of this emulsion on the cherry aphis, I can say but little, as our experiments were not decisive; but they were encouraging enough to induce us to give it a much more thorough trial next summer, if necessary.

STORING APPLES FOR WINTER.

By Henry M. Dunlap.

[From Transactions of the Illinois State Horticultural Society, 1886.]

I put my apples into the cellar the last of October or first of November, after carefully sorting, placing them in open bins made of pine lumber, or in barrels, according as I expect to sell in a local market or ship. Winter fruit I pick as late as possible, being governed by the weather, color of fruit, and how well it adheres to the tree. Place in piles under the north side of the tree, and remove to the cellar on a cool day, or during the morning hours. If it is intended to store in bins, I fill the bushel boxes before mentioned at the piles, carefully assorting the fruit at the same time. The filled boxes are transferred to the cellar and there the contents carefully emptied into the bins.

If it is desired to store in barrels, the barrels are filled in the orchard, headed without the use of the barrel press, and stored in tiers in the cellar, as many deep as cellar will permit. The apples in bottom tiers keep the best. It is desirable to have narrow alleys between the rows of barrels, in order that access can be had to any barrel in the cellar. These alleys also prevent the rats from doing damage to the fruit, because no cover is afforded them in which to hide.

Storing in bins I much prefer where apples are marketed in bulk, the cost of the barrels being saved. The bins are made by laying upon the floor of cellar two-by-four inch lumber, and pine boards upon these for the floor of the bin. The two-by-fours should be close enough together to prevent the sagging of the boards, and thus affording an entrance for the rats. My object in having these two-inch pieces beneath the bin floor is to afford circulation of the air. Next to the side walls I nail up strips one inch thick, with the pine boards forming the sides of the bin removed from the wall one inch, thereby making the circulation about the bin complete. Any kind of pine lumber will do, and can be used for any length of time, if exposed to the sun before using, and allowed to cool in the shade. I usually use fence lumber, and find it useful in the spring, either in building new or repairing old fences. Care must be taken to have the sides of these bins as tight as possible, so that no holes are left for the rats to get in. I have found that rats will not attack an open bin of apples filled to the top, but allow him to get an opening into the bottom or side of bin, where he can work in secret, and he can make more chips than an old-fashioned hand cider mill; for he worketh both night and day, and his jaws are reversible. I have found that apples keep best when they are four to five feet deep in the bins. Large dry goods boxes are excellent, or for storing for family use, shoe boxes can be used, and covers nailed on.

Ventilation and temperature are the two most important items in keeping apples. For the first four weeks that apples are in the cellar, and while the temperatature is warm during the day and cool at night, I open the cellar in the evening and close up in the morning, and when the first cold snap comes I leave the cellar open both day and night, closing up when the weather again turns warm. During extreme cold weather the cellar must be opened on the opposite side from the wind, and can be allowed to remain open until the temperature in the cellar goes to 25°, when it should be closed until it runs up above the freezing point, which, owing to latent heat in the apples, it will quickly do. This process of ventilation can be repeated until you have your apple cellar about 32°, when it should be closed as tightly as possible, and not opened oftener than necessary. To keep apples, then, we should open the cellar when the temperature outside is lower than in the cellar, and close it when the temperature outside is warmer than in the cellar. Keep the cellar as dark as possible at all times. Burn sulphur in the cellar frequently, say once or twice each week for several weeks after apples are placed in the cellar. The nearer air-tight cellars are, the better fruit will keep. I find it much easier, and many times more profitable, to regulate the temperature of my apple cellar than to sort out rotten apples. My apples are never sorted until I get ready to market them, for the reason that apples will decay much faster after being disturbed, and it does not pay to handle twice. If they are not keeping, sell them at once.

FEWER ACRES OF SMALL FRUIT—MORE FRUIT TO THE ACRE.

By P. C. REYNOLDS, Rochester, N. Y.

[From Report of the Michigan State Horticultural Society, 1886.]

Very general complaint has come from nearly all sections of the country where small fruits are produced for market, that prices the past season were unremunerative. Such being the case, one of two alternatives seems to be indicated, namely: the reduction of volume of products or the diminution of its cost. It is a very difficult matter for fruit growers, scattered as they are over a wide area, to combine to reduce production. The orderly operation of the laws of trade and production have a tendency to diminish production when excessive, but combination rarely does. The prices of small fruits are destined, I believe, to rule low in the future, and growers will be wise to adapt their business to that condition of things. With unlimited land and labor for production, the amount produced will be likely to increase quite as fast as population. The proper way to cheapen production, in my opinion, is by producing more per acre. Every grower can do this for himself without the necessity of combination or co-operation.

Small-fruit growing used to be considered a branch of horticulture. Recently many have conducted it as if it belonged to agriculture. The result is not surprising. The horticulturist aims to grow large quantities of produce on small areas of land by means of heavy manuring and high culture, the agriculturist spreads his operations over broad areas of soil, which he cultivates enough to enable the roots of crops to spread through the soil, without serious obstruction, in search of adequate supplies of suitable food and to prevent weeds from obtaining such growth as to overcome the plants he is seeking to grow. The horticulturist seeks a small tract of garden soil, near a town or city, where he can have an abundance of fertilizers, laborers of the right kind, and where proximity to market enables him to deliver his products, from day to day, fresh to consumers.

Now, it seems to me that too many small-fruit growers have within a few years come to adopting the methods of the agriculturist rather than those of the horticulturist. They have planted their fruits in fields instead of gardens; they have manured as if for farm rather than garden crops, and they have cultivated after the manner of farmers rather than as gardeners cultivate. Moreover, many have located remote from town, subjecting themselves to quite a tax in transporting their fruits to market and in transporting their laborers to and from their labor. Let the farmer stick to farm crops and they who are fitted by nature, tastes and training for horticulturists grow small fruits. This, I think, is the natural order of things, and to this I believe we shall be obliged to come.

Can it be proved that growing the same quantities of fruits on smaller areas of land will reduce their cost? I think it can. Let us first take strawberries, the fruit in which the grower now sinks the most money. We will say that 200 bushels per acre is a possible crop of strawberries. I have known much larger crops grown, but we will take 200 for our demonstration. I do not believe that the average yield, in the way they are generally grown, is over 50 bushels per acre. Suppose that a grower of strawberries cultivates so as to grow on one acre what he now grows on four, does any intelligent horticulturist believe that the berries would cost so much per quart?

To start with, the rent of three acres would be saved. At a low estimate this would amount to $24 in the cost of 200 bushels. It would neither require the same amount of manure nor labor to grow 200 bushels on one acre that it would on four acres—one-half of each would be a liberal allowance. If 20 two-horse loads of barnyard manure to the acre is generally applied under the present system, I think 40 loads would answer under the approved system, thus saving 40 loads, worth $40, in the 200 bushels.

The cultivator of one acre would probably plow deeper and pulverize much finer, expending about as much labor in preparing the one acre for planting as the farmer does in preparing four acres. Only one-fourth the number of plants, however, would be required. If we plant three feet by eighteen inches it would take 9,680 plants to set one acre—three times the number, or 29,040, would be saved. At $2.50 per thousand, these would amount to $72.60. In planting the strawberries, I suppose that about one-half the time would be expended on the one acre that is ordinarily devoted on large plantations to four acres, and about half the labor in cultivating, hoeing, weeding and clipping runners. It is not practicable to make a very close estimate of the value of the labor saved, as different tracts of land differ so much in the amount of labor required to keep them clean and mellow, and the same grounds require so much more labor in a wet than in a dry season. Taking an average of seasons, we will say that it would take four days' work to clean an acre of the larger plantation and that it would need cleaning four times before the first crop is grown. That would be 64 days for the four acres, which at $1.50 per day would amount to $96. It would be fair to estimate that half of those $48 would be saved in labor by our plan of intensive culture.

When we come to the picking I think all will agree that it would cost not more than half as much to pick 200 bushels from one acre as from four. If it costs two cents per quart for picking, on the larger plat, it could be done for one cent on the smaller, and this saving of one cent per quart, or $64 on 200 bushels, would afford a moderate profit on an acre. We have figured out savings as follows:

In rent of land	$24 00
In manure	40 00
In plants	72 60
In culture	48 00
In picking	64 00
Total	$248 60

This in 200 bushels, or nearly 4 cents per quart. If the agricultural strawberry grower comes out about even growing strawberries by farmers' methods, the horticultural grower might make a few cents per quart at the reduced cost.

Very likely considerably more can be done in cheapening production by extensive culture in strawberries than in other small fruits, but the same principle holds good in all. It is quite doubtful whether plantations of black raspberries, covering from 40 to 80 acres, yield upon an average more than 50 bushels per acre, yet 150 bushels are a possible yield. By cultivating so as to produce the latter amount you save the rent of two acres, the value of nearly 5,000 plants, and quite a sum in manure and labor. Raspberries planted six feet by three require 2,420 plants to the acre. To grow 150 bushels, 4,800 quarts, on those plants, every hill must yield about two quarts. There must be no vacancies and every hill must contain quite a number of strong, vigorous canes, and every cane must be productive. Such results can only be achieved by thorough, intensive culture.

The same methods would undoubtedly result in cheapening production of blackberries, currants, and grapes. I have visited a great many small-fruit farms during the last fifteen years, and the difference in yields where slack, partial culture and high, thorough culture were followed, was too different to permit a doubt as to which resulted in most profit.

THE "BLEEDING" OF APPLE TREES.

By T. H. HOSKINS, M. D., Newport, Vt.

[From Report of the Minnesota State Horticultural Society, 1886.]

A recent writer says he has trimmed apple trees every month in the year, and has come to the conclusion that from May 25th to June 25th is the best time, because a wound made in the full flow of the sap will begin to heal immediately. He adds that March and April are the two poorest months to prune, because there will be a liquid "forming" (query, flowing?) out of the wound, which will kill the bark underneath the limb. Another writer insists that March is the best of all months to prune, because the sap is not then in motion, and the wound will dry before the sap starts, and that then the process of healing will go on most favorably, while anything but very light pruning in June will greatly weaken and sometimes kill the trees. Still another writer says, shortly and emphatically, "Prune when your knife is sharp," without regard to season. All these writers are orchardists of experience. Is there, then, no proper time to prune, or no way of intelligently reconciling the seemingly contradictory views of these practical men?

WHY APPLE TREES BLEED.

A widening accumulation of facts does, in all disputed questions, tend towards the reconciliation of conflicting opinions. In the thirteen years that I lived in Kentucky I never saw an apple tree "bleed," that is to say, I never saw a flow of disorganized and blackening sap from the stump of a severed limb. In the first years of my orcharding in northern Vermont, this so-called bleeding exhibited itself in nearly every case where a limb of any size was removed, no matter at what season the operation was performed. It was the most discouraging of my experiences at that time, and I could not understand it, or find a remedy for it.

About fifteen years ago, at a session of our State Board of Agriculture in the Champlain Valley, where this question of pruning and subsequent bleeding was discussed by many orchardists of that orchard country, one of the speakers dropped the casual remark that he had never known an apple tree that was not "black-hearted" to bleed, no matter at what season it was pruned. That thought was much more fruitful to me than my orchard had been up to that time, for all my trees were black-hearted, except the Siberians and Russians, which I at once remembered never bled, no matter when they were pruned. And at the same time I remembered that apple trees are never black-hearted in Kentucky.

THE CAUSE OF BLACK-HEARTEDNESS.

The state of black-heartedness in the apple tree is unquestionably the result of excessive winter's cold. In New England a large proportion of the most popular apples are grown upon trees that are more or less black-hearted. The Baldwin is always black-hearted in Maine, New Hampshire and Vermont, and frequently so in the three southern New England States. Along its northern limit it can only be grown when top-grafted on some hardier stock. With me a Baldwin tree or graft has never lived long enough to bear an apple.

Now, if it be true that only black-hearted trees bleed, then the experience of orchardists must vary according to whether they are growing more tender or more hardy sorts. When I began, though I planted the hardiest known of New England sorts, yet almost all my trees became black-hearted in a few years. Now that nearly all of that class of trees have been up-rooted from my orchard, and replaced by the "iron-clads," I see almost no bleeding, and when I do see it I know the cause. I do grow a few sorts that suffer some in this way (such as Fameuse), because of the excellence of their fruit. The Fameuse is with me as hardy as the Baldwin in the upper Champlain Valley, and though the trees are short-lived in both cases, they are planted because of the merits of the fruit.

WHEN TO PRUNE.

In my experience it makes no difference at what season a black-hearted tree is pruned, as regards the subsequent flow of disorganized sap, provided the limb severed is so large that the stump will not quite or nearly heal over in one season. This flow takes place during the whole growing season, and injures (often kills) the bark over which it runs. A tender tree, subject to black-heart, should be pruned very sparingly. Branches not too large to heal over in one season may be taken off, and the best time to do this is in June, as the sap is then too thick to flow freely. But heavy pruning in June is a severe shock to the tree, even to the hardiest kinds, and almost surely fatal to any tender sort. Fall and winter pruning is also injurious to tender sorts, as the bark around the wound will be killed for some distance, and there is little hope that it will ever afterwards heal. But any of the varieties that never become black-hearted may be pruned "whenever your knife is sharp," remembering this, that June pruning is a shock more or less severe, according to the amount of wood removed. "Prune in summer for fruit" is an old and correct rule, for the very reason that the shock of summer pruning (like anything that weakens the tree) tends to cause the formation of fruit buds. The effect is much like that of root pruning, and both must be practised with moderation and judgment.

ARSENICAL POISONS FOR THE CODLING MOTH.

[From Bulletin No. 1, of the Entomologist of the State of Illinois, Prof. S. A. Forbes, Ph. D., 1887.]

The Paris green mixture was of the same strength as last year, —three-fourths of an ounce by weight, of a strength to contain 15.4 per cent of metallic arsenic, being simply stirred up in two and a half gallons of water. The arsenic solution was made by boiling one ounce of arsenic in one quart of water, and adding this solution to twenty gallons of cold water. The method of procedure was precisely as last year, the trees being thoroughly sprayed with a hand force-pump, and with the Deflector Spray and Solid Jet-Hose Nozzle, manufactured by the Lowell Faucet Company, Lowell, Mass. The fluids were thrown in a fine mist-like spray, applied until the leaves began to drip.

As a summary statement of the final issues of the Paris green experiments for the years 1885 and 1886, we may say in a word, that, in 1885, eighty-seven per cent of the fruit exposed to damage by the codling moth was preserved to ripening by the poisons applied, and that fifty-eight per cent of the picked fruit had been thus preserved; or, that taking picked and fallen fruit together, sixty-nine per cent, which would otherwise have been sacrificed, had been saved by our remedial measure.

Furthermore, during 1886, seventy-three per cent was saved from falling by a single spraying, seventy-seven per cent by two, and about seventy-two per cent by three. The difference unfavorable to the last was doubtless due to the accidental differences in trees and treatment.

The benefit to the picked fruit apparent from a single spraying, stands at forty-seven per cent, and that from twice spraying, at ninety per cent, while that from thrice spraying falls away, again, to seventy-seven per cent. Or, summarizing still more briefly, we may say, in general, that *the results of once or twice spraying with Paris green, in early spring, before the young apples had drooped upon their stems, resulted in a saving of about seventy-five per cent of the apples exposed to injury by the codling moth.*

I wish especially to emphasize the fact that the results now obtained are drawn from computations so made that they may be expected to hold good without reference to conditions other than variations in the treatment itself. The apples protected from injury by the codling moth are evidently apples *effectively poisoned*, and our "ratios of benefit" really express the ratios of these poisoned apples to the whole number treated. These ratios clearly will not vary either with the abundance of the apples, with the abundance of the codling moths, or with anything else except the original treatment, and subsequent accidents affecting the *length of time* during which the poison may adhere to the apple. This view is, in fact, substantiated by the essential agreement between the results of 1885 and 1886, under conditions as widely different as it would be possible to find by ten years' waiting.

We have next to determine the time of the year at which poisoning is the most effective: whether, in fact, it takes principal effect upon the first brood or the later ones. A moment's reflection will show that if only the first brood of the larvæ was directly diminished in a certain ratio, the second brood should show a similarly diminished ratio, since these descend from the first; whereas if both first and second broods are directly poisoned, then the ratio of damage to the second brood should be greater than that to the first; or, in other words, the percentage of benefit to the picked apples should be greater than that to the fallen. Our data for the present season do not apply to this question, since all the sprayings were made in May and early June while the apples were still very small; and it is incredible that the poison should have remained upon the fruit through all the vicissitudes of weather and time for the two months and more that elapsed before the appearance of the second brood of larvæ. The results of 1885, however, when the spraying was continued until September 3, give us important information. Referring to our records it was shown that the benefit to the picked apples, instead of being greater than that to the fallen fruit, was in 1885 about twenty-seven per cent less, so that certainly no appreciable effect was produced by spraying during the life of the second brood. The greater injury to the picked fruit is readily accounted for by a circumstance to which I have already alluded: viz., that our experimental trees were surrounded by others upon which no experiment was tried, and were consequently subject to invasion by codling moths of the second brood reared upon these unpoisoned trees.

Not only do these experimental facts point to the inefficiency of Paris green as against the later broods of the codling moth, but it is plain that the result was what we must have expected *a priori*, As the codling moth of all broods deposits the egg habitually on the blossom end of the apple, the poison taking effect only in case it reaches the surface of the apple between the calyx lobes, it is evident that there is little probability of effectively poisoning the fruit when the apple is full grown and pendent upon its stem,

Furthermore, I wish to emphasize especially the point that *spraying after the apples have begun to hang downward is unquestionably dangerous*, and should not be permitted under any circumstances if the fruit is afterwards to be used. The results of the chemical analysis reported in 1885 show that even heavy wind and violent rain are not sufficient to remove the poison from the fruit at this season, and remembering that the stem end of the apple presents a large conical pit by which the poison could be received and held, where neither rain nor wind could dislodge it, we have additional reason for this absolute prohibition of the use of any poison dangerous to health except when the fruit is young.

The experiments above described seem to me to prove that at least seventy per cent of the loss commonly suffered by the fruit grower from the ravages of the codling moth or apple worm may be prevented at a nominal expense, or, practically, in the long run, at no expense at all, by thoroughly applying Paris green in a spray with water, once or twice in early spring, as soon as the fruit is fairly set, and not so late as the time when the growing apple turns downward on the stem.

[From Report of the New York Agricultural Experiment Station, 1885.]

Spraying trees with Paris green and water has been often recommended as a preventive against injury from the codling moth (*Carpocapsa pomonella*, L.). In order to learn to what extent the harm wrought by this destructive insect may be thus avoided, we sprayed a few of the trees of the station orchard the past season, and on a portion of the trees made careful notes, intended to show as nearly as possible how much benefit resulted from the application. The trees selected for the experiment were eleven in number, of which nine were of the Fall Pippin variety, and the remaining two Rhode Island Greening. On June 3d we sprayed five of the Fall Pippin trees and one of the Rhode Island Greenings with Paris green and water at the rate of a teaspoonful to ten gallons. At this time the fruits were about the size of a cranberry. Alternate trees were left unsprayed for comparison.

The liquid was applied to the trees by means of a garden engine and the "cyclone nozzle." The nozzle attached to a hose was tied to the end of a light pole, about ten feet long, by means of which it could be raised and lowered at will, for spraying different parts of the tree.

We found this method of application quite laborious. The amount of water that the nozzle would allow to pass through it was so small that from a fourth to half an hour was necessary to thoroughly wet the foliage of a large tree. We tried attaching two nozzles to the end of the hose, which performed the work considerably faster than one.

On June 5th a very heavy rain fell, and fearing that this had largely washed off the poison, we made a second application of the Paris green and water at the same rate as before.

On June 17, we found on close examination that the larvæ of the codling moth were still hatching and entering the fruits, which were at this time about the size of a small cherry. Wishing to make our application as thorough as possible, we sprayed the trees again on the following day, using one ounce of Paris green to ten gallons of water; applying the mixture this time with the so-called Field force pump fitted with the "Boss" nozzle. We found this apparatus very satisfactory. The liquid left the nozzle in a thin sheet, which expanded in width as it rose in the air, and soon became broken up into a fine spray. By the time it reached the height of the tree top it was so finely distributed that it was necessary to hold the nozzle in one position for a considerable time before the water commenced dripping from the leaves. The nozzle could be held in the hand, dispensing with the pole, and by waving it to the right and left the foliage of the tallest apple trees in the orchard could be wet in one or at most two minutes, with very little waste of the liquid.

As the apples began to drop in August, the windfalls were collected and examined, under the sprayed trees, and those not sprayed, and the number of sound and wormy fruits counted. Oct. 5 and 6 the remaining fruit was picked, and assorted, and counted in the same way. The whole number of sound and wormy fruits yielded by each tree and the per cent (fractions omitted) of wormy fruits upon each was as follows:

SPRAYED TREES.

	Fruits not Wormy.	Wormy Fruits.	Per Cent of Wormy Fruits.
Tree No. 1, Fall Pippin	1755	225	11
" 3, "	1429	129	8
" 5, "	707	49	6
" 7, "	129	27	17
" 9, "	178	48	21
" 11, R. I. Greening	186	39	17

Average per cent of wormy fruits from sprayed trees, $13\frac{1}{3}$.

TREES NOT SPRAYED.

	Fruits not Wormy.	Wormy Fruits.	Per Cent of Wormy Fruits.
Tree No. 2, Fall Pippin	331	292	47
" 4, "	617	247	29
" 6, "	393	309	40
" 8, R. I. Greening	1591	518	25

Average per cent of wormy fruits from trees not sprayed, $35\frac{1}{4}$.

Tree No. 10 was sprayed on June 11th with a kerosene emulsion consisting of four pounds common yellow hard soap, one gallon kerosene oil, and one gallon soft water, the soap being dissolved in the water, the solution heated to boiling, the kerosene added, and the whole stirred until cold. One pint of the mixture was diluted with twenty gallons soft water, and applied to the trees in the same manner as the Paris green and water. The foliage seemed to be injured considerably by the application, a portion of the leaves turning brown in a few days, as if scorched.

This tree yielded 208 fruits that were not wormy, and 162 wormy ones, or 44 per cent of wormy fruits.

It appears that the percentage of wormy fruits from the trees sprayed with Paris green and water was about 22 per cent less than from those not sprayed. In other words, at this rate 100 barrels of apples picked from the sprayed trees would have yielded 22 barrels more fruit free from worms than the same number from the unsprayed trees. The kerosene emulsion in this case did not seem to prove beneficial.

THE APPLE SCAB.

[From Proceedings of the New Jersey State Horticultural Society, 1886.]

What is the experience of the Society in respect to what is generally known as apple scab?

The PRESIDENT would like to hear from Prof. Scribner.

Prof. SCRIBNER. The Department of Agriculture is engaged in preparing a special investigation of this disease of the apple, and I should be very glad to learn from practical fruit growers their experience in regard to it, and what varieties are most subject to it; under what conditions is it most prevalent; whether any one has noticed its absence under any peculiar circumstances, and what are the probable losses resulting from it.

The fungus in its active form, as it attacks the apple, is well known. It attacks the apple, the leaves and young shoots, and has been repeatedly propagated from one orchard to another on the grafts. It is probably perennial in its habit, living from one year to another in its vegetative state; what other forms it may have besides those familiar to us all we don't know. It does not penetrate deeply in the tissues, but is a surface disease, and is readily susceptible to fungicides.

Experiments have been made at the New York Experiment Station the past year to combat this disease. A tree badly affected, in 1885, was selected to experiment with, one-half of the tree was sprayed with hypo-sulphide of soda; two weeks later it received another application; the result at harvest was that this portion of the tree yielded much better fruit than the other.

This is a disease which causes an immense loss, rendering the quantity of number two apples unnecessarily large. Mr. Charles S. Pope, the President of the Maine Pomological Society, wrote to the Department a few weeks ago relative to this disease, saying it had damaged him to the extent of $1,000 the past season; the Baldwin was especially affected.

I have noticed apples in our Washington market, particularly the Bellflower, badly affected with this disease.

The SECRETARY, in reply to the Professor's inquiry, would say, That with him the Carolina Red June, Fall Pippin, Red Astrachan, and Early Harvest, were among the varieties most affected, the loss to the first named being fully fifty per cent.

WM. R. WARD. The Greenings and Baldwins have been affected this year badly; had never seen them troubled before. I attribute the early dropping of the apples to this cause. However, this may be due to the very dry season. I think a solution of London purple or Paris green sprayed on the trees would be beneficial.

Prof. SCRIBNER. The fungus of the apple-scab does not cause the apple to rot. These apples keep as well as others. Under the fungus growth is found a corrugated layer that protects the healthy tissues of the apple from decay. There are other fungi, more conducive to rot, that attack the apple; I have noticed several this season. I have noticed that apples affected with the scab, if kept in a warm place, will commence to rot about this fungus sooner than elsewhere.

I have noticed, also, that on trees affected with this *fusicladium* the leaves fall prematurely, and when the apples are attacked when quite young the disease will doubtless hasten maturity and cause the premature falling of the fruit.

The SECRETARY had noticed that where the fruit was attacked it stopped the growth and expansion of the fruit at the point of attack.

Prof. SCRIBNER. This fungus distorts the apple very much; sometimes to the extent to cause the apple to crack.

Mr. BAIRD reported the apples of Monmouth County very badly affected the past season. Smith's Cider especially.

President PEARSON reported the loss of fruit and foliage.

[From article by Prof. J. T. Burrill of Illinois, in Transactions of the Mississippi Valley Horticultural Society, Vol. I, 1883.]

It is, however, no new thing. It has neither come into existence in our time nor has it recently been introduced in our part of the country. Its dispersion over the world seems to be as wide as that of the apple itself, and records now exist in the books of its occasional prolific development and injuries over nearly a century of time. Botanists have baptised it with several names, hard enough of course, and collectors of specimens count it in the make-up of herbaria, sometimes more than once, on account of the synonymical names under which it is known. Now, however, the authorities are quite generally agreed that henceforth *Fusicladium dendriticum*, Fhl., shall be its true and only title in scientific parlance.

Turning now to the supposed conditions which have of late influenced the increased injuries of the fungus, nothing can be asserted with positiveness, but all indications seem to point to atmospheric and climatic causes rather than any special physiological changes in the trees themselves. Some kinds of trees are much worse affected than others, and this may be generally true of special varieties, or only during certain seasons, or at certain ages of the stock. But nearly all varieties of apples and pears have unusually suffered, at least in places, during the last year. Even nursery stock has been singed and stunted.

It seems to me, we are first to look to the open and humid autumn of 1881 as an important contribution to the severe result. During this time the fungus certainly did vigorously develop on the fading leaves, and especially on the unripened shoots of the year's growth. As the spores very readily germinate when moistened, it is not probable that any of them survive the winter on the fallen leaves. When once germinated, winter's vicissitudes soon put an end to them as they do to sprouting seeds. But on the twigs, in the dry air, both spores and mycelium successfully pass the winter and freely grow in the spring.

Having thus an unusual start last spring (1882) and unusually favored by the remarkable lateness and wetness of the season, the fungus became immensely developed, and, as we know, did immense damage. The outlook for next year (1883), as at present indicated, is not encouraging, but no one can certainly predict the results. Certain it is that the trees are now badly infested, and with similar conditions a similar development may be expected.

The important question is, "Can anything be done to reduce the damage?" I cannot, with assurance, say "yes." But some experiments on a small scale seem to be sufficiently encouraging to plan for further and more extended trials. The thing to do, of course, is to kill the fungus and prevent its reappearance. From what has been said the most favorable time for treatment is in the winter, when the leaves are off, and the applications should be made to the young wood.

The suggested trials are, first, pruning away any unnecessary young growth and especially that most affected, then syringing the tree with an emulsion of kerosene oil made with soap and water. To prepare this, mix equal quantities of soft soap, or hard soap softened with water and heat, and common coal oil; stir vigorously and for at least five minutes, then add ten to twenty times the quantity of water, and again stir. The result should be a uniform milky fluid. Apply in any way so as to wet the bark of the last year's growth, or, for thoroughness, that of two years' production. No fears need be entertained of injury to the tenderest part of the tree if the emulsion is well made. It can be applied, if desirable, to the leaves, but there is much less surface to wet before these appear, and it is much easier to reach it.

Coal oil of itself is injurious to vegetation, but when made into an emulsion, and thus diluted, no fears need be entertained about its use. Still, it may be in this State quite destructive to such fungus growths as that of which we write.

Sulphur has been recommended for similar use, but in this case little good can be anticipated from it, at any rate, if applied in winter. The sulphur itself does not kill fungi, because it is insoluble, but the beneficial effect comes from the gases, products of which it forms a part. In the winter these are not formed, while the rains wash away the solid material. Kerosene, on the other hand, is as effectual in cold as in warm weather, and kills by direct action.

There is another thing that may be mentioned in favor of the oil emulsion: It is also destructive to insects, and, wherever they may be reached, to their eggs. It is probable that the eggs of the apple aphis, which are deposited in autumn on the twigs, may be destroyed in this way. If so, we can kill two birds with one stone.

[By Prof. William Trelease, in the Report of the Agricultural Experiment Station of the University of Wisconsin, 1883.]

The scab fungus does not seem to penetrate below the epidermal layer of cells. These are split open and destroyed. The cells immediately below them are usually somewhat shrunken and flattened, while their contents are dead or injured, as is shown by their brown color. Sometimes, but not always, a small mass of tissue lying under the scab is quite green and intensely bitter, but the injury seldom extends far beneath the surface of the fruit, unless this is deeply cracked, and the seeds of scabby apples are apparently as vigorous as those of sound specimens. Usually, as the spot grows older and enlarges, an effort is made to throw off the parasite and heal the wound by the formation of a layer of cork just below it, and it is this brown cork which is seen through the cracks in old scabs.

From what has been said, it appears that the leaf or twig mildew and the scab of the fruit are diseases caused by the same parasitic fungus, which at first lives beneath the cuticle, in the one case, and in the epidermal cells, in the other. I have not yet been able to learn how the parasite penetrates the epidermis. It is well known that the skin of many varieties of the apple is marked by simple or areole dots which occur naturally on the healthy fruit, and are similar in their nature to the corky dots called lenticels that are found on the branches of the apple tree. These dots are slightly elevated portions of the skin where the epidermis is commonly split, and I suspect that the spores often find a lodgement in these dots, and through them reach the surrounding cells, when they germinate.

The age at which the fruit ceases to be infected is also uncertain. Last spring Mr. Tuttle found the young apples scabbed when no larger than peas, and it appears probable that the disease may attack them at any time from the unfolding of the blossom to their maturity; but the scab does not seem to spread from one apple to another in the barrel, though, as has been said, the individual spots continue to grow on the ripe fruit.

Those conditions of the soil and atmosphere which favor the development of leaf mildew are, in the main, most favorable for the formation of scab on the fruit, although hotter weather may be necessary for the excessive development of the former. This fact, taken in connection with the greater prevalence of active spores when there is much of the leaf disease, explains the belief of many orchardists that scab is caused by the mildew.

Mr. A. L. Hatch, of Ithaca, writes: "Apple scab worst on a poor soil, or rather subsoil. Where an orchard has been planted on heavy timber lands, where the original forest was mainly basswood, white oak, and some ash and maple, the apples are much fairer than on our white oak brush land, or on black oak land. An apple tree is more influenced by subsoil than surface soil, when of bearing age. In 1882, Joseph Elliot, of Port Andrew, in this county, had 1,600 bushels Fameuse, fair and smooth, while almost every apple we had in 150 to 200 bushels here, was scabbed. On some soils Walbridge is smooth and good. Mildew, we think, is worst where scabbing is worst, *i. e.*, as far as soil influence goes; but is also very bad on richer, warmer soils, especially if sandy.

"Our notion is, that soils and subsoils that furnish most of the protecting covering to leaves and fruit (whether it is silex or wax), will grow trees less affected with scab and mildew: and this is heavy timber soil, with a subsoil not as porous as we have here on white oak brush land—such as we find where basswoods, white oaks, ash, etc., attain large size, but not where black oak and second growth brush, poplars, etc., prevail. Also, that a very damp atmosphere, with cold when apples are from one-tenth to one-quarter grown, produces scab, and with heat produces mildew, provided it occurs before the first of July, before the first growth of apple trees is completed, and while leaves are tender. This first growth is always complete in orchard trees by the middle of July at latest."

Prof. W. J. Beal states that scab is worst in seasons which are wet at first, with alternating extremes of wet and dry weather later, and Mr. Harris finds more of it in "muggy" weather following a cool, dry period. According to Mr. Garfield, the side of the apple most exposed to light is most seriously affected as a rule, so that from the center of the tree "the fruit looked fair and beautiful, when really there was not a perfect apple on the tree because of scab on the outer side of the fruit."

Like the mildew, scab is more troublesome on some varieties than on others. As a boy I noticed the knobby, cracked fruit of the Early Harvest in New York State, where, in damp summers, this variety was always ruined. Professor Beal mentions Fameuse and Northern Spy as scabbing badly, especially on the lower limbs where they are thick, while the Baldwin and Rhode Island Greening scab little, often not at all; and Secretary Garfield reports Early Harvest, Fameuse, Rhode Island and Northern Spy as suffering in other parts of Michigan.

In Wisconsin, the Fameuse is pre-eminent as scabbing badly, while the Walbridge, Late Strawberry, Haas, Northern Spy, fall and winter Winesop, Roman Stem, Sweet Pear, Rawles Janet, Fall Stripe, McMahon's White, Ben Davis and Talman Sweet scab more or less badly in wet seasons or on heavy, poorly-drained soil.

Several correspondents believe that no variety is absolutely exempt from the disease under all circumstances; but they agree that Duchess, Alexander, Golden Russet (and, in fact, all russets), Wealthy, Pewaukee, Tetofsky, Red Astrachan, Sops of Wine, Plumb's Cider, Utter, Bethlehemite, Fall Orange, St. Lawrence, Cole's Quince and Lowell, scab much less than most varieties of the first list. Of about one hundred Russians in Mr. Tuttle's nursery, only a few scab to an injurious extent.

Some idea of the injury caused by the scab may be gathered from Mr. Hatch's statement that in his locality (Richland County) 99 per cent of Fameuse and Walbridge, 40 per cent of Haas, 20 per cent of Plumb's Cider, 10 per cent of Pewaukee, 5–10 per cent of Tetofsky, and something less than 5 per cent of Duchess, scab injuriously in bad years. The total failure of the apple harvest in 1883 over a large part of the State is attributed to the leaf mildew and scab by several correspondents.

These two diseases of the apple are not new diseases, nor are they confined to Wisconsin. The theory has prevailed with a few orchardists that both result from the age and lessened vigor of their trees, or from a sort of natural deterioration of certain varieties through long cultivation; but neither of these theories is accepted by the best observers. The same diseases occur on the pear. On either plant they are, so to speak, epidemic in seasons which are favorable for their development and propagation. Like a widespread outbreak of small-pox in a large city where isolated cases have occurred all the time, they appear new to many people, and, like the small-pox epidemic, may require active, concerted and intelligent measures to prevent extensive damage as a result of their thorough establishment in the past two years.

Both diseases occur the world over. The fungus on the leaf was studied and described in 1833, by Wallroth, as *Cladosporium dendriticum*. From the variability of its spores and its wide distribution, it has received a number of synonyms, of which *Spilocæa pomi*, applied in 1829 to the reproductive cells which separate directly from the mycelium, is the only one which need be mentioned. In 1875, Sorauer published an account of the scab, which is known in Germany as the apple rust or scurf, showing that it is caused by the same fungus that attacks the leaves, as Cooke had suggested in 1873. From the occasional presence of two-celled spores, and the slight turnip shape of these bodies, Von Thuemen has proposed the genus *Napicladium* for the reception of our plant, which he calls *N. Soraueri*; but the general tendency of botanists is to retain it in the genus *Fusicladium*, to which it was transferred by Fuckel.

The reader who has followed this account so far naturally desires to learn of a remedy or preventive for the disease. Several measures can be suggested as promising relief. One of these is a better system of a drainage* and more open planting than we find in the average orchard, both tending to promote the general health of the tree. Where leaves fall from mildew, they should be raked together on a damp, still day and burned.

In the paper referred to, Professor Burrill suggests "pruning away any unnecessary growth, and especially that most affected, then syringing the tree with an emulsion of kerosene oil made with soap and water. To prepare this, mix equal quantities of soft soap, or hard soap softened with water and heat, and common coal oil; stir vigorously and for at least five minutes, then add ten to twenty times the amount of water and again stir. The result should be a uniform milky fluid. Apply in any way so as to wet the bark of last year's growth, or for thoroughness, that of two years' production. No fears need be entertained of injury to the tenderest part of the tree if the emulsion is well made." It is recommended that this be done before the leaves appear, to destroy the mycelium and spores on the twigs, but this treatment should also be tested after the leaves were out and the fruit has set, if the fungus is on the increase. The oil emulsion, if properly made with either soap or milk, is a good and safe application for the apple aphis, oyster shell bark louse and other insect enemies of the tree; used in connection with a proper system of planting and drainage and the occasional removal of the

*I am aware that our agricultural journals for the last year contain numerous articles written to show that the apple lives in soggy soil or can even be flooded for a long time without dying, just as the bark may sometimes be stripped off without killing it; but the testimony its practice of most successful and well informed horticulturists is against the ultimate success of trees subjected to such barbarous treatment.

old bark and of fallen leaves and rubbish, it promises to well repay the man who uses it. Alkali, which is largely used for the destruction of orange scale insects, in California, might likewise be tried against this fungus, and experiments with sulphur and lime, when it is likely to do harm in summer, may yield good results. From the observations of Secretary Garfield it would also appear desirable to test the efficacy of protecting the fruit from too strong sunlight. The results of careful experiments in any or all of these directions will be gratefully received at the Station.

The prevention or eradication of this and other fungoid diseases should be understood to demand a rigid application of the principles which govern the rational treatment of the contagious diseases of man and the domesticated animals. Until a proper system of orchard supervision is adopted, at any rate, we must expect that whenever a favorable season occurs both leaf blight and scab will appear on susceptible varieties and in badly located orchards. In setting an orchard, therefore, care should be taken to choose the greater part of the stock from those hardy, "thick-leaved" varieties which prove most resistant to this disease, as well as to our trying winter and summer climate.

[From Report of the New York Agricultural Experiment Station, 1885.]

We made a series of applications intended to prevent the growth of the fungus which produces the apple scab, *Fusicladium dendriticum* Fclk. The tree chosen for the experiment was one of the common Siberian (?) crab that had been very subject to injury from this fungus in previous years.

On May 5th, we syringed one-half of the tree with a solution of hyposulphate of soda, at the rate of one pound to ten gallons of water, and repeated the application on May 9th and May 15th.

During the summer, the foliage appeared less injured by the fungus upon the syringed half of the tree. On September 19, we picked a quantity of the fruits from the syringed part of the tree, and from the part not syringed, and assorted each lot into three qualities. In the first quality we put only the fruits not attacked by the fungus, in the second, those attacked in but one place, and there but slightly, and in the third, those much injured. The results appear in the following table, in which the percentage of the fruits of each quality are given for the syringed and unsyringed part of the tree. We also give the weight of 100 fruits in each quality, as an indication of the amount of injury wrought by the fungus:

	Syringed Portion.		Unsyringed Portion.	
	Per Cent.	Wt. of 100 fruits: oz.	Per Cent.	Wt. of 100 fruits: oz.
First Quality..........................	21.5	19	10.	15
Second "	38.5	16	29.7	13
Third "	40.	13	60.3	8

It appears that in the syringed portion of the tree the per cent of uninjured fruits was double that in the unsyringed portion, while the percentage of the third quality, or much injured fruits was one-half less. It also appears that all the fruits on the syringed portion were larger in size than those on the unsyringed portion. We also noted that there were many more decayed fruits on the unsyringed portion of the tree.

The indications are, therefore, the hyposulphite of soda proved beneficial. The solution may be applied at the same time as the Paris green and water, where the latter is used for the codling moth, thus avoiding the expense of a special application.

KEROSENE EMULSION AS AN INSECTICIDE.

[From Report of Prof. C. V. Riley, U. S. Entomologist, 1884.]

It cannot be too strongly impressed upon all who use kerosene as an insecticide, that it can be considered a safe remedy only when properly emulsified. The formula for the kerosene and soap emulsion, as found most satisfactory by Mr. Hubbard, is as follows:

Kerosene............................2 gallons=67 per cent.

$\left.\begin{array}{l}\text{Common soap or whale-oil soap ...... } \tfrac{1}{2} \text{ pound} \\ \text{Water .... 1 gallon}\end{array}\right\} = 33 \text{ per cent.}$

Heat the solution of soap and add it boiling hot to the kerosene. Churn the mixture by means of a force pump and spray-nozzle for five or ten minutes. The emulsion, if perfect, forms a cream, which thickens on cooling, and should adhere without oiliness to the surface of glass. Dilute, before using, one part of the emulsion with nine parts of cold water. The above formula gives three gallons of emulsion, and makes, when diluted, thirty gallons of wash.

The kerosene and soap mixture, especially when the latter is warmed, forms, upon very moderate agitation, an apparent union ; but the mixture is not stable, and separates on standing or when cooled or diluted by the addition of water. A proper emulsion of kerosene is obtained only upon violent agitation. It is formed, not gradually, but suddenly: in short, to use a familiar phrase, "it comes" like butter. The time required in churning depends somewhat upon the violence of the agitation, but still more upon the temperature, which, however, need not be much above blood heat.

When obtained, an emulsion of kerosene and soap is known by the perfect union of the ingredients, and the absence of oiliness, so that the liquid clings to the surface of glass or metal. It resembles a rich cream, more or less thickened according to the proportion of soap in the mixture.

PREVENTIVES AND REMEDIES FOR PEAR BLIGHT.

By Prof. J. C. Arthur.

[From Report of the Mycological Section of U. S. Department of Agriculture, 1886.]

Whatever form Pear Blight assumes, it is started by germs gaining access to the tree in one of the three ways described—through the flowers, the growing shoots, or injuries of the bark. No method is known or has yet suggested itself of rendering the tree insusceptible to the disease, and a direct prevention must be sought in some means of excluding the germs. There are three ways by which germicides may be applied to trees—by fumigation, by spraying and by washing. The first method offers a possibility of at least partial success, and is done by sulphur mixed with lime and applied as a wash to the trees. The odor remains upon the trees for weeks and is said to ward off the disease.

Spraying offers little more hope of success than fumigation. An experiment tried during last season in spraying with a solution of hyposulphite of soda, applied several times during the period of expansion of the buds, gave no evidence of beneficial effects.

The application of washes cannot, of course, be made to the flowers or growing shoots, but excellent results may reasonably be expected when made to the trunks and larger branches. To decrease the amount of cracking the body of the tree may be shielded from the sun's fiercest rays by a low trimmed head, or by leaning the whole tree toward the southwest, or by boards, matting, or other protection, on the sunny side of the trunks.

Among the indirect methods of fighting the disease none are more important than those which secure slow growth and early maturity of the shoots. This has been recognized from the first agitation of the subject, but until the present time there has been no unanimity of opinion as to the exact objects to be accomplished.

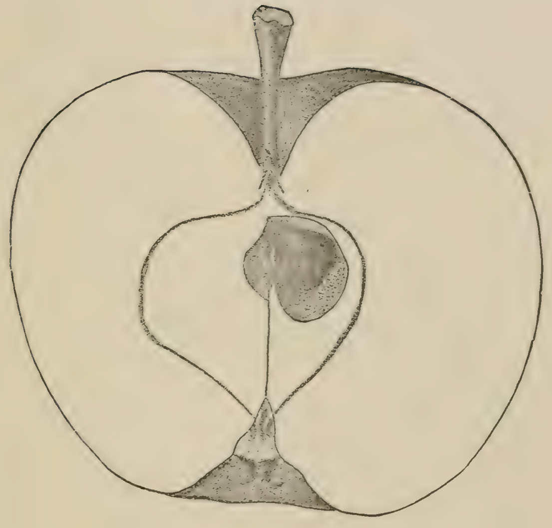
Of genuine remedies there are none; but as the disease is local, and spreads through the tissues slowly, it is possible, as has long been known, to effectively check its progress by amputation. The smaller limbs are to be cut off a foot or two below the lowest manifestation of the disease, and the spots on the trunk and larger limbs are to be shaved out, cutting deep enough to remove all discoloration. A careful operator will keep the knife disinfected with carbolic acid or otherwise; if this is not done the disease will be conveyed in a small percentage of instances to the freshly cut surface, necessitating a subsequent excision. The beneficial effects of this treatment are least apparent during periods of epidemic, when the tree is attacked at almost every vulnerable point. At such times a more radical method has been found serviceable, which is to cut off the whole top to within a foot or two of the ground. It can be practiced to advantage upon trees that are as much as ten years old, or even older.

THE BOARDMAN APPLE.

[From Report of U. S. Department of Agriculture, Division of Pomology, 1886.]

A box of very handsome apples of medium size and quality was received from Mr. E. H. Purington, of West Farmington, Me., said by him to be from a seedling of the Dean, and which I named "Boardman," in honor of Samuel L. Boardman, the Secretary of the Maine State Pomological Society. Below is a description of one of the specimens:

Size, small to medium, 2½ inches; shape, flat, conical, but not pointed, regular; surface, smooth, glossy, bright mixed and splashed carmine almost entirely covering a white ground; dots, not very numerous, gray, prominent; basin, medium, abrupt, regular, slightly marked with russet or leather-cracked; eye, small, partially open; cavity, deep, narrow, furrowed, but little russeted; stem, long, slender; core, small, closed; seeds, broad, plump, sharply pointed, dark; flesh, very white, tender, fine grained, juicy; flavor, subacid, not rich; quality, good; season, December to spring in Maine.



THE BOARDMAN APPLE.

From Plate 10, Report of Department of Agriculture, Division of Pomology, for 1886.

APPENDIX.

D. H. KNOWLTON, *Treasurer*,

In Account with Maine State Pomological Society.

Dr.		Cr.	
To cash in treasury Dec. 31, 1885....	$12 78	By paid orders of Executive Com...	$237 25
" loan First Nat'l B'k of Wiscasset,	400 00	" Secretary's salary................	125 00
" " People's Trust Co., Farmington....................	300 00	" note, First Nat'l B'k, Wiscasset,	400 00
" " State Treasurer, bounty for 1885........................	500 00	" interest on loans	26 35
" life members' fees.................	60 00	" premiums paid, bal. 1885	242 50
" annual members' fees............	54 00	" " " in full, 1886......	613 25
" State Agricultural Society	380 00	" cash in treasury Dec. 31, 1886....	81 51
" interest on Permanent Fund	15 64		
" " " deposit	3 44		
	$1725 86		$1725 86

Financial Condition of the Society Jan. 1st, 1887.

Assets.		Liabilities.	
Amount due from State Treasurer, bounty for 1886	$500 00	Amount due on loan at Wiscasset National Bank...	$200 00
Cash in treasury	81 51	Amount due on loan, People's Trust Company, Farmington............	300 00
Property owned by the Society, estimated	150 00	Amount due on bills and accounts not rendered, estimated	100 00
Amount on deposit in Wiscasset Savings Bank to credit of Permanent Fund...............................	344 40		
Balance due from State Agricultural Society	45 00		
	$1120 91		600 00

Permanent Fund.

Dr.		Cr.	
To amount on deposit to credit of Fund...............................	$344 40	By fees of 88 members..............	$880 00
Balance due Fund	535 60		
	$880 00		$880 00

D. H. KNOWLTON, *Treasurer*.

Farmington, Feb. 2, 1887.

Maine State Pomological Society,
In Annual Meeting, Farmington, Feb. 3, 1887.

The following members were appointed a committee to examine the Treasurer's account, viz.: D. J. Briggs, L. H. Blossom, W. P. Atherton. The committee reported that they had attended to their duty, having examined the account, which was found correct and properly cast, with vouchers for all amounts paid out. The committee was discharged.

A true copy from the records.

Attest: Samuel L. Boardman, *Sec'y*.

Pomological and Horticultural Societies.

Below is given a list of those Pomological and Horticultural societies and their Secretaries, in the different States, with which our Society is in correspondence, and with which it exchanges Reports and Transactions. We should be very glad to extend the list so as to embrace all societies of this nature in every State in the Union.

American Pomological Society. Charles W. Garfield, Secretary, Grand Rapids, Michigan.

Department of Agriculture of the United States. Hon. Norman J. Colman, Commissioner, Washington, D. C. Hon. Henry E. Van Deman, Chief of Division of Pomology.

American Horticultural Society. W. H. Ragan, Secretary, Greencastle, Indiana.

Society of American Florists. Edwin Lonsdale, Secretary, Philadelphia, Penn'a.

Massachusetts Horticultural Society. Robert Manning, Secretary, Boston, Mass.

Western New York Horticultural Society. P. C. Reynolds, Secretary, Rochester, N. Y.

New Jersey State Horticultural Society. E. Williams, Secretary, Montclair, N. J.

Pennsylvania Fruit Growers' Society. E. B. Engle, Secretary, Waynesboro', Penn'a.

Ohio State Horticultural Society. George W. Campbell, Secretary, Delaware, Ohio.

Wisconsin State Horticultural Society. H. C. Adams, Secretary, Madison, Wisconsin.

Indiana Horticultural Society. C. M. Hobbs, Secretary, Bridgeport, Indiana.

State Horticultural Society of Michigan. Charles W. Garfield, Secretary, Grand Rapids, Michigan.

Illinois State Horticultural Society. A. C. Hammond, Secretary, Warsaw, Illinois.

Iowa State Horticultural Society. G. B. Brackett, Secretary, Denmark, Iowa.

Missouri State Horticultural Society. L. A. Goodman, Secretary, Westport, Missouri.

Kansas State Horticultural Society. G. C. Brackett, Secretary, Lawrence, Kansas.

Nebraska State Horticultural Society. Samuel Barnard, Secretary, Table Rock, Nebraska.

State Board of Horticulture of California. A. H. Webb, Secretary, San Francisco, California.

Minnesota State Horticultural Society. S. D. Hillman, Secretary, Minneapolis, Minn.

Columbus Horticultural Society. W. S. Devol, Secretary, Columbus, Ohio.

Colorado State Horticultural Society. Nelson Millett, Secretary, Denver, Col.

Massachusetts Agricultural College. Hon. Henry H. Goodell, President and Librarian, Amherst, Mass.

New York State Agricultural Experiment Station. E. Lewis Sturtevant, Director, Geneva, N. Y.

Entomological Department of the State of Illinois. Prof. S. A. Forbes, Entomologist, Springfield, Ill.

Ohio Agricultural Experiment Station. N. S. Townshend, Director, Columbus, Ohio.

Department of Fruit Pests, California State Board of Horticulture. W. G. Klee, Inspector of Fruit Pests, Sacramento, Cal.

North Carolina State Horticultural Society. S. Otho Wilson, Secretary, Vineyard, N. C.

California State Board of Viticultural Commissioners. Chas. A. Wetmore, Chief Viticultural Officer, Sacramento, Cal.

Fruit Growers' Association of the Province of Ontario. L. Woolverton, Secretary, Grimsby, Ontario.

Montreal Horticultural Society. E. J. Maxwell, Secretary, Montreal, P. Q., Canada.

Entomological Society of the Province of Ontario. Edmund Baynes Reed, Secretary, London, Ontario.

Fruit Growers' Association of Nova Scotia. C. R. H. Starr, Secretary, Port Williams, N. S.

Ontario Department of Agriculture, Entomological Division. James Fletcher, F. R. S. C., Entomologist, Ottawa, Canada.

OFFICERS FOR 1887.

President.

CHARLES S. POPE, Manchester.

Vice Presidents.

D. J. BRIGGS, South Turner.

O. C. NELSON, New Gloucester.

Secretary.

SAMUEL L. BOARDMAN, Augusta.

Treasurer.

D. H. KNOWLTON, Farmington.

Executive Committee.

The President and Secretary, *ex-officio*; W. P. Atherton, Hallowell; L. H. Blossom, Turner Centre; J. W. True, New Gloucester.

Trustees.

Androscoggin	County,	A. S. Ricker, Turner.
Aroostook	"	E. W. Merritt, Houlton.
Cumberland	"	S. R. Sweetser, Cumberland Centre.
Franklin	"	M. C. Hobbs, West Farmington.
Hancock	"	Charles G. Atkins, Bucksport.
Kennebec	"	E. A. Andrews, Gardiner.
Knox	"	Elmas Hoffses, Warren.
Lincoln	"	H. J. A. Simmons, Waldoboro'.
Oxford	"	Jairus K. Hammond, Paris.
Penobscot	"	J. E. Bennoch, Orono.
Piscataquis	"	H. A. Robinson, Foxcroft.
Sagadahoc	"	H. S. Cary, Topsham.
Somerset	"	James S. Hoxie, North Fairfield.
Waldo	"	D. B. Johnson, Freedom.
Washington	"	Nelson S. Allen, Dennysville.
York	"	Luther S. Moore, Limerick.

Committee on Nomenclature.

Samuel Rolfe, Portland; W. P. Atherton, Hallowell; D. P. True, Leeds Centre.

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, W. P	"
Atkins, Charles G	Bucksport
Atwood, Fred	Winterport
Bennoch, John E	Orono
Boardman, Samuel L	Augusta
Briggs, D. J	South Turner
Briggs, John	Turner
Burr, John	Freeport
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
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
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Gilbert, Z. A	North Greene
*Godfrey, John E	Bangor
Hanscom, John	Saco
Harlow, S. C	Bangor
*Harris, N. C	Auburn
Harris, N. W	"
Harris, William M	"
*Hersey, T. C	Portland
Hopkins, Miss S. M	Gardiner
Hoxie, James S	North Fairfield
Hobbs, M. C	West Farmington
Ingalls, Henry	Wiscasset
*Jewett, George	Portland
Johnson, Isaac A	Auburn
Jordan, Francis C	Brunswick
Knowlton, D. H	Farmington
Low, Elijah	Bangor
Low, S. S	"
Lapham, E. A	Pittston
McLaughlin, Henry	Bangor
*Metcalf, M. J	Monmouth
Moore, William G	"
Moor, F. A	Waterville
Morton, J. A	Bethel
Morton, William E	Portland
*Noyes, Albert	Bangor
Perley, Chas. I	Seward's (Vassalboro')
Pope, Charles S	Manchester
Pulsifer, D. W	Poland
Purington, E. F	West Farmington
*Richards, F. G	Gardiner
Richards, John T	"
Ricker, A. S	Turner
*Richardson, J. M	Gardiner
Roak, George M	Auburn
Robinson, Henry A	Foxcroft

* Deceased.

LIFE MEMBERS—Concluded.

Rolfe, Samuel .... Portland
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 .... "
Starrett, L. F .... Warren
*Stetson, Isaiah .... Bangor
Stilphen, Asbury C .... Gardiner
Stanley, Charles .... Winthrop
Stanley, O. E .... "
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

*Deceased.

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Bartlett, M. E .... East Dixmont
Blossom, Leander H .... Turner Centre
Berry, L. M .... Winthrop
Blossom. G. W .... Turner
Baker, John C .... Lewiston
Brown, Henry W .... Newburg
Bickford, James .... Carmel
Carpenter, James M .... Pittston
Colby, Mrs. D. H .... Lewiston
Cary, Henry S .... Topsham
Chase, G. C .... Lewiston
Chipman, A. B .... West Gloucester
Cook, S. W .... Lewiston
Cushing, J. S .... Turner
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Douglass, Mrs. J. L .... Bath
Dunton, John .... Lewiston
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Espionnette, Albert .... Lewiston
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Harmon, Mrs. G. H .... Auburn
Hoyt, Mrs. F .... Winthrop
Hawkins, M. P .... Auburn
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McKenney, I. V .... Auburn
Murch, Mrs. T. W .... Auburn
Nowell, Frank E .... Fairfield
Nelson, O. C .... New Gloucester
Perkins, L. J .... Deering
Penley, Arthur W .... Auburn
Powers, L. G .... Georgetown
Ring, Miss Cora E .... Richmond
Sanford, C. E .... Bowdoinham
Skillings, Lorinda .... Lewiston
Swan, D. H. .... Waterville
Wakefield, Seth D .... Lewiston
Wharff, William R .... Gardiner
Waterman, I. T .... East Auburn

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Merrill, T. M .... West Gloucester
Nelson, O. C .... Upper New Gloucester
True, J. W .... New Gloucester

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