Public Documents of Maine:

BEING THE

ANNUAL REPORTS

OF THE VARIOUS

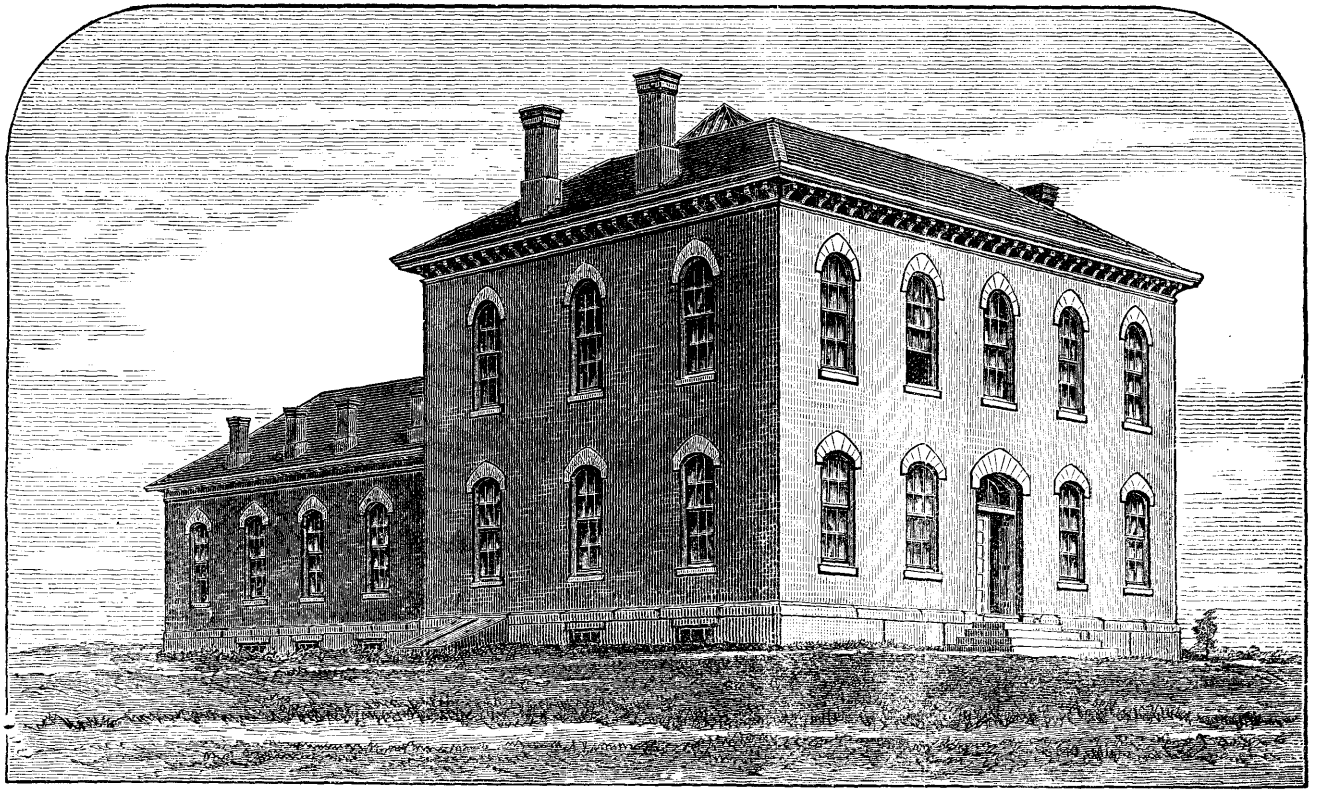
PUBLIC OFFICERS AND INSTITUTIONS

FOR THE YEAR

1877.

VOLUME II.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1877.



LABORATORY BUILDING OF MAINE STATE COLLEGE, ORONO, MAINE.
[Including Laboratory, Museum, and Library.]

TWENTY-FIRST ANNUAL REPORT

OF THE

SECRETARY

OF THE

MAINE BOARD OF AGRICULTURE,

FOR THE YEAR

1876.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1876.

MAINE BOARD OF AGRICULTURE.

J. E. SHAW, PRESIDENT.
IRA E. GETCHELL, VICE PRESIDENT.
S. L. BOARDMAN, SECRETARY.

MEMBERS AT LARGE APPOINTED BY THE GOVERNOR AND COUNCIL.

Name.	P. O. Address.	Term expires Dec. 31.
M. C. Fernald	Orono	1877
Henry Carmichael	Brunswick	1877
C. F. Allen	Orono	1879
George E. Brackett	Belfast	1879
D. M. Dunham	Bangor	1879

MEMBER CHOSEN BY STATE AGRICULTURAL SOCIETY.

B. M. Hight	Skowhegan	1877

MEMBER CHOSEN BY STATE POMOLOGICAL SOCIETY.

J. A. Varney	North Vassalboro'	1878

MEMBER CHOSEN BY MAINE POULTRY ASSOCIATION.

W. W. Harris	Portland	1877

MEMBERS CHOSEN BY COUNTY SOCIETIES.

Samuel Wasson	Hancock	East Surry	1876
Joel E. Shaw	Penobscot	West Hampden.	1876
A. L. Bradbury	Franklin	Phillips	1876
Lyman Lee	Piscataquis	Foxcroft	1876
Timothy Williams	Knox	Rockland	1876
Isaac Barker	Aroostook	Houlton	1876
Ira E. Getchell	Kennebec	N. Vassalboro'.	1877
Z. A. Gilbert	Androscoggin	East Turner	1877
Lyman H. Winslow	Lincoln	Nobleboro'	1877
C. W. Hersey	Washington	Pembroke	1877
P. W. Ayer	Waldo	Freedom	1877
Horace Bodwell	York	Acton	1878
Thomas Reynolds	Oxford	Canton	1878
J. Marshall Brown	Cumberland	Falmouth	1878
George Flint	Somerset	North Anson	1878
Isaac E. Mallett	Sagadahoc	Topsham	1878

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INTRODUCTION.

To the Honorable Senate
and House of Representatives:

I have the honor to transmit herewith, the Annual Report of the Maine Board of Agriculture for the year 1876.

The annual meeting was held at Lemont Hall, in Brunswick, February 8th, 9th and 10th, 1876, at which the following officers were duly elected: President, J. E. Shaw of Hampden; Vice President, Ira E. Getchell of Vassalboro'; Secretary, Samuel L. Boardman of Augusta. The usual committees for the year were appointed, the new members qualified and took their places at the Board; after which an eloquent and appropriately worded address of welcome was given by Hon. Charles T. Gilman of Brunswick. The public exercises then opened with the reading of a paper by the Secretary, on the place which the horse should occupy at our agricultural exhibitions. This paper was prepared in accordance with the instructions of the Board, and will be found in full at page 120 of this volume. After its reading, a general discussion of the same was engaged in, which occupied the entire forenoon. With a few exceptions, the speakers endorsed the views presented in the essay. So far as breeding was concerned, it was believed it should be the aim of our farmers to breed a good moving, stylish, well proportioned, kind, serviceable class of horses, of good size, good for the road, the farm, the heavy load—with good speed added to other desirable qualities—and not waste so much effort in the endeavor to raise a two-thirty horse from material that will hardly produce a three-minute one. Concerning the matter of speed, there was little diversity of opinion, and in the main the position taken in the paper was supported. Mr. Gilbert said it was much easier to find fault with than to correct the handling of horses at exhibitions. He said that at the present time we could not have horse trots without some evils; and he thought agricultural exhibitions should be conducted without horse racing; sup-

porting his argument by the fact that the outlay was greater than the revenue. As to preventing gambling at fairs, it was a thing easier said than done. Mr. Harris replied, and said he believed gambling could be kept from exhibition grounds, but the revenue to societies was chiefly obtained from this feature of our fairs. Mr. Wasson took the ground that of the 70,000 horses in Maine, five or six thousand are trotters—which would show that the production of horses was a leading industry of our agriculture, and he knew of no reason why it was not a legitimate industry. He knew there was an indiscriminate objection to trials of speed at fairs, but for these abuses the community is largely responsible. If the public say what is right is to be permitted, and what is wrong is to be prohibited, the evils that accompany trials of speed will be corrected. The discussion was closed by Mr. Tenney of the Brunswick *Telegraph*, who spoke in a pertinent and forcible manner upon the subject, and believed the trials of speed at fairs, properly conducted, was a great source of revenue, and a satisfaction to the spectators. In the afternoon a paper was read on the relations of veterinary science to agriculture (followed by a discussion); and in the evening a lecture, giving the results of certain experiments in Plant Nutrition, by Prof. Levi Stockbridge of the Massachusetts Agricultural College. Both these are given in full in a subsequent part of this Report.

At the previous semi-annual meeting of the board, the subject of Fences and Fencing was assigned as a leading topic for consideration at this session. This subject was divided into four sections, viz.: history of fences; statistics of fencing in Maine as to amount; cost of the fences in the State, and the law of fences with its needed changes. These subdivisions formed the topics of papers which were treated respectively by Mr. Gilbert of Androscoggin, Mr. Getchell of Kennebec, Mr. Ayer of Waldo, and Mr. Wasson of Hancock. The first two papers formed the programme of the forenoon on the second day of the session, and with the discussion following are given in subsequent pages. In the afternoon Prof. Stockbridge gave the second of his lectures, viz.: On the Management of Pastures, given in full at page 70 of this volume. The two lectures of this distinguished gentleman form a marked contribution to the present volume on the Agriculture of Maine, and are of so valuable and practical a character as to be of great service to all farmers. There are few more important matters coming within the range of

the farmer's study or practice than those which form the subject of these lectures, and they are presented in so clear and comprehensive a light as to be of great service to all who will master their contents by a diligent and careful reading. I earnestly hope their truths may be acquired and put in practice by all. In the evening an able lecture was given by Prof. M. C. Fernald of the Maine State College, on Taxation, elsewhere given in full.

The forenoon of the third day was devoted to the consideration of the cost of fencing in Maine; and our fence laws as they are and as they should be—bringing to a close the discussion of this topic as proposed by the programme. These papers are published entire, and the discussion following them in satisfactory fullness, in their proper place. The afternoon session opened with a paper by Mr. Lyman Lee of Foxcroft, on the Value of Covered and Uncovered Manure, in which he introduced the results of an experiment conducted by a celebrated Scotch farmer to determine their relative value. Four acres of soil of uniform character were selected for an experiment, two of which were manured with uncovered ordinary barnyard manure, and two with an equal quantity of manure from covered sheds. The whole was planted to potatoes with the following result:

Uncovered manure, one acre, produced					272	bushels.	
"	"	"	"		293	"	
Covered manure,		"	"		442	"	
"	"	"	"		471	"	

Or an increase of 348 bushels from the sheltered manure on two acres. The following year the field was sown to wheat, and the result found to be as follows:

Uncovered manure, one acre, produced				41	bushels,	18	pounds.
"	"	"	"	42	"	38	"
Covered manure,		"	"	55	"	5	"
"	"	"	"	58	"	47	"

Each bushel containing 61 pounds; the latter showing a gain of 31 bushels on the acre. The straw on the portion dressed with manure which had been covered, was also one-third heavier. Mr. Lee followed these experiments with an earnest appeal for farmers to give more care and attention to the manufacturing, collection, and use of fertilizers upon the farm. We can hardly give too much attention to this subject, and if we but protect the manure of our farmyards from the wasting influence of sun and rain, we may assure ourselves that we have all that is necessary for the best cultivation of our crops. Manure cellars and sheds are im-

portant auxilaries in the manufacture and saving of composts, manures and fertilizers—and the greater value of manures thus protected will more than pay the expense of building such sheds and cellars. In his own experience he had applied twenty-five loads of manure to the acre for corn, and by observing a proper rotation had kept his fields in good condition, and produced good crops of corn. In the winter of 1871–2, in consequence of a light hay crop, farmers were obliged to use western corn to "help out" the hay-mow. This corn could be purchased at 70 or 75 cents per bushel, at the depots in this State. This low price of corn had led many farmers to believe they could purchase western corn for feeding, cheaper than they could grow it, and they had been raising potatoes to sell for the purpose of purchasing corn. But it was a bad system and was sure to reduce the fertility of the fields—as but little manure was used in their culture, the crop was generally light, and prices low. This was a wrong course. Farmers should make and protect their farm dressing, manure liberally, and depend upon raising, themselves, rather than purchasing, their corn and other staple crops. Following this Mr. Shaw, the President of the Board, read a paper on some points of general farming as conducted in Maine, and the session closed with an essay and discussion on Co-operation, the former of which, by Mr. D. M. Dunham of Bangor, is published in full. In the evening Prof. H. Carmichael of Bowdoin College, and one of the Members at Large, delivered a lecture on the Beet Sugar Industry. It has been my hope to give this lecture as delivered, in this report, but owing to a multiplicity of college and professional duties the author has been unable to place a copy in my hands for this purpose; consequently I am forced to content myself with a brief outline of the same in this place, and to substitute it, farther on, with an essay on the same subject, to which I invite particular attention, from the pen of Prof. Alfred E. Aubert of the Maine State College. The lecture of Prof. Carmichael was accompanied with large tables and diagrams showing the chemical analysis of the sugar beet; increase of sugar production from the beet for the past thirty years in France, and the different kinds of machinery used in the manufacture of sugar. These diagrams were fully explained by the professor while lecturing, and the following brief abstract of his remarks will give an idea of the points to which he referred: Of the 3,000,000 tons of sugar consumed in the whole world the last year, 700,000 were the product of the

beet. These are the two great rivals for the world's supply of sweetness. The cane and the beet sugar are of very unlike origin and expectations. The former was introduced by the crusaders, and it has been extracted to this day by the crusade processes and by ignorant laborers, to the lasting detriment of the warm lands where the cane has been raised. The manufacture of beet root sugar is comparatively a recent industry, and is peculiarly the product of northern sagacity. By the demands its difficult separation makes upon the skill and intelligence of sugar producers, it has brought about a combination of labor, capital and scientific knowledge to which no other industry can furnish a parallel. The history of its cultivation shows such vast, direct and indirect advantages that it seems likely at no distant day, to supplant the cane. The beet has already virtually driven the cane from the European market, and the question arises, why America forms such a conspicuous exception. It is not from the lack of a proper soil or climate, it is not from the price of labor, the abundance of cane sugar or the absence of necessary machinery. It is agreed to be solely from the fact that no adequate experiment has ever been made upon the eastern seaboard. The question of its profitable introduction should be studied and solved in New England. The history of the beet sugar industry reveals the secrets of its success in other countries, and points out the conditions of its successful production in America. 1st. It was born of science and has always been allied with it. 2d. It has been fostered by government at the outset. 3d. It has been dependent upon sound agriculture. 4th. It has secured the co-operation of labor and capital. To the total neglect of one or all of these conditions the hitherto unsuccessful attempts to transplant it are well understood, and the recent successes in the West excite the hope that the beet root culture is now permanently established in this country. Without abundant capital, skilled labor, scientific knowledge, and co-operation of agriculturists, any attempt would be folly. With these, the venture would be safe, large profits be fairly expected, and the experience of other countries leads to a promise of success in our own.

The semi-annual session was held at Fryeburg, in Oxford county, on the last day of October and the first and second days of November. At this session the students of the State College of Agriculture and the Mechanic Arts were in attendance, having, through the liberality of the Maine Central, Portland and Ogdens-

burg, and European and North American railroads, been furnished free transportation for this purpose—that provision of the statute requiring one session of the Board annually to be held at or near the State College being held to be complied with, if the students can attend such meeting in any part of the State free of expense to them. The students were in attendance during the entire session, and under the command of Capt. W. S. Chaplin, the Military Instructor at the College, won generous applause from all who saw them, for their fine military discipline and gentlemanly bearing. The sessions of the Board were held in the Methodist Church, and were very largely attended.

On assembling, a most cordial address of welcome was extended to the Board, in behalf of the West Oxford Agricultural Society, and the citizens of Fryeburg, by Hon. George B. Barrows. Some of the interesting facts connected with the Indian occupation, and with the settlement of the place, were detailed, and the members were informed that some four-fifths of the cultivated land in the town consists of the rich intervales that line the winding course of the Saco; that besides these there are four or five thousand acres of low meadow land, and that the balance of the area is made up of pine plain not valuable for cultivation, but producing with great rapidity successive growths of white and Norway pine lumber, and that the especial lack of the farmers was in a deficiency of pasturage, there being little or no good grazing land within the town limits. The farmers of Oxford had looked forward to this meeting of the Board with anticipations of pleasure and the expectation of receiving profitable counsel which should assist them in developing their resources. The speaker referred with gratification to the recollection of his own pleasant association with the Board in former years. This was responded to by the President of the Board, and the remainder of the forenoon was given up to a general discussion on practical matters, which proved very interesting and instructive. It was participated in by Hon. Geo. B. Barrows, Col. James Walker, Mr. C. W. Waterhouse, and others of Fryeburg, besides several members of the Board. Mr. Waterhouse gave some of his personal experiences in farming, which contain so much that is practical and useful, especially concerning the use of lime on his land, that I give from the reporter's notes some account of the same.

Mr. Waterhouse said: I began last year to plow in June and seed in the fall. I had excellent success—got the best catch of

grass I ever had. I sowed 1¼ acres with rye and 3¾ to grass seed alone, in both cases getting an excellent crop. I put on only a peck each of red-top and herds-grass to the acre, and I put on as much as that besides clover when I sow in the spring. This fall I have seeded down about 20 acres. The reason I seed so much is because the grass winter-killed on about 16 acres last winter. I use a good deal of lime on my land. This fall I use 62 casks of lime and 3200 lbs. plaster. Some who use this dressing do not put enough on to make it pay. We can cheat one another, but we cannot cheat mother earth. I tried some winter wheat this summer. One dull day in haying I plowed up a couple of acres, went 30 miles and got my seed, and sowed wheat and grass seed together. The wheat is up and looks finely. I have had good success in raising oats. I have raised 400 bushels of oats on three acres, and my crop has not generally fallen short of from 60 to 75 bushels per acre. I generally sow two bushels to the acre. I have good success in raising potatoes. When I have my ground fixed right, I generally get from 300 to 400 bushels per acre. I think people do not take so much pains to prepare and enrich their ground for potatoes as they do for corn, and they pursue a wrong course. I am satisfied we can raise potatoes here. It takes me three times as long to cultivate my land as it does some of my neighbors to cultivate theirs. I hold that land should be thoroughly pulverized, and I think it pays to do it. I take pains to plow or dig clear out to my fences, and do not allow any bushes in my field. I have nearly 100 acres of this intervale land. When I lay it down I mow it a few years, and then turn it out to pasture when it will cut two or three tons of hay to the acre; pasture it awhile and then take it up again. By this plan it does not take so large a piece of ground to pasture my cattle. I do not know whether this is the best way, but it is the way I manage. Some people say a pasture should be fed close, but I have the best success when I have a good growth on my pasture land. In plowing to lay down land, I do not plow so deep as when I plow for cultivation. I have an idea that there is a good deal of nourishment in the roots. This fall I did not allow the men to plow over six inches deep, and I then put on the Nishwitz harrow and cultivated it down deeper, and that left the ground all mellow and the grass roots mixed with the soil. In breaking up I want to go deeper the second time than the first, as I hold to having the sod well mixed with the soil. I have used a good deal of superphosphate

for the past fifteen years—from 1000 to 1500 lbs. per year, and have had very good success with it. I bought Coe's, first, and then Bradley's, and then I thought if I was going to use superphosphate I had better buy two kinds and try them. I got two barrels each of Bradley's and the Cumberland, measured it out and dropped it myself; went seven rows with one kind and then seven with the other, and so on until I used the two casks. I could see but little difference in my corn. I thought that on the Cumberland ripened a little earlier, but not enough to make any account of. The next year I sowed oats and had about 75 bushels to the acre. I spread on what dressing I used and harrowed it in. One of my neighbors was looking at the oats and he said to me, "You can see where each of your rows of corn was last year;" and come to look, you could tell where part of it was, and I went through the piece and you could tell where the seven rows of Cumberland were and couldn't discern the Bradley's. And so I concluded that you do not lose the Cumberland the first year—that it leaves something in the ground that the other does not, and I have used it every year since. I have sowed some on grass land but thought it was not so cheap as the lime and plaster, and these answered every purpose. By putting on four casks of lime and three bushels of plaster I can get three tons of hay to the acre—as much as I can with a liberal dressing of manure. I do not know as I could follow that up. I generally put on lime at one time, and the next time put on manure and put my lime in another place, and sometimes I put on a little manure and three or four casks of lime to the acre. When I was paying for my land I hired money to buy lime and superphosphate, and I found when I bought the most I could pay the most. I have used ashes some. Some say leached ashes are as good as unleached. I have not found them so. I bought some leached ashes last year and sowed them, and I noticed that the grass did not grow well on that edge of the piece where they were sown. I think farmers do not keep accounts enough to know what their crops are paying. I love farming so well that I take all the notice I can, and try experiments, and if I try a new method I try to see what it costs and what my profits come from. I think quite an improvement has been made in farming in my section of the town since I came there. I sow four casks of lime per acre, if I sow it without plaster, but I think it is better with plaster—I mean four casks before it is slacked. I buy the best lime I can and think it is the cheapest. It will

average 6½ or 7 bushels to the cask after it is slacked. I bought some refuse-black lime once, but did not think it profitable. I harrow it in. Generally I use only the roller with which to cover my grass seed. The discussion occupied the entire forenoon, and was regarded as very profitable.

In the afternoon a paper on the Resources of Aroostook County, was read by Isaac Barker, member of the Board for that county. "There is no county in Maine so rich in all the elements of a great wealth and for sustaining a great population as the county of Aroostook—with its noble river and tributaries entering more than fifty townships, many of them still covered with primeval forests, which become more and more valuable each year as immigration still continues to these hitherto worthless forests. Aroostook's mighty forests contain hundreds of thousands of acres of pine, spruce, hemlock, cedar, maple, birch, beech, ash, elm and basswood. In addition to all this, there is scattered about this county limestone of excellent quality. Since the opening of the railroad to Houlton, larger quantities of hay, oats and potatoes are shipped to Boston. Starch factories are scattered about the county to the extent of ten or twelve, which consume annually from fifty to eighty thousand bushels of potatoes each. With us, as in other counties, the stimulating idea of a 2 40 nag has proved detrimental to the farmers' true interest. But in consideration of the many cheese factories which are being built throughout our county and the facilities for grazing, it is hoped the farmers will awaken to the idea of keeping more cows and raising more stock." Following the reading of the paper, proper, Mr. Barker made some additional statements concerning farming in the county, of which a summary is given herewith :

There are in Aroostook county three cheese factories and eight or ten starch factories. The latter pay from 25 to 30 cents per bushel for potatoes—at Houlton 30 cents; at Bridgewater and Presque Isle, 25 cents, and I believe they pay 35 cents at Fort Fairfield this year. They take them large and small, as they come. When the factories were built the farmers contracted to furnish potatoes, delivered at the factories, for 25 cents per bushel for five years. The factories are owned mostly by parties in the county. They run as long as they can get potatoes. How much they could afford to pay on the average I cannot tell. They do not want to tell us what their profits are, but they say 30 cents is as much as they can afford to pay. They buy them by weight, 60

pounds to the bushel. The farmers bring them in barrels which are emptied and taken back. A large part of the potatoes are raised on burnt land. Some raise 200 bushels to the acre; I have known as high a yield as 400 bushels. I know a man who says his potatoes cost him 8 cents per bushel when he got them in the cellar; the average is far above that; he raised on new ground and I presume did not reckon the cost of clearing the land. All varieties are used for starch. The Garnet potato is a favorite with the farmers for its large yield. We raise wheat to some extent, but not as much as we used to. In some sections it is a good crop; in others, midge and rust hurt it. Some sow it as soon as the snow is off, others not until the last of May or first of June. I think the early wheat has done the best on the whole. I should think the average per acre is from 15 to 20 bushels, not less than 15 I think. They do not raise any winter wheat at Houlton but they do in the vicinity of Presque Isle. There are different kinds of wheat raised. Some raise the Lost Nation, some what is called the Fife Wheat. I think the Lost Nation rusts more than other kinds, and is longer ripening. Barley does well; it is the most profitable sown crop with me. It now sells for 25 cents per bushel. A good many oats are raised. I should think the average yield would not be above fifty bushels to the acre. They do not use fertilizers for oats; some may a little, but they generally raise them on the green-sward. We generally lay down land with wheat or barley. I have got a good catch with oats but they are apt to lodge. We raise considerable buckwheat It is a crop we can put in after our other grain. We do not raise much corn about Houlton. A good many beans are grown—generally as a separate crop. First quality hay is worth $8 per ton at the barn; the buyer pressing it and the farmer hauling it to the station after it is pressed. Last year it was up to $10. It is shipped to Boston. I raise some grass seed, but do not make much account of the straw after I get the seed from it. I thresh with a flail and then clean up with a winnowing machine. Some grind it out with a threshing machine, and some have clover machines to clean it up. I think the yield per acre would be perhaps from two to three hundred pounds. I threshed some one winter with a flail, and after I had done my day's work I would have a half bushel of clean seed. I believe that with hay at $10 per ton you would get more from it to let it ripen for grass seed; but it injures the ground more to grow grass seed than hay. The

labor of getting out the seed can be done when we havn't much to do. They are getting in pure-blooded stock of different breeds—more Jerseys, I think, than any other. There has been some splendid stock driven from the Aroostook. I know of one thoroughbred Ayrshire bull that has been brought there. Large numbers of sheep are raised and sent to the Boston market. From 600 to 800 sheep per day, from the Aroostook and the Provinces, pass over the road. Blooded sheep have been introduced—some Cotswolds, but mostly Leicesters. Occasionally we have a frost in August, but generally not till September—sometimes not till October. I do not think we have them as early as we used to. We can generally begin farming in Aroostook as early as they can in Somerset county, and I think the fall frost is not much, if any, earlier. We cannot raise corn as well as they can—we have colder nights, but other crops we can raise as well as in any other part of Maine. I do not know as I could average the value of land, including buildings in the county. Farms about Houlton village are worth more than they are further back; as they value them at about $15 per acre. Following this, a paper on Cranberry Culture, by Mr. Washburn, was read—given in full in its proper place; and the discussion which followed it occupied the remainder of the afternoon. In the evening the subject of Sheep Husbandry was presented, the paper by Mr. Flint of Somerset county, being published in full in a subsequent portion of this report.

The forenoon of the second day was partially given up to the reports on crops in the several counties represented, as follows:

Aroostook: Hay yielded better than the average, and it was secured in excellent condition; oats better than the average; barley and rye not much sown, but very good; not much corn is raised in the county, but it ripened well, free from frost; potatoes generally good, the early ones rotted, while the late ones were sound; fruit, good; grass seed filled well; the cheese factories in the county made somewhat less cheese than last year, but have done a very fair season's work, cheese selling for 11 to 12½ cents, and the product about half sold; starch factories in the county seem to be doing well. *Hancock:* Hay twenty per cent. below the average; potatoes better than the average; wheat yielded double what it has for the past fifteen years; cranberries about half a crop, owing to the drouth; fruit more than an average. A new industry is springing up in the town of Hancock in the form of a factory for the extracting of tannin from sweet fern, and also

from alder. The former is proving a success, but the latter is yet somewhat uncertain. From a ton of sweet fern a barrel of extract tannin is made, worth $22, and also a barrel of second quality worth $7.50 per barrel. From the alder, one cord will make one barrel of extract, worth $20; while from hemlock bark, one cord will make a barrel first-class extract, worth $20. The sweet fern is dried twenty-four hours before being hauled to market, and the price paid for it at the factory is $5 per ton, with 25 cents per mile for hauling. *Cumberland:* Where the hay crop was harvested early it was good, and farmers have found out the great advantage of beginning to cut their hay before July 4th, especially on the seaboard; roots damaged fully fifty per cent. by drouth; early potatoes good; oats light, on account of drouth; the Colorado beetle was observed about Portland and vicinity. *Knox:* Hay yielded about an average, and was harvested in good order; corn is not planted largely in the county, but was extra good; wheat and grain of all kinds fully an average; potatoes light and much below the average, on account of drouth; fruit crop not an average in the county; currant worm very destructive, but no signs yet of Colorado bug. *Lincoln:* Hay not above an average, but secured in good order; grain of all kinds fully an average; corn a very good crop and much better than the average, and the same is true of potatoes, which are of excellent quality; root crop better than an average; the best crop of beans ever raised in the county has been raised this year, also of cabbages, and of the latter considerable quantities are raised which this year have sold for from 1 to 2½ cents per pound; more than an average of fruit, but not of wheat; cheese factories have done about as well as usual; Colorado beetle all over the county. *Oxford:* The hay crop was an average one and was secured in excellent order; corn abundant in localities where it was not injured by drouth, and especially on such lands it was never better; potatoes on moist land were good, but light on dry soils, on the whole being about an average; grain was somewhat under an average, being injured by drouth and grasshoppers; roots an average, but apples about a total failure; last year in some orchards where one hundred bushels were harvested, not more than a peck has been gathered; cheese factories have done about two-thirds as much as last year—last year the Canton factory made 15,000 pounds, and this year about 9,000 pounds; hops from one-half to two-thirds of an average, with prices from 27 to 28 cents; the Colorado beetle has been

plenty, and the currant worm has taken everything before it. *Piscataquis:* An average amount of hay, and of good quality, secured in good order; wheat crop, a fair one but not as good as last year on account of the drouth; oats almost a failure, owing to the drouth; potatoes, average crop; fruit, good; cheese factories made less than in 1875, because there have been less cows to furnish milk, and it has sold for 12 cents per pound. *Somerset:* The hay and corn crops both above the average; wheat below the average and much less sown than formerly; potatoes an average crop and of excellent quality; root crop two-thirds of an average; beans good; fruit below the average, on account of the ravages of caterpillars; cheese factories fallen off in yield one-fourth from last year. *Sagadahoc:* Hay above an average, and harvested in good order; grains of all kinds fully an average, and will probably largely exceed the average of the past ten years; wheat culture is increasing in the county, and when not sown too early does well; farmers find now that it is better to sow wheat the 10th of June than to sow earlier; early planted potatoes good, the later varieties and those planted later, inferior in quality; fruit fully an average; the Colorado beetle is in the county, but not yet to any great extent. *Waldo:* The hay crop large and got in better condition than usual, except in cases where it was cut late; corn heavy and nice; wheat where it was sown late was good, early sown being generally a failure and below the average; oats light; potatoes large and good; fall fruit plenty, winter fruit somewhat scarce; cheese factories in the county have done a smaller business than last year, but have sold their products for 11 cents; Colorado beetle making its appearance; fall feed good and remains as it is. *Washington:* Hay about two-thirds of an average crop, but secured in excellent condition; potatoes an average crop of an excellent quality; grain, owing to the dry season, light; pasturage short throughout the season; stock is rather light and thin; fruit below an average; there is much improvement manifested in this section in removing the unnecessary road fences, and in clearing up the roadside brush and weeds. *Penobscot:* An average yield of hay; late sown wheat good, early sown much injured, the best time to sow being June 1st; oats and barley light; a fine crop of fruit, but the specimens under size; potatoes and roots good; factories taking less milk than last year, and cheese selling from 11 to 12 cents; the Colorado beetle has been observed in the town of Dixmont. *York:* Hay fully up to an average; grain crop below

the average; early potatoes an average, but late planted ones injured by the drouth; all kinds of fruit never better, although grapes suffered from the cold winter and spring; the Colorado beetle has been seen at Parsonsfield on the Early Rose potatoes.

The public session was occupied with the reading of a paper on the Capacity of Milch Cows, by Horace Bodwell of York county, published in full.

The afternoon was given up to an exercise by the students of the State College, and the church was completely filled, the students occupying the right and left wing seats. On the right wall had been placed large charts giving a history of the college, a statement of its equipments and property, the number of students, accounts of farm experiments, and the general results obtained since its opening. These were easily read from any part of the room, and were so arranged as to answer many questions which an inquiring mind would naturally ask. On the left wall was displayed a collection of drawings made by the students in the ordinary course of term work; of which the following is a list: Elevation of Brick Hall State College, Topography of North Part of College Farm, Trapezodical Truss for Railway and Plan of the Orono and Stillwater Railway, by E. S. Sturgis; Side elevation and ground plan of Laboratory State College, Groined arch, Skew arch, Plate band and Cloistered arch, by A. D. Blackington; plan and elevation of Iron Planer, Plate band, Iron Planer in detail, and Muley drawn from a model, by S. Shaw; Elevations, plans and sections of Tail Stock, and Elevations of Foot-lathe, by J. W. Meserve; Plan and side and end elevation of Iron Planer, and detail of Iron Planer, by A. J. Elkins; Bridge over Penobscot river for E. & N. A. R. R., Groined arch and Cloistered arch, by J. C. Lunt, and details of Iron Planer by J. W. Weeks. These drawings were closely examined by a large number of interested persons, who expressed the highest satisfaction at the degree of proficiency attained by the students in architectural and mechanical drawing. On calling to order, President Shaw invited Rev. Dr. Allen, President of the State College, to the chair, who made a brief statement of the aims and purposes of the college and the training specially given to its students. He then announced an exercise in the Elements of Agriculture, which was conducted by Mr. Farrington, Farm Superintendent. The exercise embraced the character and composition of soils, and the action of manures, and was highly satisfactory. At its close several questions were

asked by farmers in attendance, which were promptly answered by the students. Following this was an exercise by the Junior and Senior classes, which consisted of the reading of several essays, selected from about thirty papers, written by the students to show the relations of science to the different branches of agriculture, and how farming may be aided by an intelligent application of scientific principles. The following essays were read: Value of Chemistry to Farmers, C. C. Chamberlain, Foxcroft; Use of Mechanics to Farmers, J. W. Weeks, Castine; On Underdraining, I. E. Webster, Orono; Book-keeping, G. E. Sturgis, Riverside; Value of a Knowledge of Entomology, F. P. Stone, Livermore Falls; Market Gardening, A. S. Elkins, Oldtown. They were very creditable, and the exercises were satisfactory to the large audience present. In the evening, at the request of a large number of the citizens of Fryeburg, Dr. Allen repeated his lecture on the Conditions of Successful Agriculture, given in a previous volume of the Agriculture of Maine.

The third day was largely devoted to the purely business matters of the Board, assignment of topics for the next session, &c.; and to an excursion, by invitation of the citizens of Fryeburg, along the beautiful intervals of the Saco river in that town. In the evening a lecture was delivered by Prof. H. Carmichael of Bowdoin College, one of the Members at Large, on What Science may do for Farming. It was attentively listened to by a large audience, was highly instructive, and I regret I have not been favored with a copy for this report.

The State College has closed a most successful year, and, I am happy to know, is beginning to be better understood and appreciated by our people than at any time in its history. Its classes have been large, the instruction efficient and faithful, and when its somewhat limited appropriations and the requirements of the institution are compared with its actual work and results, it will be found to present a satisfactory exhibit to the people of the State. It is of course an easy matter to tell what should be done, to point out wherein it is deficient, to say that certain improvements or additions should be made to this or that department,—but it is quite another matter, *with the same means at hand*, to do any better. The Trustees have long seen the need of making some of the instruction more completely practical, as in the department of mechanics; and of giving greater prominence and

efficiency to the agricultural feature of the course. These views are also entertained by the entire Faculty, who would hail such an improvement with satisfaction—but it is impossible to say to what extent the Legislature will coincide with these opinions of the Trustees, or how far they will enable them, by appropriations, to put them into successful operation. It is safe to say, that should the Legislature in its wisdom, appropriate the needed funds to carry out the scheme which will be presented to them for consideration, the Trustees will endeavor to place these departments of the Institution in a position to command the confidence and support of every friend of industrial education in the State. The report of the Trustees and accompanying papers will be presented to the Legislature at an early day, and will, I hope, be generally circulated among our people. Its reading can but strengthen the good opinion in which the College is held by every intelligent person in the State.

The reports from the cheese factories in the State during the past year, show a considerable falling off in this department of farming, or a failure to make returns to this office. In part it is no doubt owning to the former, and in part to the latter cause—for as there is nothing to compel factories to make returns, being really private corporations, many may object to having their doings made public. However this may be, I have reports from but thirty-five factories this year, against sixty in 1875—although I cannot believe that the interest in this branch of farming as represented by these returns, has depreciated to the extent indicated. The cheese factories should on no account be neglected, and I counsel a steady, constant, determined attention to dairying and cheese making as one of the sheet-anchors of Maine farming. A two or three years' trial of the system is not sufficient to determine its adaptability to our State: it must be diligently followed for a term of years, before its highest advantages can be obtained. It is a system which, well followed, cannot but result in improved agriculture—but to accomplish this it must not be followed in an intermittent manner. On no account should the cheese factories be neglected the coming season. I present herewith condensed reports of those factories from which returns have been received:

Returns from the Cheese Factories in Maine, for 1876.

NAME OF FACTORY.	Opened.	Closed.	Greatest No. cows.	Average number.	Total lbs. of milk received.	Most for one day, in lbs.	Lbs cheese made.	Average weight of cheese—lbs.	Lbs. milk to one of cheese.	What part of cheese is sold.	Where marketed.	Price obtained per lb.
Aroostook Valley. (Presque Isle.)	June 15...	Sept. 10...	–	96	167,211	2,835	16,640	50	10.05	All.	At home.	12½c
Andover	–	–	80	–	48,770	–	4,589	–	–	All.	Portland.	11a12
Burnham	June 14...	Aug. 26...	80	60	111,790	2,100	11,179	45	10	All.	Portland.	11½
Canton	June 5....	Aug. 28...	140	120	184,347	2,621	20,128	40	9	All.	At Factory.	9½
Corinth	June 5....	Sept 22...	230	180	337,178	4,609	33,608	48	10 03	Two-thirds.	Bangor.	10a13
Dixmont Mountain	June 12...	Aug. 31...	130	120	209,831	2,994	19,807	47	10.25	All.	At home.	11
East Sangerville	June 8....	Sept. 2....	–	175	190,314	3,161	20,588	40	9.25	One-half.	At home.	10a12
East Jefferson	June 5....	Sept 2....	180	–	147,601	2,394	14,034	35	10 08	All.	Portland.	11
East Orrington	June 5....	Aug. 31...	150	125	222,457	3,114	22,925	47	9.75	Three-fourths.	At home.	12a13½
Elm Dale. (Montville.)	July 19...	Aug. 26...	150	125	159,363	2,669	15,936	48	10	Two-thirds.	Portland.	11a13
Exeter	June 12...	Sept. 9....	175	125	223,797	3,397	23,918	38	9.35	Four-fifths.	Portland.	11¾a14
Etna	June 12...	Sept. 3....	–	–	177,279	2,730	16,784	43	10.50	Three-fourths.	Boston.	11½a12
Freedom	June 12...	Sept. 8....	120	110	140,744	2,066	14,936	35	–	All.	At home.	11a13
Hermon	June 14...	Aug. 31...	115	75	141,100	2,300	14,110	44	10	Three-fourths.	Bangor.	12
Houlton	May 29....	Oct. 14....	150	120	299,501	3,299	30,98¢	54	9.66	All.	Boston.	12a15
Kenduskeag	June 15...	Sept. 2....	–	–	146,506	2,200	14,114	44	10.38	All.	Portland.	12
Livermore Centre	May 5	Sept. 3....	75	–	98,891	–	9,615	32	10,05	All.	–	12a13
Morrill	June 6....	Sept. 4....	100	80	117,822	1,600	11,349	42	10 03	–	At home.	11a12
North Turner	May 29....	Sept 9....	200	150	245,329	3,350	28,367	34	10 50	All.	Portland.	11a12
North Livermore	June 2	Sept. 2....	150	125	196,174	2,995	19,138	35	10 25	All.	Portland.	13
North Jay	June 5....	Sept. 13...	160	100	191,302	2,544	18,564	34	10 03	All.	Portland.	12
Phillips	Aug. 2	Aug. 30...	86	77	34,810	1,466	3,211	45	10.75	All.	Phillips.	12
Stetson	May 29....	Sept. 12...	220	150	326,125	4,329	32,239	47	10.13	All.	Boston.	10a12

RETURNS FROM THE CHEESE FACTORIES IN MAINE, FOR 1876—*(Continued.)*

NAME OF FACTORY.	Opened.	Closed.	Greatest No. cows.	Average number.	Total lbs. of milk received.	Most for one day, in lbs.	Lbs cheese made.	Average weight of cheese—lbs.	Lbs. milk to one of cheese.	What part of cheese is sold.	Where marketed.	Price obtained per lb.
Searsmont and Montville	June 25	Aug 20	-	-	67,510	1,416	6,096	40	11	All.	At home.	12a13
Sandy River. (Strong.)	May 22	Sept. 9	150	120	310,000	3,800	31,000	40	10	All.	Portland.	12a13
St. Albans	June 12	Sept. 1	150	90	162,470	2,890	18,333	40	9.50	All.	At home.	11
South Paris	June 1	Sept. 4	225	175	285,000	3,500	30,000	40	9.50	-	-	12½
South Newburg	May 22.	Sept. 15	220	140	344,892	4,500	34,489	47	10	All.	Bangor.	12
Union	June 12	Sept. 12	155	110	166,973	2,264	16,451	37	10.05	All.	At home.	12½
Unity	June 5	Sept. 3	100	80	150,000	2,400	15,000	45	10	All.	Boston.	11
Winthrop	June 1	Sept 16	-	-	253,365	-	26,889	50-25	9.42	All.	At home.	10a14
Wilton	June 12	Sept 6	105	65	122,481	2,100	12,029	35	10.05	All.	Portland.	10
West Minot	June 20	Aug. 30	119	80	114,159	2,023	11,490	33	9 13	All.	At home	12
Winterport	June 26	Sept. 2	85	60	89,766	1,650	8,986	50	10	All.	At home.	12
Waldo	June 12	Sept. 2	95	86	111,632	1,645	12,552	46	8.89	All,	Belfast.	10

SECRETARIES OF CHEESE FACTORIES IN MAINE—1876.

Name of Factory.	*Secretary.*	*P. O. Address.*
Aroostook Valley	G. A. Parsons	Presque Isle.
Andover	W. H. Talbot	Andover.
Burnham	O. S. McAlister	Burnham.
Carmel	John Harvey	Carmel.
Canton	Otis Hayford	Canton.
Corinth	Charles Megguire	East Corinth.
Dixmont Mountain	John Whitcomb	Simpson's Corner.
East Sangerville	H. L. Leland	East Sangerville.
East Jefferson	J. J. A. Hofses	East Jefferson.
East Orrington	A. N. Lufkin	East Orrington.
Elm Dale	J. C. Carey	Montville.
Exeter	L. D. Butters	East Exeter.
Etna	J. E. Friend	Etna.
Freedom	D. B. Johnson	Freedom.
Hermon	G. W. Moore	Hermon.
Houlton	Francis Barnes	Houlton.
Kenduskeag	F. D. Jenkins	Kenduskeag.
Morrill	D. O. Bowen	Morrill.
North Turner	J. H. Quinby	North Turner.
North Livermore	E. A. Weld	North Livermore.
North Jay	N. L. Phinney	North Jay.
North Pownal	Charles E. Fogg	North Pownal.
Phillips	A. L. Bradbury	Phillips.
Stetson	John Rogers	Stetson.
Searsmont and Montville	Alexander Woodman	North Searsmont.
Sandy River	A. J. Norton	Strong.
St. Albans	A. J. Bonney	St. Albans.
South Paris	S. R. Parsons	South Paris.
South Newburg	J. J. Dearborn	Newburg.
Union	F. A. Seiders	Union.
Unity	B. B. Stevens	Unity.
Winthrop	J. H. Moore	Winthrop.
Wilton	E. Bridges	Wilton.
West Minot	John B. Atwood	West Minot.
Winterport	J. H. Carter	Winterport.
Waldo	Joseph L. Chase	Waldo.

The returns from the local agricultural societies have been duly received at this office, in accordance with the Statute, and the same will be found in full in the second part of this report. They show a good degree of interest and success attending their efforts the past year; and a table compiled from these returns, giving their dates of incorporation, number of exhibitions held, financial condition, &c., is herewith presented:

Compiled from Returns of Agricultural Societies in Maine—1876.

SOCIETY.	When Incorporated.	How many Fairs held.	Have you enclosed grounds?	Number of Members.	Amount received from State in 1876.	Amount raised by the Society in 1876.	Amount of Premiums Offered.	Amount of Premiums Awarded.	Whole amount of Disbursements.	Value of Property belonging to Society.	Liabilities of Society.
Androscoggin	1852	23	No.	100	$358 83	$729 45	$789 75	$625 25	$961 25	-	-
Aroostook	1846	-	No.	60	236 00	105 50	415 25	188 10	264 10	-	-
Cumberland	1832	41	No.	100	-	-	1,200 00	1,000 00	-	-	-
East Somerset	1832	18	Yes.	200	88 71	717 04	403 00	316 40	805 75	$2,500 00	$1,045 32
Eastern Kennebec	1868	8	Yes.	175	70 00	225 00	585 00	361 00	700 00	3,000 00	2,000 00
East Oxford	1861	16	Yes.	335	92 44	297 50	297 50	255 40	258 40	3,500 00	2,214 67
East Piscataquis	1873	4	No.	75	40 00	56 51	112 00	89 75	110 51	25 00	-
Franklin	1840	37	Yes.	320	150 20	713 45	873 70	503 67	804 80	350 00	75 00
Franklin Central	1876	2	Yes.	106	-	103 00	166 43	92 79	-	550 00	475 00
Kennebec Union	1860	4	Yes.	100	88 56	223 15	700 00	361 50	534 00	-	-
Kennebec	1818	45	Yes.	500	132 00	672 28	600 00	558 15	875 43	300 00	71 15
Knox	1866	10	No.	800	154 11	-	585 00	316 50	549 23	-	-
Lincoln	1852	22	No.	691	255 97	310 30	575 00	233 31	586 09	-	45 00
North Penobscot	1852	23	No.	250	84 48	61 60	234 12	116 19	163 37	-	84 88
North Knox	1869	7	-	1300	154 11	211 50	561 10	305 25	644 79	100 00	-
North Kennebec	1847	19	Yes.	462	119 54	462 60	736 50	462 25	-	2,500 00	500 00
North Waldo	1861	16	No.	100	69 40	242 68	615 75	415 65	-	-	-
North Aroostook	1855	21	Yes.	60	60 00	137 64	278 40	154 27	187 27	-	-
North Franklin	1850	25	Yes.	250	70 86	395 90	438 55	323 00	456 38	-	75 00
Oxford	1841	34	Yes.	574	150 00	-	891 25	728 85	1,318 62	3,912 09	1,269 54
Portland Horticultural	1860	42	No.	100	-	-	-	-	-	-	-
Penobscot and Aroostook Union	1853	20	No.	80	100 00	80 00	125 00	85 96	159 96	25 00	-

Piscataquis Central	1853	23	Yes.	135	127 30	357 65	371 50	353 33	503 31	500 00	141 03
Penobscot Central	1874	3	No.	120	88 30	109 70	453 00	300 00	350 00	–	–
Sagadahoc	1854	22	Yes.	1150	257 00	2,053 19	1,794 75	1,234 95	–	5,000 00	–
Somerset Central	–	–	Yes.	100	137 00	467 77	–	650 00	–	1,000 00	–
State Pomological	1873	3	No.	–	500 00	612 65	1,080 00	697 00	–	100 00	329 22
Shapleigh and Acton	1867	11	Yes.	250	125 23	210 80	276 78	324 60	364 20	3,540 00	–
West Somerset	1848	–	Yes.	125	120 29	136 89	419 25	303 25	376 55	1,000 00	253 25
Western Piscataquis	1869	9	No.	37	32 85	59 15	101 20	69 50	99 50	–	44 14
West Penobscot	1855	22	Yes.	200	186 12	649 72	735 00	306 70	–	5,000 00	1,400 00
West Oxford	1851	26	Yes.	150	92 44	743 03	576 25	374 10	612 47	1,500 00	775 00
West Washington	1860	17	Yes,	800	200 00	419 54	616 65	536 85	684 18	–	–
Washington	1841	34	Yes.	400	200 00	836 18	724 00	574 50	892 55	1,800 00	200 00
Waldo	1847	29	Yes.	200	–	–	993 15	–	–	–	–
Waldo and Penobscot	1869	8	Yes.	60	130 00	670 25	612 25	499 25	703 95	1,200 00	100 00
York,	1841	–	–	–	274 77	668 50	1,373 00	1,038 00	1,405 00	–	1,000 00

So far as can be gathered from the returns of the county and local agricultural societies, and from the reports of the same which are generally published in the local press, they seem to be doing a good work in stimulating farmers to a healthy competition in their business; while through the guidance of the Board of Agriculture, so far as relates to the disposition of a portion of the State bounty granted to agricultural societies, they are stimulating improvements of a positive and enduring character. By offering premiums for permanent farm improvements, for thorough drainage, for the introduction of pure blood stock, for the establishment of home nurseries, for the culture of wheat, for the encouragement of Farmers' Clubs, and other matters affecting the real prosperity and advancement of our agriculture, these societies are doing a most useful and important work.

By reference to the table just given, it will be noticed that from a very early date agricultural societies have had an existence in our State, and in districts where they have longest existed, there we find to-day agriculture is in a more advanced and prosperous condition than in sections beyond the immediate influence of such societies. In Kennebec county, for example, an agricultural society was organized so early as 1787, and as early as 1818 it was incorporated by the State of Massachusetts, and which has continued to the present day—having been the parent of all similar societies in Maine. When this pioneer society was organized by a few intelligent and far-seeing farmers, there were but half a dozen similar societies in all North America, and the good results of its labors in behalf of improved and enlightened husbandry in our State can never be over-estimated. Through its labors an agricultural journal was early established in Maine, and with this, other agencies for the advancement of improved agriculture have been carried forward, until it seems not too much to say that to this one society we are largely indebted for the character of our agriculture of to-day.

The present year has witnessed the completion of the first century of our National existence, celebrated by the holding of the great International Exposition at Philadelphia, to which thousands of our Maine people went as visitors. It is safe to say that our people did not fully come up to a proper appreciation of the importance of this exhibition, and that notwithstanding the creditable display made by residents of Maine, it was not half what it

would have been had they realized at the outset the great value our State would have received from a full exhibit of its products at Philadelphia. The report of the State Centennial Commission will soon be published, which will give a full account of the part Maine took in this great World's Fair. Meanwhile, as being of general interest, I place on record here, a list of contributions from Maine, kindly furnished by Hon. Enoch Knight, Secretary of the Maine Centennial Commission:

In General. Hon. Warren Johnson, Sup't of Common Schools, Augusta, collective educational exhibit; T. J. Whithead, South Paris, furnaces; Paris Hill Manufact'g Company, children's carriages and sleds; Joseph Russell, Portland, sleighs; Hugh Smith, Gray, sleighs; A. B. Morrison, Portland, specimens of manufactured goods; Ara Cushman & Co., Auburn, boots and shoes; Evans Rifle Company, Mechanic Falls, case of rifles; J. W. Munger, Portland, detergent; A. G. Schlotterbeck, Portland, thermometers; L. F. Pingree, Portland, artificial limbs; Androscoggin Pulp Company, wood pulp and its products; Joseph Wood, Bath, specimen of newspaper printing; A. H. Merrill, Brownville, slate; T. H. Dinsmore, Skowhegan, slate; C. H. Chandler, Brownville, slate; Knight & Whidden, Portland, ground and calcined plaster; Davis Tillson, Rockland, specimens of wrought granite; Red Beach Granite Company, Red Beach, specimens of red granite; Bodwell Granite Company, Hallowell, display of granite monuments; Hallowell Granite Company, display of granite; W. R. Chase, Bluehill, granite pedestal; F. O. Morton, St. George, granite block; (specimens of granite were also exhibited from nearly all the quarries in the State, including Gouldsboro', Jonesport, Spruce Head, Fox Island, &c.); Katahdin Iron Works, Bangor, specimens of iron ore and products; Fred. H. Patten, Bath, feldspar and quartz varieties; Harry Brown, Portland, oil painting, "The Giant's Causeway"; P. C. Holmes, Gardiner, oil painting, "New England Autumn Scene."

Textile Fabrics. Lewiston Falls Company, Bates Company, Hill Company, Androscoggin Company, Baker Company and Continental Company, Lewiston; Farwell's Mills, Lisbon; Laconia Company, Pepperell Company, Biddeford; York Company, Saco; Newichawanick Company, South Berwick; Worumbo Company, Lisbon; Knox Company, Camden; Sanford Mills, Sanford; Westbrook Company, Saccarappa.

Agricultural. Maine State Pomological Society, collective

exhibit of orchard fruits; Hall C. Burleigh, Fairfield Centre, herd of Hereford cattle; S. L. Goodale, Saco, food extract from fish; William Thorp, Cape Elizabeth, preserved haddies; J. Winslow Jones, Portland, hermetically sealed goods; Burnham & Morrill, Portland, vegetable and animal extracts; Portland Packing Company, Portland, preserved extracts and sweet corn preserved; Dunn Edge Tool Company, West Waterville, scythe blades, grass hooks, &c.; Hiram Holt & Co., East Wilton, hay knives, &c.; A. J. Mosher, Portland, bag holder; Ansel Stevens, Gorham, centennial mower.

Machinery. Hardy Machine Company, Biddeford, grinding machinery; Saco Water Power Company, Biddeford, mule spinning, drawing and roving machine; Lewiston Machine Company, Lewiston, Thomas' power looms and warping machines; G. S. Follansbee, Lewiston, steam pump; John C. Getchell, Machias, capstan; E. W. Barker, Portland, car coupler; S. N. McGilvery, Belfast, ship's model; L. R. Palmer, Belfast, stave jointer; Howard Manufacturing Company, Belfast, mitering machinery; Burgess Proof-Press Company, Belfast, proof-press; Andrew Morse, Skowhegan, models of machinery; F. Lyford, Augusta, clothes dryer; A. W. Decrow, Bangor, smoke conductor; William Flowers, Bangor, boat lowering apparatus; J. P. Bass, Bangor, photographic burnisher; Elisha Newcomb, Portland, car replacer; C. B. Harrington, Bath, miniature yacht; W. Thompson, Gardiner, road scraper; J. W. Stockwell & Co., Portland, cement pipe machinery; J. H. Snow, Bucksport, ship's model.

From the accounts that have been received from different parts of the State, it appears that the Colorado potato beetle (*Doryphoa decemlineta*) has been noticed quite generally throughout the State the present year, and may be looked for in abundance another season. While it may be true, as some Western writers of authority are inclined to believe, that the potato beetle is born of heat and multiplies more rapidly in a dry climate, and from this cause may not become so destructive in our State as it has proved further West—yet it will be well for us to prepare ourselves for a visitation from them in large numbers the coming year, and by an acquaintance with their habits and the modes of destroying them, be ready to deal them effectual blows. The means used to keep them in check are hand picking, and the use of Paris green; the former, it is claimed, may be done at a cost of $5.00 per acre;

while the latter mode, although on some accounts objectionable, is more effectual than any other agency that has been tried. Prof. Chadbourne, of the Massachusetts Board of Agriculture, sums up the treatment of this matter as follows; (and for those who wish additional information, I recommend the perusal of a treatise on Potato Pests, by Prof. C. V. Riley, published by the Orange Judd Company, New York, and sold for 50 cents):

"1. Plant a few potatoes in your field as early as possible, and destroy the bugs as they appear on them.

2. For the main crop, plant at good distance between the hills, and manure well with ashes or such manures as do not specially promote the growth of vines.

3. Pass through the field after the potatoes are up, once a week until the time of blossoming, picking all bugs, larvæ and eggs that appear.

4. If for any reason the bugs get beyond the hand picking, use poison till every bug is destroyed, if not for your own crop, for the benefit of others.

5. As bad as the potato bug is, remember that no other injurious insect can be more securely kept in subjection and destroyed than it; and those who are determined to raise potatoes can raise them at an extra expense of not over five cents per bushel, in spite of the bugs and their allies—the indolent farmers who feed them.

6. Do not wait till the second crop of bugs appear, and then try to demonstrate that hand picking is powerless against such an army; because it is conceded in the beginning without waste of words.

7. If you are not determined to kill by hand or poison, every bug that appears on your crop, then do not, as a good neighbor, plant at all."

It is impossible now to tell to what extent the present interest in the beet sugar industry will take practical and tangible form with the opening season; but I am persuaded if mills for its manipulation could be started at an expense of not more than twelve or fifteen thousand dollars each, it would prove a profitable business for our State. The culture of the beet would certainly be a beneficial crop, for it would involve deep plowing, heavy manuring and thorough weeding, while the increased amount of manure secured from the cattle fed on the pulp, combined with the thorough culture, would put the land in splendid condition for

raising wheat and corn, and go far towards settling the question of redeeming and improving our worn-out farms. The direct profit is large; for a crop of twelve or fifteen tons per acre, at a value of four to five dollars per ton, would pay better than any cash crop now raised, aside from the indirect advantages of cattle food, mellow and improved land for future crops. It would give employment to increased field labor during the summer culture, and in the manufacturing department during the winter months. It would supply a new branch of industry, establish new centres of trade, develop new fields for inventive skill, save millions of dollars to the country at large in foreign cost of sugar and transportation, and enhance the value of every farm in the vicinity of the factory. It is a subject of national importance; for, with a demand for two thousand tons of sugar a day from abroad, what would be our position in case of war with a maritime power? Imagine the increased prosperity if we could add to our annual national production even fifty million dollars' worth of sugar. It would induce superior methods of culture, better home markets and greater prosperity for the people.

It seems to me that the farmers of Maine need to turn their attention more to the saving and composting of farm manures and home fertilizers, obtained from every source possible; to the growing of sheep and neat cattle, and to the production of those great food crops, Indian corn and wheat. The hay fed upon the farms will give manure of the best quality, (if there is fed with it meal and shorts it will be so much the better,) and this applied to the land will keep up its fertility, and yield good paying crops. The selling of hay, and the purchase of corn, flour and commercial fertilizers, is a somewhat questionable system of farm management, and I believe has too long been practiced by many of our farmers. The change indicated would contribute largely to the advancement of our agriculture in its truest sense; and with the opening season a strong and united effort should be made to put it in practice.

Respectfully submitted.

SAMUEL L. BOARDMAN,

Secretary of Board of Agriculture.

AUGUSTA, December 28, 1876.

MAINE BOARD OF AGRICULTURE.

PAPERS AND DISCUSSIONS,

AT THE ANNUAL MEETING AT

BRUNSWICK, FEB. 8th, 9th, 10th, 1876.

FENCES AND FENCING.

I. Introduction to the Subject.

By Z. A. Gilbert, East Turner.

A small part only of the labor expended on and around our farms is devoted directly to production. Take as an example an average farm as we find it at the present time in any section of the State, where the principal energies of the proprietor are devoted to the farm itself, and consider for a moment how little of the labor expended contributes directly to production. A full comprehension of the facts in the case will render a solution to certain perplexing problems which the proprietor of such a farm has frequently presented to him. It will plainly show why the harvests of the farmers here are not heaped as high as are found in some other sections of our broad country. While our soil is sufficiently productive to give us acreable returns almost equal to any other State in the Union, at the same time we are able to work but few of those productive acres, hence the number of acres bearing a harvest are few in comparison. A rough estimate would be safe in saying that of the year's work not over one-fourth is employed directly in production and in harvesting the

product. The corn grower and the grain farmer of the West devotes almost his entire labor to the production of his corn or his grain. Why should he not then heap high the golden corn in autumn when it represents his year's labor?

It should be our aim more than is now the case to devote our labor largely to production. We should study to do away to a greater extent with the fancied or actual requirements which now draw so largely upon our time, and turn that labor to production itself. It would be equivalent to the saving of just so much time —and time to the farmer at all seasons is money. When we apply business principles in preparing for our productions, as the manufacturer applies them in preparing for his products, we shall find an immense saving of labor. A little capital many times judiciously invested will save labor to the farmer as well as to the manufacturer; and capital costs nothing but its six per cent.

Among the outlays of labor which draw so heavily away from what otherwise might be productive industry—and the only one proper to introduce here—is the labor required to build and keep in repair the numerous lines of fences found at the present time on the farms in this State; and not only is there a large outlay of *labor* expended in this direction, but there is also a large expenditure of *money* which labor devoted to other purposes had laid by as a profit from the outlay.

It is believed by many thoughtful, progressive farmers, and by some members of this Board, that much of this outlay—that a large part of it in fact—may be averted, and the money and the labor now expended be turned to better account. For the purpose of drawing the attention of farmers and other land owners to the matter, it was deemed best to devote a portion of the time of this convention to its consideration.

For the purpose of understanding in the outset what we are driving at, what we are aiming to reach by introducing the subject as we do, let us take a view of fences as we find them over the State, and then set forth our claims. We shall then start in with a fair understanding, and can the more understandingly discuss the subject.

A large part of the farms in this State—and the same statement will apply to other of the New England States as well—are divided and subdivided by costly fences, till they present in many cases a net-work of lines enclosing small areas like the lines on a checker-board, save that, instead of regularity, we find them run-

ning through all points of the compass, and the enclosures entirely without form, plan or system. The fields are fenced up into small areas, the pastures are divided, the highways carefully fenced in—hedged in we might say in many cases—the garden is fenced up, and the back yard and the door yard. In the villages spacious grounds and seven by nine lots alike are fenced in, picketed, palissaded, cribbed up, choked and stifled by the irresistible fence. All taste, beauty and convenience is sedulously fenced out. Most of these fences on the farm and in the village are costly, and those whose first cost was light are expensive to keep in repair. Many valuable farms may be found, in good condition, and on which are good stands of buildings, which are worth little more at the present time than the fences on the same have cost.

Now it is claimed—it is believed—that many of these fences are useless. Yes, more; it is believed they are an *incumbrance to the land.* Many of them were not needed as permanent structures when they were built, and others have become useless which might for a brief time have been needed. A vast saving in the aggregate to the present occupants of these lands would be made, were these useless fences removed where they would no longer occupy valuable land and be an obstruction to the economical working of the farm, or were they placed in a condition where there would be no further outlay for their repairs. In expressing these views, it is not claimed that we who entertain them have grown wise above those who have preceded us. Much of the fence now claimed to be worse than useless was believed by those who built them to be necessary. Indeed, to them, with the manners and customs and ideas then prevailing, they were necessary. The laws of the land may not have required all the outlay then made, but an unyielding custom which is stronger than law demanded it. We are living in a different age and generation, and the customs and usages demanded of our predecesors do not hold good on us. We are looking from a different stand-point to day from which the same field of vision was observed by our fathers. We are, too, *living* from a different standpoint. We are surrounded by different usages which have gradually come upon us. What was once necessary and desirable under the then existing usages and customs may not and quite likely is not best in our day and generation. It was once thought necessary to enact laws against witchcraft, and even to hang the witches. It was,

no doubt, then necessary, not only to have the laws, but to enforce them. Now all will claim that such laws are not needed upon the statute books. We have so far advanced into a new order of public opinion that no one is so wild as to believe that there are any witches now, or ever were. Many other of the early New England laws would now be quite as useless and uncalled for as the laws against witchcraft. Public sentiment has been and is now gradually changing, and we should not expect the customs and usages of the past to govern and control the present. Farmers are strongly inclined to retain old usages and follow practices handed down from former generations. This is the case in regard to fences and enclosures. We occupy farms which have been laid out, divided and fenced by former owners. Those owners gained their ideas of fencing and fences from the conditions by which they were surrounded, or adopted those handed down from others.

The ancient idea of a fence was as a *defence* to garrison against danger to person as well as to property. Hence the ancient cities were walled—fenced—against the encroachments of enemies. In Jeremiah we read: "And they shall eat up thine harvest, and thy bread, which thy sons and thy daughters should eat: they shall eat up thy flocks and thine herds: they shall eat up thy vines and thy fig-trees: they shall impoverish thy fenced cities, wherein thou trustedst with the sword."

This idea of a fence was transported to America, and here applied to the farms and their appurtenances where each farmer's house was his castle. It is true, surrounding circumstances from time to time modified the idea as the surroundings of the settlers changed, still the primitive idea of a fence as a defence was handed down from generation to generation, even to the present time; and now we find the farmers all over the State building and supporting numerous costly lines of fences to defend their property from the encroachments of their neighbor's stock. There is not the shadow of a law, and never was, to compel them to do it; yet the idea prevails and the custom corresponds with it. The party of the second part accepting the custom which defends his stock from damaging trespass upon his neighbor's property, transgresses the spirit of the law by depending upon the neighbor's fence to keep his stock out, while the law requires him to depend upon his own to keep them in. We can all easily understand how, in the early settlement of the country, these customs and usages became established. The country was sparsely settled,

the people were poor, communication from town to town and between individuals was difficult, and the inhabitants were more dependent upon each other than is the case at the present time. Hence grew up a sort of mutual consent that each should protect his own crops. The stock was allowed to run at large in the highways, and this necessitated the building and maintenance of road fences.

It is quite probable that the custom of impaling the garden and cribbing the front yard, handed down to the present time and still by many rigidly adhered to, originated from the necessity of defence from roving stock. So fully established was the custom of making public pasturage ground of the highways that it was adhered to down to a recent date. It was but a few years ago that towns decided by vote, at their annual meeting, whether cattle should run at large or not, and it was still later before the fact was generally received that the rights of the public to the road were limited to its use as a highway for travel. Had this enlightened view been entertained by the early settlers it would have saved to productive industry a vast outlay of labor.

In looking over the division fences of our farms a man of taste and judgment is seriously puzzled to know what ideas of arrangement were entertained by the former proprietors. Large and otherwise unobstructed fields are cut up into small enclosures by tumble-down stone walls, to the modern farmer of no earthly use, and serving only as unsightly obstructions to profitable tillage. Field boundaries are crooked and irregular apparently for no other reason than to try the skill of the plowman in turning crooked furrows, or the skill of the teamster in driving the mowing machine. These are conditions which have been handed down to us from a less enlightened age, and are allowed to remain to disfigure the landscape and embarrass the operations of the farm—are endured without apparent effort at removal, solely from that indifference to taste, neatness and good order which may too frequently be chargeable to the farmer. The early settlers gave their attention to the removal of the stately forests. To this their chief energies were necessarily directed. The forests were the great incumbrance, and so closely were they absorbed in their removal that little time was given to a cultivation of the beautiful; and even the useful and convenient were by many sadly neglected. The fences were generally constructed of logs from the felled trees, and were built where it could be done the easiest, without

regard to the arrangement. Material was plenty and division fences, under the custom then in vogue of feeding the fields in autumn, were deemed convenient, so the clearings were divided into enclosures. After the stumps had decayed and the plow was taken to the fields, it became necessary to remove the rocks from the surface. These were heavy to draw, the oxen were light, and it was the most natural thing in the world to dump them down into a cheap wall just where the old log fence was rotting down, and just where in too many cases we find the old tumble-down walls to-day. There was no laying out of the farm into fields—no calculation about it. These arrangements, or rather lack of arrangement, grew naturally out of the conditions by which the early farmers were surrounded. We now occupy those farms, and having become accustomed to the arrangements, are indifferent to their inconvenience, and apparently do not realize that their beauty is in any way marred. We are far more at fault than were those who did the work for us. In these matters, as in much of our farming, we adhere to that which has been handed down to us from a former period. It is extremely hard for us in any direction to break away from the old ruts. We can hardly tell why this is so, and in many cases do not know that we are controlled by any such influences.

The laying out and dividing of farms is a subject which may well claim the careful attention of every land holder; and this Board can do no better service than to direct some of its talent to its consideration, that the attention of farmers may be called to it. There is a wide field for influence, and the beauty and value of our farms might thereby be greatly enhanced. Our farms have been reclaimed from the forest—the fields for the most part have been cleared and smoothed. Now, shall improvements stop here? If we intend to live and labor upon the farm during life, let us fit it for the purpose by attention to matters for which our fathers had not the time. It was theirs to reclaim and subdue—it is ours to beautify, adorn and arrange. Thus each generation would leave its heritage better fitted for that which is to follow. It is largely a matter of education, and to whom does it more fittingly belong to introduce the first principles of this education than to this Board of Agriculture, to whom are intrusted the wants, present and prospective, of the agriculture of our time?

Gentlemen, the part assigned me in the general topic of Fences and Fencing in the published programme was denominated the

"History of Fencing." Instead of pursuing the subject—or that branch of it—therein named, I have aimed only to give a brief *introduction* to the general topic, and my "history of fences" will no doubt remind you of Mark Train's lecture on milk, in opening which he said, "The richest part of milk is the cream," and omitted to make any further mention of milk during the lecture. I say I have only intended to introduce the subject. The general topic is not only an important one, but it is a broad one—too broad to be comprehended in one single paper. It was therefore divided into the several branches designated in the programme, and each branch assigned to a different individual. That the subject is of incalculable importance will be made apparent, if you are not already cognizant of the fact, as the discussion progresses.

The cost of supporting the *necessary* fences of our farms is immense. The cost of supporting what we now have is a still greater tax upon us. It is believed that with us in fences, as with Brigham Young and his followers in matrimony, we are too much fenced. It will be claimed that the progress we have made has brought us to a time and to a condition wherein all the fences that were once deemed necessary are not now needed; that we can without serious inconvenience dispense with much of our costly fence and correspondingly reduce the heavy tax in this direction now levied upon us. Yes, more than this, it will be conclusively shown that much of our fence is not only useless, but that it is also a serious burden to us aside from the cost of repairs. These facts, as we believe them to be, will be brought out by those who have the matter in hand. These are matters which claim our most serious attention. Practical farming—the manipulations of the soil and the care of crops, are not all of the important questions which may properly be considered. If we can in any way reduce expenses by reducing the amount of unproductive labor on the farm, we practically increase the productiveness of the farm, and this, too, without any greater draft upon the fertility of the soil.

II. The Statistics of Fencing.

By Ira E. Getchell, North Vassalboro'.

The part assigned me in the discussion of this question is largely statistical, and I have made use of many facts and figures from the last United States Census Report, as being more reliable than perhaps can be obtained from any other source.

Our State has a total land area of twenty million acres, a little less than one-third of which is devoted to agriculture. In other words, we have six million acres occupied and improved for farming purposes, as distinguished from the wild and timber lands of the State. The same report gives the average size of the farms in the State as ninety-eight acres—the report of 1860 as one hundred and three acres. The number of farms that exceed three acres in size is sixty thousand. Taking these figures as a basis from which to make our estimates, we have sixty thousand farms of one hundred acres each, which law and custom require shall be enclosed with a good and substantial fence. To inclose a farm of one hundred acres—dimensions 100 by 160 rods—requires 520 rods of fence, one-half of which each proprietor is required to build and maintain. This multiplied by 60,000, the number of farms in the State, gives 15,600,000 rods of fence required to build our boundary or line fences. For the partition or internal fences of the farm we have no data upon which to form our estimate, excepting observation and the opinions of intelligent farmers with whom we have conversed. They include the enclosures of the flower and vegetable gardens, orchards, farm yards, lane and pasture fences, (excepting such as are enclosed by road or boundary fences.) I think it a low estimate to call the internal fences of our farms as equal to one-half the circumference or boundary fences. This divides them into fields of twenty-five acres each, requiring 260 rods of fence per farm and 15,600,000 rods for the State.

To assist me in my estimate of the road fences of the State, I have taken several agricultural towns, with the roads of which I am familiar, as a basis from which to estimate the whole. My own town, (Winslow) which is nearly the average of the towns of

the State both in area and population, an agricultural town with no villages and no surplus of roads, has about sixty miles of road, requiring one hundred and twenty miles of fence. Deducting from this twenty per cent. for the small portion unfenced, leaves in round numbers one hundred miles of road fence per town. But considering that city and village fences are excluded, and all the sparsely settled sections of the State included in this estimate, we make a further discount of twenty per cent. from the above figures, which gives 80 miles of actual road fence per town. This, multiplied by 420—the number of towns in the State—makes 33,600 miles, or 10,752,000 rods of road fence in the entire State. Accepting these estimates, we have of

Division or line fences.....	15,600,000	rods.
Partition fences.....	15,600,000	"
Road fences.....	10,752,000	"

Making a total of 41,952,000 rods, or 131,000 miles.

I will also mention, although not being an actual direct tax upon the farmer, that there are about one thousand miles of railroad in the State requiring two thousand miles of fence. Admitting that this great amount of fence has to be repaired every year, and rebuilt every generation—imposing a large annual tax upon every land owner for labor and material—the question forcibly presents itself to us: Cannot a portion of these fences be dispensed with? We do not present the "no fence" system as being new and better than the good old ways of our fathers, but rather that our present wants and resources demand a change in the direction of economy.

With the pioneer farmers of our State fence material cost nothing. With farms to clear of stumps and stones and wood, it was rather an incumbrance to be got rid of. Since their day all material has increased in value many fold, and farm labor increased in price and deteriorated in quality. The number of improved acres has increased in much greater proportion than our farm stock; our cattle remain in the stable a greater portion of the year than formerly, and are more domestic in their habits. These and many other facts go to show that the time has come when the system inaugurated by the pioneers of our State, and followed since their day with little or no change, should receive such modification as our changed condition and circumstances require.

Admitting that the legitimate use of a fence is to confine our farm stock and prevent our farm crops from injury, we will give a few more statistics. The whole number of neat stock kept on farms in the State—reducing the number of sheep to their equivalent in cattle—is 500,000. To pasture these requires 1,500,000 acres of pasture lands, and to fence this it will take 7,800,000 rods of fence. Add to this the amount for lanes and farm-yard, eighty rods per farm, making 4,800,000 additional. These amounts make thirty per cent. of the fence we now have. We will add to this ten per cent. more for gardens and orchards and other necessary fences, which makes the whole amount 16,795,200 rods. Thus we find we have our pastures and lanes and farm-yards, our gardens and orchards fenced, and we still find we are supporting more than twenty-five million rods of fence beside, some of which may be desirable; but it is a growing opinion among a large class of the intelligent farmers of this and other States that the supporting of this large surplus of fence costs more than the benefits to be derived will warrant.

Discussion of the Above Subject.

Mr Wasson. I will simply occupy a moment, hoping that I may be able to open the door of discussion a little wider, and that as usual there will be plenty of volunteers. One of the great difficulties that meets the farmer of Maine is the cost of production. To make myself understood: If I am a grower of hay as a main crop, and hay is worth $12 per ton in the market, and it costs me $12.50 to grow a ton of hay, I shall not as a matter of economy grow hay for a long time, and so of any other crop. I believe that this question of cost is the great one which presents itself to-day to the farmers of Maine, and I believe that the reason why the West presents greater attractions to the working men than the East, is because the cost of production is less in proportion to the market value. I believe that Maine any time since 1870, can show a greater yield of wheat per acre than any of the wheat-growing States. Yet the farmers think it won't pay to grow wheat in Maine. Why not, when wheat is worth three or four times as much as it is in the West? Because it costs $1.55 to produce the wheat which sells for $1.50. I put these down not as accurate statements, but to illustrate my position. I say then that so far as there is a want of success in farming in Maine, it

is due to the fact that it costs too much to grow our corn, wheat and hay.

Now one of the great costs of production bearing so heavily upon the agriculture of Maine, lies in its fences. We can produce statistics of a character which no man can doubt, showing that to-day we are maintaining in Maine four or five thousand miles of useless fences. Now reduce that number of miles to rods, and put these at $1 per rod. Take this to the farmers of Maine, and show them what they are taxed simply to support useless fences.

I notice that in this town the fences are largely board and rail. In our section fortunately we have some cedar. When I became the owner of a farm I could buy the best cedar rails at from $8 to $10 per hundred. Now the railroads can come in and pay prices the farmers cannot afford to pay; and now second growth cedar rails cost from $12 to $14 per hundred. Now what will it cost to fence a farm twenty years hence? We have a right to suppose that prices of fencing materials will continue to increase and that it will cost double what it does at the present time. Now this is a question that comes home and addresses itself to the farmer. Here we have a burden that is bearing like a dead weight on the prosperity of Maine; it is yearly increasing, and is doing more than any other one agency in driving our young men to people the west. More than once members of this Board have presented this question to the legislature with all the ability that they could command, and asked for a remedy; but we have failed to impress upon that august body its importance. This very winter the question has been presented in this form: Will you rid us of the useless line fences? and after a full examination and recommendation of the Committee we have received the cold response of a "right to withdraw."

PRESIDENT ALLEN. A few years ago the fences spoken of as unnecessary were removed from the College farm at Orono. A few facts are worth more than all our theories in regard to the consequences which result from taking this step. The cost of fencing I suppose will be presented hereafter. There are some considerations, such as the cost of having more or less land on each side of our fences producing weeds, thistles and all these other things which are a detriment to the farm, and which require so much labor to exterminate them; and the cost of breaking out our roads in winter, which are filled with snow drifted in in consequence of the road fences. Many things are preserved for their beauty as

matters that minister to higher wants of our Natures than merely feeding the body. Now if so many of these fences are not kept for their utility we want next to inquire—Are they objects of beauty? Take our fences as you see them as you ride along—the Virginia fence, the stump fence, the log fence, the pitch-pole fence and the post and rail fence—are they such objects of beauty and taste that we need be at this heavy expenditure to maintain such ornaments on the farm? I must confess that I am so deficient in taste in this respect, that, though little accustomed to see fields extending to the road, I love to view a cultivated field without these classic fences with their accompaniment of brambles.

The neighbors about the college farm are beginning to dispense with their useless fences. We find no difficulty with our neighbor on the south. I don't know that he has trespassed on us. I think we can mow about straight. I see no disadvantage thus far. The only objection likely to be brought up is this: "We want our fields fenced because we want the fall feed." It seems to me this is one of the great advantages in not having fields fenced—because you can't feed in the fall. It is not only our immediate neighbors that are doing away with these fences, but I find every season as I pass over our roads in every direction, that the farmers are removing their fences from the road-side, and boundary fences where fields come together. We have not yet experienced the inconveniences that are urged as reasons against the doing away with this expenditure, and I am thoroughly convinced that the pasture fences and the fences about the buildings are all the fences needed on a farm.

Mr. Joseph R. Farrington of Orono. I wish to criticise one or two statements made in the papers. Mr. Gilbert says in his opening paper that the old fences are allowed by the farmers to remain solely through want of taste and want of ability to see that the beauty of the landscape is marred by them. President Allen has just said that we have removed our useless fences at the College farm. I wanted to throw in a word there and say—abandoned. We have abandoned our useless fences, but the work of removal is not the work of a day or a month or a year. We have some of these rumbling, tumbling stone walls, not laid up of such stone as might be moved with a small team, but such as the lumberman farmer who occupied land before us hauled with his six or eight yoke of seven foot cattle. We have them there, abandoned but not removed, a disfigurement on the farm, but we

cannot remove them. I wish to say a word for the credit of my brother farmers. We have it thrown upon us that we are stupid, have no taste, are careless and indifferent, and go about with hay-seed in our hair, and leave the stumps in our fields from sheer ignorance. It is not so; we do it from sheer poverty, for which we are not to blame, in which we do not propose to remain, and out of which we are slowly and surely working. We do appreciate the fact that these things are a disfigurement to our farms, but we cannot remove them to-day nor to-morrow; but the day is coming, and it is not for distant, when farms are not to be disfigured with stumps and stone walls, and when they will present a view to the passer-by that will be a credit to the taste of our farmers, and though our eyes for a time may be closed by the pressure of poverty, as soon as we gain strength we mean to get our eyes open.

Another criticism. I think the gentleman who gave us the statistics of fencing, in reckoning the rods of line fences took for his illustration a farm of a hundred acres, and supposed the fences to run entirely round it. The truth is bad enough, let us not make the burden larger than it is. How many farms in the State are all arrable land? Isn't there a large wood lot not fenced? By reckoning the amount of fencing at five hundred rods don't we make a statement greater than the facts will bear? Now the practical point in regard to the useless fences is, how can we get rid of them? I am glad to hear that the law requiring these fences on the farm is all imagination; and it seems to me that if the Board could make this fact known to all the inhabitants of the State it would do a work of incalculable value to the farmers. Why, when the law of the State provided that cattle should not run in the road you have no idea of the obliquy, I might say the curses, that were heaped upon us who claimed that we were not obliged by law to keep up our fences by the public highway. We were held up as oppressors of the poor, who would take away from the widow her last chance to pasture her cow; but I am happy to say we were successful.

It is not only an expense to build and keep up these fences, to break out the roads, and keep down the weeds they harbor, they are not only a blot to the landscape and a disfigurement to the farm, but they are useless, and we are under no obligation to make them and keep them in being. We have no right to make anything but pasture fences, because they are not only an expense

but an injury to the community. Now here I think I present a practical point. You can each one of you, if you have not already done it, remove your roadside fences, and leave your fields open to the gaze of the passers-by, and make them not only a source of pleasure to the looker-on but a source of pride to yourselves. Will you not do it, and show that the farmers of Maine are doing something for their own betterment and credit?

Mr. BAILEY of Bath. I suppose I shall be called an old fogy and I have no doubt I am. I am in favor of having my land fenced. I don't like to see a pasture fenced for twenty rods, and then the field all open. I don't like to travel on a road of that kind. I presume you will say my eyes are not straight. I would inquire why those who wish to leave their land open in this way, don't leave their houses open at night? There is beauty and system to my eyes in a farm that is fenced, and with regard to its cost, the "'almighty dollar" isn't the only thing to be taken into consideration. Gentlemen speak of useless fences, but they don't tell us what useless fences are. Would the owner of a field that cuts sixty or eighty tons of hay call the fences round that field useless? I do not call fences round my farm or by the road useless. There are cattle that get out unexpectedly, and if they get into your corn it will cost more than the fences would. I see before me a gentleman who has a farm not far from where I live, and he has taken pains to build good road fences along his lot. I think he is to be commended for it. It shows that he is industrious, and I should recommend to all my friends to fence their farms and be at peace.

Mr. TENNEY of the *Brunswick Telegraph*. I am as much of an old fogy as my friend Bailey, and I will quarrel with any man who wants to fence me in. Statements have been made that the cost of fencing in New York is more than the cost of building. Mr. Bailey says he would build road fences; if I understand aright the law does not require that I should fence out my neighbor's cows. We have had more trouble in the village of Brunswick from stray cows than there has been anywhere else, I venture, on the face of the earth. The proprietors of Brunswick about the middle of the last century conceived the idea of giving to the town 1,000 acres of this sandy land. Some gentlemen appropriated 150 acres of it, so that the town of Brunswick now holds 850 acres of it, and I think the general idea prevails that the common can only be used as pasture land, and the consequence is that all the cows in the

village have been pastured on the town common and the farms about it. But now the cows instead of being turned loose have herders, and are brought home at night, and don't climb four story college buildings, and get milked on the college grounds. The idea has come to be accepted that the owners of cows must take care of them, and that is a great improvement.

Let me cite the case of a farm at New Meadows bought by two stable men who of course have an abundance of dressing. The land was very much impoverished. They hauled rock-weed and brought up the crop of hay from one and a half to three tons per acre. The land sloped to the river and was drained cross-wise. They took down the stone-walls and drained towards the river. I know other places where they are taking their fences down. So far as beauty is concerned, I see nothing more charming than an open field. The marked improvement which has been made in this town has been brought about under the most adverse circumstances, and if Brunswick can throw down its road fences, other towns can do the same. What is the use of doing work which the law does not ask us to do?

Professor Carmichael. It has been assumed here that those who advocate the removal of road-side fences take a new position. I maintain that the good old custom is not to have fences, and that the custom of maintaining them is an innovation, and one peculiar to this country. You may land upon the English coast and travel from Liverpool to London, and then you may cross the channel and travel to St. Petersburg and not see a fence on the whole road. In Germany they have no term for a fence. Now the question with us is whether it is cheaper to fence in cattle or to fence them out. In regard to the question of beauty, we see these little white fences about our buildings. They are intended for ornament, but any man of artistic taste will tell you that they are blots. I point to the town of Cheneyville, Conn., as an example of a village beautified by planting trees, and by other improvements the work done by association directed by cultivated taste. I defy any one to bring forward so beautiful a village as that made from so slight material. It has not any remarkable scenery, and yet it has become a popular place of resort. We have become so accustomed to ugliness that we don't know what beauty is; but to any one who has looked at such a place as this there is no comparison between the trees and lawns and our fences. As to the profitableness or unprofitableness, that is a question of statistics,

but of course it is cheaper to remove the fences. I wish to give an illustration of what might be done. You know in Germany there were a great many old Lombardy poplars along the highways. They shaded the land so as to be injurious, and their roots ran out and injured the fertility of the soil. The Prussian government issued a mandate that they should be cut down and apple trees planted in their stead, and it was done within two years, and it is found that the revenue from these apple trees pays the whole cost of maintaining the highways.

Mr. L. L. Lucas of St. Albans. The owner of cattle is under obligation to take such care of them that they will not annoy his neighbors, and in order to do so he must have protection of some kind to keep them on his own premises. The question has been discussed whether he will fence them in, or fence them out. Whether we fence them out or not we must fence them in, and if we do both it makes two fences to build and keep in repair. If every one fenced his cattle in there would be no need for any one to fence them out. As to the road fences, for at least four months in the year, in a large part of New England, they are an expensive nuisance. The highways through a great many of our towns are blocked up with snow so that it is expensive to clear them out, and many of them are shut up three or four months in the year because there is not sufficient travel on them to pay the expense of breaking them out. We asked in our town a few years ago for a legislative enactment making it imperative on a town to have the fences that could be, taken down before the snow came, and put up again in the spring, at the expense of the district. They said that surveyors had the right to do that now, and so "legislation was inexpedient."

One argument against leaving down the roadside fences is the inconvenience of driving herds of cattle and of driving cows to pasture over these roads. The herds are driven more generally during the last part of the season than any other time, and then the crops are taken off and the bars left down, and it makes more trouble and is more expense to get sheep by the fields than it would be if there was no fence there. There are just gaps enough to make trouble. These fences are a nuisance for the collection of weeds and briers, and are not of any use when you want a fence, for there is not one in fifty of them that will stop cattle if you want them to. Now if we can make a change and get rid of these useless fences, or apologies for fences, and apply the mate-

rial to the pasture fences, and have the line fences, where they are necessary, good ones, (for poor line fences make a good deal of trouble.) If we can do this we shall have taken a step in advance, worth more than anything we have done for the last five years.

HON. C. J. GILMAN. I should like to inquire of Professor Carmichael whether all the fences in England, Ireland and Germany are simply for ornament. I have an impression that their hawthorn hedges are almost impervious.

PROF. CARMICHAEL. They find from the experience of centuries that it is unprofitable to have fences—that it is easier to take care of cattle than to keep up fences. There are many fences in England, but to mark the terminus of land I saw but few. There are no lines of demarkation except such as the crops give, and these lines run with mathematical accuracy. So far as I have seen in Germany and in England there are no fences, as such. You may see a beautiful prospect from the top of Mt. Holyoke, in the neighborhood of Amherst, and the example set by taking down the college fences, followed as it has been to a great extent, has had much to do with making it what it is. Village associations are taking hold of this matter of improvement, and they see that the fences are in the way. It is like buttons on the coat tails. Formerly coat tails were made so long that they had to be buttoned up. There is no longer any necessity for the buttons, but we keep them there. I say that any unprejudiced person, passing through those villages where attention has been given to beautifying the landscape, and where the grass can be kept cut by association, without expense, will say that they are much prettier.

Mr. GILBERT. I am glad that the discussion has taken the course it has. It has proved to me that advanced ideas are prevailing and that we are taking steps forward. I speak from a farmer's stand-point, and many of the speakers have spoken from the stand-point of the villager, and we are agreed in the main, although the distinction has been made. Now as to the uselessness or usefulness of these road fences on the farms, the practical working of their abandonment, as I know from experience and from a somewhat extended observation, is this: If you wish to protect your farm from your neighbors' cattle take down the fences; when you do that, your neighbors feel compelled to take care of their cattle. All over the State they are practising this,

and I defy any man to find the case where they do not enjoy better protection after doing it than they did before. I had it proved on my own farm. Unfortunately for me, there are three miles on it where once was old fence. Of course some of that land is remote from the residence of the proprietor; and occasionally these fences were not in repair, for, as the gentleman from St. Albans says, they are not kept up if they pretend to keep them up. Some of the neighbors liked to have their cattle crop the luxuriant herbage by the roadside, and coming into possession, I found that the cattle were not always satisfied with what was on the roadside. I did not feel myself able to keep up these fences, and so I just removed them; the consequence was that not one of these fields was trespassed upon, and the harvest upon them is as valuable as those raised about the buildings.

Mr. HIGHT. In reply to the criticism of the gentleman from Orono, I would say that I went to the Census Report for my information. The census return says that the number of acres of occupied land in the State is 6,000,000. We are not obliged to fence our roads, but we are obliged to fence our occupied lands; and if, as he says, we don't fence entirely round them, it is making a bad matter worse, for if we don't fence them we are liable for the consequences.

HON. C. J. GILMAN. In relation to driving herds of cattle?

Mr. GILBERT. The road leading past my premises to Lisbon, following down the river, is a leading highway through the county, and one on which nearly or quite every week during the season cattle are driven to market. Many of the proprietors along that highway are removing their road fences and no inconvenience whatever has ever been experienced from the removal on that account. The cattle can be easily driven provided they are properly cared for, and if there are fences the cattle are carelessly driven. Every day in the summer I drive my herd of cattle, varying in numbers, past a field which borders on the highway, where no fence has been maintained since I came there. Of twenty head of cattle driven there not once during the summer did one of them step over the ditch or inside the field.

III. The Cost of Fencing in Maine.

By Peter W. Ayer, Freedom.

You have had this question of fences so ably handled in the two papers preceding me, that I would not present my efforts in this direction, did my duty demand more than some statistics and estimates of cost which have been obtained largely by the assistance of intelligent land-owners.

The total area of the State is 31,760 square miles. Estimating three-fourths of the same, including lakes and ponds, as unimproved, leaves 7,940 square miles, or 5,080,600 acres of improved occupied lands. This if fenced into thirty acre lots will require nine rods per acre, but inasmuch as more than one-third of this is line or division fence it is reduced to a trifle less than seven rods per acre actually built by the owner. This estimate of the size of lots is made up by comparing large farms with small ones in widely different localities, and makes an aggregate of 40,644,800 rods of fence in the State—not considering ornamental fence at all. From the Report of the Seventh Census and other data, I find about one-fourth to be highway fence—at least seven-eighths of which only separates fields from roads harboring all sorts of weeds, and helping to perpetuate the pernicious practice of pasturing them, thus becoming worse than useless; the other eighth cannot be dispensed with, enclosing pastures as it does.

I have said there are 40,644,800 rods of fence for all practical purposes in the State, and it is divided nearly as follows: Highway fences, 10,161,200 rods; line or division fences, 15,288,000 rods; partition, (including lanes and orchard) 15,195,600 rods. Estimating the cost of this fence at one dollar per rod, shows $40,644,800 to be the first cost of fences now on our farms. For line or division fences, $15,288,000; for partition fences, $15,195,600; for highway fences, $10,161,200. Now add to this as the annual cost, interest at six per cent., $2,438,688; repairs or deterioration, six per cent., $2,438,688; taxes, two per cent., $12,896; snow bills about one-tenth of the municipal taxes—$360,000, is fairly chargeable to cost of repairing highways in winter. Here you have the sum of $6,050,272 as the annual cost of our fences

which divided among the seventy thousand farms of the State, make the average first cost $677, and the annual cost of keeping in repair, &c., $100 each.

In my estimate of cost I shall assume that the land occupied by useless fence is quite an item. Let us see how much. The same authority quoted several times before, viz: farmers in different sections, uniformly allow that *ten per cent.* of their partition fences can well be abandoned. Adding this to the seven-eights of road fences which ought to be removed, and we have 10,410,610 rods of fence not needed, occupying or destroying the utility of soil eight or more feet wide. But for convenience we will call it half a rod wide, equal to 5,205,305 rods, or 32,533 acres, worth certainly on an average $30 per acre, or $975,990 in round numbers. I deem no recapitulation of the above necessary, as my figures are all very plain, right or wrong.

I may be allowed to digress a little here. In yesterday's discussions very little of anything was said in relation to the manner in which these useless highway fences may be got rid of. Now it is well known that quite a large part of such fence is composed wholly or in part of stones, and I suggest that the practical way, in fact the only correct way to dispose of them, where drainage will be a benefit, is to put them into well made drains, where they should have gone in the first place, thus giving the owner several acres of new or virgin soil. One more suggestion and I am done. Some exceptions were taken to the statistics presented yesterday by the gentleman from Kennebec, (Mr. Getchell). Now the more I examine this matter the more I am convinced that my figures are not large enough, neither are his; or, in other words, although our estimates look large, they are inside the facts.

IV. Anomalies of Fence Law.

By Samuel Wasson, East Surry.

Fence laws, like the fences to which they relate, are full of defects. Of fence laws, we have too much, and of fences, too many. Of the many anomalies now existing in our fence law, the pure logic of justice is quite incapable of explaining.

The present law, in its best estate, is a "double and twist" of usages and enactments, ancient customs and modern decisions; a compound of common and statute law. Its first official act was the recognition of all farm property as being either *locomotive* or *stationary*, or that which could, and that which could *not*, pass its "metes and bounds;" and for the benefit and protection of all concerned, the law enacted that *fences*, as a "line of obstacle," should be maintained between them.

The next link in the legal chain was how, when, and by whom such barriers should be erected? Equity and justice say, that class of property which could not astray needed no restraint, for it could neither make an encroachment nor do an injury. So said Common Law; and to make its saying heeded, it attached a "peril" to locomotive property when it escaped beyond its bounds. As if to "moor" this declaration of common law "with two anchors," written law declares (R. S. c. 23, §. 4,) that "any person injured in his land by cattle, etc., may recover his damage." Thus far every declaration of law and justice is, that fences are for the protection of crops and the restraining of cattle, and that the fence burden is to be borne by the latter.

The first irregularity of Statute Law, that "Americanism" for *fraud*, comes to the light in these words: "by proceeding, as hereinafter directed," (R. S. c. 23, § 4,) "one injured in his lands may recover his damage *by proceeding as hereinafter directed.*" It is this "proceeding as hereinafter directed," which has become a "Felix waiting for a bribe," throughout the whole fence law. The chief anomalies for which it makes way, are found in the laws which relate to DIVISION FENCES, ROAD-SIDE FENCES, and the PERILS. Bear in mind that the underneath inferential of law is, that fences are not for the restraining of crops but of cattle, and that fences,

or "lines of obstacle," are lawfully required of those only who may be the owners or occupiers of cattle; yet in the face of this time-honored law our statutes declare (c. 22, § 2,) "That occupants of lands * * * shall maintain partition fences in *equal shares*," irrespective of the use to which either of the "occupants" may put that land. Suppose the enclosures adjoining to be a pasture of A's and a field of B's—then by this twist of law B must build one-half or an "equal share" of A's pasture fence. Suppose A's land be a common, then B must build both shares, or the whole, so that the cattle of the neighborhood may go at large upon this common. If this is not an anomaly of a finely knit character, tell me what its cunning is?

Again, says this astute statute, (c. 23, § 4,) that if there be a defect in B's half of the division fence between himself and A, and the cattle of A's enter his field and destroy his crops in consequence of such "defect," no damage can be recovered of A. Even if A's cattle break through where no defect is and do damage, as a matter of economy, B better pocket the injury than to resort to coercive measures to replace the loss, for the whole course of "an action of trespass" runs counter to swift justice and results in adding insult to injury. This phase of the statutes which requires division fences between grass and grazing lands to be maintained in "equal shares," shipwrecks that whole principle of law which imperils the owner of cattle, unless he fence them in and upon his own land. This muscle of the law's anomaly is more powerful than the law itself.

The next in course, of the law's deviations, is that which relates to roadside fences. It is supposed to be written in the law that roadside fences are not required. If so written, let the eagle-eyed find it. By the spirit of the fence law road fences are not required; but by its administration they are an anomaly of law, deeply freighted with vexation. Suppose the *divide* between the fields of A and B to be an *un*fenced highway. The lawful line between lots is the center of such highway. Either or both have a lawful right to occupy to the road-center line. They may crop or de-pasture up to such line. If either elects to de-pasture and his cattle pass over such unfenced line—that is, cross over the highway into and upon the land of the other, what is the remedy for the party thus trespassed upon?—for the same law which is *supposed* to grant the removal of road-fences, indisputably enacts (c. 23, § 4,) "that if the beasts were lawfully on the adjoining

lands and escaped therefrom in consequence of the neglect of the person suffering the damage to build a fence, the owner of the beasts shall not be liable." Gehazi begging gold, begs the leprosy. One begging for fenceless roads, begs for *lawful* encroachments. This is one of the "beatitudes" of our fence law. Say you, "that beasts at large, without a keeper in the highways, may be impounded?" Say I, that one's cattle upon his own land, be that land without or within the limits of a highway, are not at large, and being lawfully there, need no keeper and cannot be lawfully impounded. There may be redress in an action of trespass, but he who appeals to it will be quite as likely to find some things in its delays which are not of regular orthodox standing.

But suppose stray cattle, unlawfully in a public way, pass therefrom into your garden or corn-field—what protection is by law afforded? Why, as a law-abiding citizen, you must house, water, feed, and otherwise care for the comfort of such invading beasts for the space of ten days, waiting for an owner to "turn up;" nor during those days of probation can you lawfully advertise. Let the owner find his stray cattle as best he can, the law's command to you is to keep "mum." If no owner calls before or at the expiration of the martyrdom-days, the beasts must be committed to pound, or you forfeit one per cent. on their value for each week. Joy go with him who attempts to impound an estray, for with such an attempt comes a swarm of vexations, petty yet powerful as the wasps and hornets of Canaan. Here an inspection of the accompanying diagram is invited.

By the diagram is represented a field of A's, 130 rods square, his pasture on the south, 70 rods, a strip of common between the pasture and village lot; B's pasture on the east, C's on the north, D's common on the west, and a road 183 rods crossing the field diagonally. For the security of the field, with a law without defects, A need build but 130 rods of fence, (the division line between field and pasture,) while to protect his field, as required by the defects of law, he must build the 130 rods between his field and pasture, 65 rods of B's pasture fence, 65 rods of C's, 130 rods of D's, and 366 rods of highway fence. For A to keep his cattle out of his field requires 130 rods of fence, while practical law requires him to build 626 rods, for no other earthly reason than to keep out the cattle of B, C and D. At common law, as per diagram, A must build 390 rods to fence in his cattle, but

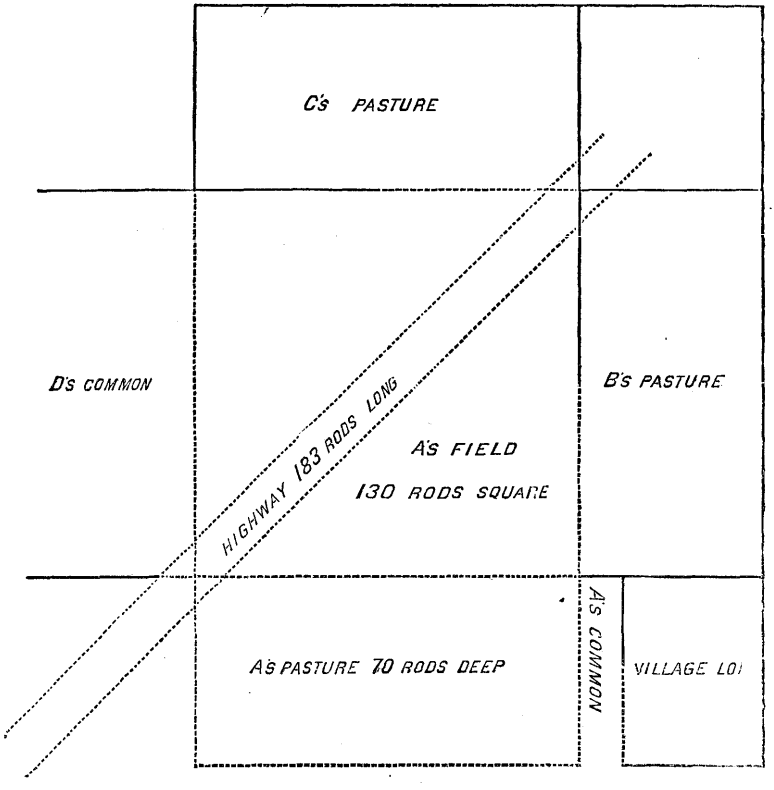


DIAGRAM ILLUSTRATING FENCE LAWS.

by the anomalies of statute law, additional to the 390 rods, he must build one-half of the village lot fence adjoining his strip of common, half of B's, half of C's, the whole of D's, both road fences, or 1,051 rods in all. Thus it is how the anomalies of fence law oppress, an oppression which comes to every farmer having fences to build.

Suppose one to be blessed (?) with neighbors who won't take care of their cattle without the thumb-screw of law, the statutes provide a choice of ways to torture, one by impounding and the other by an action of trespass. Impounding is like a bridge of boats, broken and tossed by the angry sea, while the pinch of an action of trespass is best expressed by this epitaph, (written by one having a spite against a deceased neighbor:)

> "Here lies his body. For his soul
> You'll have to search a deeper hole."

So one searching for redress in the deep-hole of law's delay must invoke the aid of meek-eyed patience. The perils, the motors of law, have become little else than wordy blows, or so slow and uncertain as to incur no dread. It is not excessive severity, but swift certainty, which deters crime. If the hot breath wasted over the "death penalty" was turned scalding hot on law's delays, either gallows or prison would have fresh terror. The swift certainty of peril has clean gone out of fence law, by the impounding process at least. Its road to justice is intensively crooked and full of judicial escapes. Says the law, "every beast found at large, or injurying any person in his land, may be impounded till the forfeiture and all fees are paid by the claimant." This has an enticing look, but the "look" is all there is of it. When one distrains the beast of another and proceeds to impound it, he exercises a naked and statutory authority. The course plotted upon the chart of the law must be followed without deviation. Each and every step, from first to last, is a separate and independent fact. All of these facts must exist and be in place. Every form required must be observed; any departure from the statute made is contrary to the genius of judicial law. The "steps" which must "toe in" and "toe out" with statutory precision are, 1st, That the beast was unlawfully upon the land from which it escaped. 2d, If rightfully there, that it did not escape through a defect in his share of the fence. 3d, That there is a pound. 4th, That there is a pound keeper. 5th, That he

was legally chosen and sworn. 6th, That the certificate of oath, in due form, is recorded. 7th, That he gave bond with satisfactory sureties. 8th, That the bond was properly sealed, signed and witnessed. 9th, That the bond show municipal approval. 10th, That the pound keeper has a *legal* record book. 11th, That there is a certificate of the impounding. 12th, That food and drink were furnished, as required. 13th, That the pound keeper *did not blunder*. With such a brigade of *thats*, impounding will "stick." Be it remembered, that many technical dicta are interwoven in each step, and the falling out of *one* essential dictum lames the proceedings in each step. If one is "pierced with pains" for a fence-law suit, let him resort to an action of trespass, a penal part of fence law, said to be "brimful" of peril. If one would see everything of law's delays, from the "alphabet to the diploma," and the questions of fact to be put into the lottery-verdict of a petit-jury, let him try his hand in an action of trespass against one schooled in the intricacies of law.

The procrastination of penal law with its quirks and quibbles and subterfuges, is doing more to thwart the ends of justice, multiply offences and foster crime, than all other causes combined. The law is so lax in laying penal hands upon rowdies, roughs, and rogues, that a *vigilance* magistracy may be required to preserve the peace. With all the threatenings of penal fence law, experience finds after digging down through the dead stuff of that law, that the only safeguard is in a good and sufficient fence. This, however, is a digression.

The "equal shares" of line fences, may be determined by mutual agreement, assignment or prescription. The point we make is, that division fences be upon division lines. That American weakness of ours to annex territory, retracts when a fence is pushed over the line, for it loses its chattel character and becomes a part of the reality. The land holds it. Here is another of law's anomalies, for while land may hold a division fence, a fence within the limits of a road may hold the land. To sum up:

We call for the repeal of a law which is *fencing in* by its declarations, but *fencing out* by its penalties.

We call for the repeal of a law which puts the saddle upon the wrong horse—grass, not grazing land.

We call for the repeal of a law which is a Babel of technical pesters, which no man can name or number.

We call for the repeal of a law whose "anomalies" give it a career of "victorious villainy."

We call for the repeal of a law which oppresses at every turn, and encumbers every estate.

We call for the *enactment* of a law which will shield the crops and restrain the cattle.

We call for a law which shall take counsel of equity, speedy and even-handed justice.

We call for a law which shall speak the things it means, and means what it speaketh.

We call for a law which needs no "boiling down" to extract its judicial essence, but which shall be simple, concise and efficient, and without perplexing ingenuities.

To this end we would repeal existing laws relating to pounds, impounding, actions of trespass, and equal shares of partition fences—those between adjoining pastures excepted—and create a new statute power, simple, direct, decisive, which could be exercised with vigor and success, without any of the trammels of the old law, or any of its technical fetters or judicial enigmas; a law with perils, which would not "delay its coming" until an offence had mossed over with age. It is this phraseology of the R. S., c. 22, § 2, which is so mischievous in the matter of division fences: "The occupants of lands enclosed with fences shall maintain partition fences between their own and the adjoining enclosures, in equal shares, while both parties continue to improve them." Blot out the words "improve them," and add, *use them for pasturing, otherwise, in severalty by the party so using,* and the thing is done.

Again: Make it lawful for any person to seize and take into his custody and possession any animal which may be running at large or may be trespassing upon his premises, such beast to be sold by a trial justice, and out of the proceeds thereof costs and any and all fines and profits to be paid, unless the owner make payment before the advertised time of sale. Such a law would have the merit of brevity. It would not be a web of words, requiring a lawyer to interpret. It would *bar* the perforating of law terms to let offenders out. It would not be a "pudding-stone" of anomalies like the present fence law, an epic of meaningless fables, empty as the inarticulate wind.

DISCUSSION OF THE SUBJECT.

DR. TUCK of Farmington. I would inquire what is covered by dividing fences between pastures? In my section there is hardly a farmer but pastures his whole farm some time during the year. I can see that this proposed law if applied would materially change the status of the land owner.

Mr. WASSON. In answer to the question, I will avail myself of the Yankee privilege, and inquire of the Doctor if in his judgment the Legislature could do a better thing than to pass an act whereby it would become impossible to pasture mowing fields?

DR. TUCK. I have had the idea that there is a surplus growth of grass on the mowing fields in September and October, and that both the soil and the crop are improved by having it fed off.

Mr. WASSON. The Doctor will agree that physicians make mistakes sometimes.

HON. C. J. GILMAN of Brunswick. In regard to the point made by Mr. Wasson as to the liability of the owner of cattle in an action of trespass for damage done to the property of another, our statutes and the decisions of our judges, as embodied in our reports, leave it in great obscurity. It is to my mind about as clear, well-defined and perspicuous, as the definition which Rufus Choate once gave of the boundary line between Massachusetts and Rhode Island. He said that according to the rule laid down by the opposite counsel, that line might be defined as the flight of a jay-bird or the tracks of ten thousand foxes with fire-brands tied to their tails. I think that the manner in which the fence question has been treated is an insult to the intelligence of the State, and I cannot doubt that all classes of our people would rejoice in the passage of a reasonable and clearly expressed law which should determine the rule. Whether it would be reasonable to require the owner of a pasture to make all that fence between his pasture and his neighbor's field, as our friend proposes, I am not ready to say. It involves considerations on which I should want to reflect before expressing an opinion.

In relation to the other question, as to the liability of A for damage done by his cattle on the land of B, the one owning land on one side of the road and the other on the other, it is one which involves several questions. B says the cattle are his. Why does he not prevent their passing over? A says that he did, by his fence. Then the question arises whether A was bound to exer-

cise ordinary or extraordinary diligence. But on the question of what constitutes ordinary and what extraordinary diligence a jury would very likely disagree.

With regard to the law in relation to road-side fence where the adjacent land is field, there has never been any absolute repeal of the old statute, yet the declaration of the Legislature that stock shall not be allowed in the highway repeals it inferentially, and I suppose the court would take that view of it should it ever be brought before our highest judicial tribunal. The Legislature ought to make a law on the subject so that the farmers of the State may know exactly how to govern themselves in the premises, and so that there may be no misapprehension as to the meaning of the statute.

Mr. BAILEY of Bath expressed his dissent from the views of Dr. Tuck, as to the expediency of feeding fields in the fall, holding that if there were such a thing as a surplusage of grass it was better to mow fields than to feed them, as in feeding the animal tears up the grass roots.

GEN. MERROW of Bowdoinham. Tradition has handed down to us these road fences and let us adhere to them. If I go through the country and see the fences down it looks bad to me—like a drunkard's house with hats in the window. I want to know when I go to bed that my field is safe, and if I have a good fence it is safe. If your fences are down and a wild cow gets in your field it takes three or four hours of your time to get her out. Good fences make good neighbors. There are a great many miles in our town where there are stone wall on both sides of the road. It would be more work to move them than they are worth, and where are you going to put the stone?

Mr. TENNEY of the *Brunswick Telegraph*. As to road fences making good neighbors, if I can't live peaceably with my neighbor without a big fence between us, he or I has got to move. I know of people who fence themselves in with fences as high as their windows, but they are not the right kind of people, and don't make good neighbors, citizens or anything else that I know of. Look at the fences by the side of the road in this town. They are most abominable,—stump fences, and Virginia fences, and stone walls out of repair. Now I don't think that there should be road-side fences, but there should be something as a guide in the winter, and that brings to mind the statement made by Prof. Carmichael yesterday in regard to the apple trees planted by the

road side in Germany by order of the government, which not only afford shade to the road but yield a revenue. The rock maple tree is a pretty shade tree for the road side, and is valuable for making sugar. The surveyors might be authorized to set out trees and shrubs, which would beautify and shade the road, and serve too to show where it is in winter.

The following resolution was offered by Z. A. GILBERT of the Board, and unanimously passed:

Resolved, That it is the sense of this convention that a large portion of the fences in this State, both in country and in town, are useless, and a serious incumbrance, and that we will use our utmost endeavors to encourage the further diffusion of the enlightened views which have been expressed before this convention.

ON PLANT NUTRITION.

By Prof. Levi Stockbridge, of the Mass. Agricultural College.

As has been announced in your programme, I am to speak to you this evening upon the subject of plant nutrition or the feeding of plants, a subject which has attracted the attention of the scientific men of both Europe and America, and which as matter of pure scientific inquiry and investigation, is one of utmost importance. But to the farmer, to the practical man, to him whose business it is to make plants as crops, it is a great deal more than this. For as he is enabled to apply the principles of plant nutrition right or wrong, whether he knows those principles or not, depends the result in his life work which may be success or failure.

We agree that the investigation of the principles of plant nutrition is a subject altogether of modern inquiry, and the opinions of scientific men for forty years have been in a sort of transition state in regard to it.

The time was when it was believed that to afford food for plants there should be a large percentage of organic matter in the soil, and that the value of all land depended on its quantity of organic matter. But when the chemist got at his work and showed that some soils were wonderfully fertile with but two or three per cent. of organic matter, and others very infertile with from ten to fifty per cent., the old organic theory was driven to the wall never to be revived.

Again the theory was advanced, and supported too by the highest scientific authority, that for the development of plants the mineral elements were required, that the ash constituents of the soil were first exhausted, and that to maintain it in perennial fertility it was only necessary that these should be returned. This theory, however, was met by the counter one that nitrogen was the essential element, and between the advocates of these two theories the contest went on year after year, and I am sorry to say it was sometimes an acrimonious one. On the one side

were such men as Liebig, Bossingault, Ville and Way, on the other such as Lawes and Gilbert, and Volcker, and finally it was found that both were right and both were wrong. No plant can be brought to perfection without nitrogen, no plant can be brought to perfection without its ash constituents, both are absolutely indispensable.

Again the theory was advocated that if the farmer would know what was needed for the nutrition of plants, it was necessary that the soil should pass under the eye of the chemist and be analyzed, that he might know its wanting elements and have them supplied. But it was soon discovered that the chemist with his strong acids could wring lime out of a soil when the plant, that nicer chemist, would starve to death because it was unable to obtain lime from a soil that contained it in abundance. Thus when the method of analyzing the soil was tested it was found that it could not be made available in agriculture, and there are hardly any two specimens of soil from the same field that would show the same analysis, and thus chemical analysis for this purpose was discarded.

Thus for forty years the opinions of scientists have been in a transition state in relation to the subject matter of plant nutrition. Theories have been advocated only to be disproved by the discovery of new facts. Step by step scientific men have advanced, until to-day I think we can say with truth that scientific men are practically in accord as to the principles of plant nutrition Practically we agree that the scientists know what they affirm when they say they know what are the requisites for the food of plants. It may not be time thrown away if we state what these principles are, and what the principles of practical men as shown by their practice.

In the first place we say that the plant which to us practical fellows is a profound mystery, a sealed book, is perfectly open and plain to the eye of the scientific man, because he has read it through and through beneath the microscope. Now pardon me while I say that while I cannot endorse all that has been said in regard to the ignorance of the farmer, I may be treading in the same path when I say that the farmer when he drops a seed in the soil knows little of the result which is to follow in the growth of the plant. Topsy "supposed she growed," and that is about the beginning and ending of many a practical man's knowledge in relation to that most wonderful structure the simplest seed or

plant. The scientist knows that in that seed, however diminutive it may be, there is the embryotic plant. Nature has stored along with that plant the best possible food for it in the endo-sperm of the seed. When that plant starts into activity it finds prepared for it by nature the best food it could have in the form of that endo-sperm, and on that it is nourished, growing by the simple process of adding on cell after cell until it developes the organs by which it may live—its roots to permeate the soil and gather soil food, its leaves hanging pendant in the air to gather air food, and in that cell formation the scientist knows precisely what kind of plant he has—the manner and conditions of its growth, its organs and their functions, as well as we know the most familiar objects that pass beneath our hands. And one noticeable thing in relation to the structure of a plant is this, that he who has examined one plant—a wheat plant for instance—and found out its structure, knows absolutely what was the structure of every wheat plant that ever grew and what will be the structure of every wheat plant that ever will grow on the earth's surface. The wheat plant of to-day is in its structure precisely like the wheat plant that grew five thousand years ago, and such as I hope will grow on the soil of Maine five thousand years hence.

Again, the scientists are all agreed not only as to the structure of the plant but as to the composition of the plant. There is no guess work about it, gentlemen. They know what a plant is made of just as much as the builder of a house knows what that house is built of, and not only do they know of what the plant is made, but they know absolutely the proportions in which the elements that go to make up a plant enter into its composition. Every plant grows by fixed laws made by Omnipotence—law controls it, law made it for a specific purpose, and when the scientist has examined a fully developed plant, it may be an Indian corn plant, and found out how it is made, he knows precisely of what elements and in what proportions every Indian corn plant has been made that ever was made. No plant has been produced by accident, but all have been made by the design of Omnipotence to accomplish certain results, and when we want to make a plant we may be sure that we know just what we have got to have to make it of. More than this, the scientists know in just what form the food of a plant must be presented to it in order that its organs may use it in constructing the plant.

Passing on to detail, the scientists are agreed that so far as the

plant is concerned there is no preference whatever for one class of matter over any other class of matter; that is, so far as the plant is concerned, the organic matter of which it is made is just as important as the inorganic matter. No plant can be made with the one, and no plant can be made without the other. Every plant that ever was or that ever will be made, has been and will be made by the use of both.

Now we come to classes of matter. If we take the organic material of which plants are made it is equally true that neither of the organic elements, oxygen, hydrogen, nitrogen or carbon, is supreme in importance so far as the plant is concerned. No plant can be made without all four of them; leave out which one you will and it will sicken and die. You must have them all and in the right proportions or no plant can be made, and so far as the *plant* is concerned they are equally important.

Turn now to the inorganic elements that enter into the composition of plants. We have some eight or ten of these, and neither of them has the preference over the others. No plant can be made without lime, no plant can be made without potash, no plant can be made without phosphoric acid, and so on through the whole list. Every plant that grows must have every one of these elements, and the quantity of the crop produced on any acre of land will depend upon the quantity of these elements that is available in the soil. All are equally important.

Turn now to the farmer. It makes a wonderful difference with *him* who shall supply these elements—who shall furnish the material of which the vital forces will construct plants. It makes no difference to the plant, but as I have said it makes a wonderful difference with the farmer. For Nature is a helpmate and co-worker with the farmer. He alone of all workmen is assisted by the material with which he works, and while the plant must have all the elements, the farmer can ask Nature, "What will you provide, and what must I provide for the structure of my plants?"

Now, coming to the organic matter. Nature will supply anywhere, under all circumstances, whatever oxygen the plant wants—the farmer never need supply any of that. The same with hydrogen—there is enough of that in water and in air. We need never manure our land with oxygen or hydrogen.

Precisely so with carbon. There is a large percentage of carbon in the soil, and in the water that comes down through the air there is also an abundant supply of it, and Nature has fitted

the leaves to take it from the air, and the roots to take from the soil all the carbon that the plant wants. We need not feed plants with carbon.

Now we come to the other organic element—nitrogen. This enters largely into the general structure of plants, and is available in Nature only in small quantities. There is plenty of it in the air, yet scientists are agreed that plants get little nitrogen from the air. They get some from it—more from the decomposition of organic substances—yet all scientists agree that the farmer must supply nitrogen; the plant cannot get enough of it, and he may supply it any form he please, provided it is available.

Turn now to the mineral elements. What will nature do in the way of ash constituents, and what must I do? Now, with a full knowledge of the fact that I may be in error, I say, that on the average of our soils the farmer need never apply lime to *feed* his plants. I know that you are in the habit of applying lime to your soils; keep on doing so, you are doing right, but I repeat that on our New England soils the farmer need not apply lime for plant food, except in certain cases, as in the production of tobacco—and the same is true of magnesia. He need never apply soda, he need never apply sulphuric acid, he need never apply chlorine, nature has supplied abundant material to afford all these, save in exceptional cases.

There are only two things left. One is potash, the other is phosphoric acid. It is true that all granitic rocks contain more or less potash in their feldspar. Plants take out of the soil so much potash in their structure that the supply that is available in the soil soon becomes exhausted, or nearly so, and of this the minimum quantity will measure the maximum quantity of the crop; so the farmer is obliged to furnish potash.

The other element is phosphoric acid. Phosphoric acid exists in the soil in small quantities, obtained from the disintegration of phosphoric rocks. Seed bearing plants, especially, take up large quantities of phosphoric acid, and the consequence is, that it must be applied, for the minimum quantity will measure the maximum quantity of your crops.

You will bear in mind that I am speaking of feeding plants. I am saying nothing about the construction of the soil; I am constructing plants, and for the construction of plants on the average soil of New England it is needful that the farmer shall supply nitrogen of the organic elements, and potash and phosphoric acid

of the inorganic elements, and if he does supply these elements he can make plants at will.

Scientific men are also agreed that the amount of material that thus enters into the composition of plants is very minute in quantity: that for the production of the most magnificent crops that any of our fields can be asked to produce, it is only necessary to use one, two, or three hundred pounds of material per acre, for it is not necessary that the elements should be contained in a large bulk, since they are themselves exceedingly small in quantity.

These, gentlemen, are the principles upon which scientific men are fully agreed in regard to plant nutrition, stated as briefly and simply as I can give them.

Now, to show the contrast, we will turn to the other side of the case—the opinions of practical farmers, as expressed in their practise, for I fear that they have no opinions to express in any other way. Now, then, I am one of you, gentlemen, and I say that as a general rule among the farmers of the country, and the farmers of Maine are the peers of any others, barn-yard manure is king. It has no peer; nothing can be substituted for it, and nothing can take its place. The farmer says, "Do you tell me that two or three hundred pounds of material per acre can be made to take the place of barn-yard manures? When you say that you publish yourself as a fool, for I know better." He believes in quantity, in tons, cords, bulk, and he cannot be persuaded that anything else will nourish his plants and make his fields fruitful. If I were to tell him that I could take a basket on my arm, and carry into the field what would not weigh more than twenty-six pounds, and in it there should be more plant food than he could draw there in the form of the best barn-yard manure with a yoke of oxen, he would say he knew I was a fool then, and yet I will pledge myself that I am able to do it.

Don't you know, gentlemen, that when you use barn-yard manure you often fail to get a crop? *Why* don't you always get a crop? I know what you will say—that you are dependent on the weather. Though barn-yard manure is such a wonderful thing, and has in it all the manurial elements, you cannot get crops by the use of it unless the Almighty gives you sun and rain. Now here I want to ask you one question. What is the influence of the weather on plant nutrition? That is the very thing you need to know. If you give your plants barn-yard manure, why don't

you make crops? What has the weather to do with it? The answer to this question is very simple. It is this. You have given to your land the material, you say, to produce plants. You gave it in a raw, crude, unfermented state. Now no plant ever did or ever can feed on barn-yard manure as barn-yard manure. I don't care how rich your soil may be, the plant may stand there and starve there unless the weather comes in and produces food for it. The weather then has this to do with it. You fed your plants with barn-yard manure, and there wasn't an atom of food in it. Nature comes in with her sunshine and rain, the manure passes through certain changes, is dissolved, its parts are chemically united, and thus food is produced, and the plant is able to take it.

The weather then makes your crop large or small accordingly as it is favorable or unfavorable to the decomposition of the material for plant food in the soil. When we have one of those cold seasons, so that the air cannot get into the soil with its oxygen, or the sun penetrate it with its heat, it is dormant so far as decomposition is concerned, and we have the plants waiting for the sun and air to develop food. Suppose it is the other way—there is no water; then the plants stand and wait for water to develop the food that is in the soil. They wait there until decomposition takes place, and then they get their food. That is all that nature has to do with it. This is a good corn year; last year was a bad one. What is the difference? A little too much water, or not quite water enough, and the food wasn't developed.

Now, gentlemen, if you will prepare your food before you put it in your ground, if you will take your crude manure and make it into absolute plant food, suppose you take the chemical elements that are absolute plant food, do you believe these ordinary variations will affect your crops? You may think so, but I know they will not. If you give the plant its food in proper variety the plant will grow without being affected by the ordinary variations of the seasons. Then your crops will not be controlled by the weather—they will not be controlled by anybody but yourself; and if you have done your duty intelligently they will hardly vary from year to year or from generation to generation.

Now I have drawn these pictures on the one side and the other, have stated what I believe to be the true method of feeding plants examined from a scientific stand-point, and I have stated

what is the method adopted by farmers as shown by their practice. Now I am one of those who don't believe in eating the pudding bag to find out whether the pudding is good. Many a fine-spun theory turns out to be nothing in practise, and it is fine to spin theories here on the rostrum, but can you carry them out on the farm? We must come down to the hard pan, to the soil, and see if we can make our theories work. Science made practical is what we want. Will it speak out like that on the land? Now, then, to prove this thing, which seemed to be so remarkable, we went to the land seven years ago and tried an experiment, and we have followed it up straight along for seven consecutive years. Within the last year the thing has broken away from us like a wild colt, and run over all the farming community. We couldn't hold it. If you will bear with me I will tell you something of our experiments.

Believing that the principles of plant nutrition as stated are true, the first thing to be done in the series of experiments was to find out what elements the farmer must use in feeding his plants. We began on the soil about Amherst, where the college is. I went to various localities and gathered soils, and in these soils we put plants, and commenced to feed them with one substance and another. Four years we nourished these plants in the hot-house and in the open air to find out what we must use, and after four years Nature seemed to say—Give me potash, nitrogen and phosphoric acid and I will do the work. She said this with reference to such soils as we had gathered from different localities. That seemed to be reasonable.

The next step was this: Chemists know that the different parts of plants require different materials for their nutrition. If I examine an Indian corn plant, I shall find that the roots are made of certain elements in one proportion, and the seeds of the same elements in a different proportion. Now I must find the natural relation between the stalks and the corn. "Humbug!" says somebody. "Don't you know that some corn is cared very differently from some other?" Yes; and that is the very thing I am after. I want to know what is the material that nature must use to make the stalks, and then if I put that in, I shall get just what the corn needs in the way of stalk and no more. So I must know the proportions that exists between the stalks the roots and the corn. That was the next step we had to take, and that was

gone through with for four years, and we kept correcting and revising until December, 1875. Having ascertained this thing, the remarkable statement was made and supposed to be justified by the facts, that you can make plants in any given quantity by supplying to the soil nitrogen, potash and phosphoric acid, in the proper quantity and in the given proportion. In other words, if you give to the soil as much of these three elements as would be contained in fifty bushels of corn and the natural proportion of stalks, you will get that. It is as if I were to ask you how many boxes so long, so wide, and so high, you could make from such and such a pile of boards. You would say so many, according to the number of feet in the pile. So I said, if you give me the material that is required to make fifty bushels of corn, in the form in which the vital forces must have it, cannot I make the fifty bushels of corn? I went to the land to find out. I will not weary your patience with the details of my various experiments. Suffice it to say, that in 1873, in three towns, in more than twenty different places, there wasn't a failure in a single instance with corn, oats, wheat, rye and tobacco. In a single instance there was a failure with potatoes, but not of five bushels less than the amount pledged. In the production of Indian corn we promised fifty bushels per acre more than the natural production of the land, and in no case did we ever run under more than two bushels. On more than three hundred acres of Indian corn all over the State of Massachusetts, from the Berkshire hills to Boston, the underrun, so far as we have been able to ascertain, has been on the whole less than ten bushels. We got almost exactly the quantity we said we would get, sometimes a little more and sometimes a little less, but approximating as nearly as the mechanic would to the boxes from the pile of boards, without knowing the exact number.

Now if you believe these things (and if you don't I can't help it) I have given you some practical information in respect to it so that you can make plants. I will surmise that you will ask certain questions that will be practical. "If you can do these things what will you use to do it with?" "You say, 'certain chemical elements,'—how will you obtain them?" For nitrogen it makes no difference to the plant what you use, provided that the nitrogen is available. You can provide nitrogen in the form of sole leather, and it will take about ten years to render it available. You can provide it in the form of barn-yard manure and it

will take three or four years. You will get but a little touch of it the first year. The best form in which to get it is in the form of sulphate of ammonia. You would better take it in that form rather than undertake to get it in the form of nitrate of soda. You may get it in the form of fish guano, or in the form of Peruvian guano. You need only to have the required quantity of nitrogen, and if you buy it, for instance in the form of Peruvian guano, you must know how much nitrogen you have got. But as I have said, the simplest form in which to obtain the nitrogen is in the form of the sulphate of ammonia.

Now your phosphoric acid. I do not speak of superphospate, nor of phosphate of lime, I mean soluble phosphoric acid. Ground bone treated with sulphuric acid in certain proportions will make a superphosphate which will contain this soluble phosphoric acid. You can buy your superphosphate as you please, or you can make it as I do, by mixing at the rate of one hundred pounds of fine ground bone with fifty pounds of sixty-six degree sulphuric acid. Mix them well with a hoe, and it will give you a superphosphate that shall contain from seventeen to eighteen per cent. of soluble phosphoric acid.

Now comes the potash. I don't care in what form you get it, but my formulas are based on actual potash in the form of a salt of potash. You may get it in the form of wood ashes if you can. That farmer is a happy man who can get all the wood ashes he wants. But in most sections of the country the farmer cannot get wood ashes, and he can obtain potash in the form of German potash salts; these are imported into the country, and yon can get them almost anywhere. For root crops, &c., get them in the form of sulphate of potash; and for all the grain crops, in the form of muriate of potash, for you can get it in that form much cheaper, the muriate containing fifty per cent. of potash. It answers every purpose for corn and forage crops, and you can get a large crop of potatoes with it, but they are fit for nothing but to sell. These are the forms in which I would get the articles. Though a new thing, they are quite extensively imported, and any farmer who wants to do so can get the materials and try them.

I wish to draw a few deductions from the remarks which have been made to see whither we are tending if these things are so. If we are not completely befogged—if one-half that has been said is true, where are we tending in this matter of feeding plants? We have turned the world upside down, so far as the long

accepted views and opinions of farmers in relation to farming are concerned; for if this be true, it is no longer needful to keep a single animal to make barn-yard manure to keep up the fertility of the farm. We have all felt that we could not sell our crops off the farm,—that the man who sells his hay and corn is selling his farm, and will pretty soon have only the subsoil left. That has been our theory and we have all believed it, but if half that I have been telling you is true you don't need to keep this stock. If with a few pounds of materials you can grow crops anywhere and keep up the fertility of the farm to any point you choose, you need not keep cattle on your farm *for that purpose.*

Now I want to meet an objection right here. "Why," says the farmer, "do you mean to say that we don't want any barn-yard manure on the farm? Do you mean to say that barn-yard manure isn't good for anything." Not a bit of it. I never said anything of the kind. Barn-yard manure must still be king. I only said that it wasn't necessary to keep cattle for the express purpose of keeping up the fertility of the farm, and to make crops. In ordinary culture we are obliged to have animals on the farm,—for the dairy, and for beef. We are obliged to keep animals on the farm, and the farmer must be a consummate fool who would let the waste product of these animals run to waste. You need all the barn-yard manure you can get. Utilize it and save it in every available way. Save all the waste of your fisheries, the waste of the different kinds of your manufactories, save all your waste of every kind and from every source, and apply it to your field in the best way that science can teach, and after you have done all this there is a vast waste to be made fertile that you can never make fertile by barn-yard manure, and the waste products that you have worked up from every nook and corner of the land.

One point more. If one-half that has been said is true, then we can make the old hills of New England, these worn-out plains, and these fields that are becoming depopulated by the removal of our sons, we can make them bud and blossom as the rose. We can cover them with the grandest, most luxuriant, and most profitable crops. We can make ourselves richer; we can make the whole country richer; and we can enjoy here privileges of which the emigrant to the West must be deprived. Stay at home, boys, on the hills of New England. If I were a young man, with the light that we all possess, I would make my home somewhere in the Atlantic States. You can make more money here, and you can

do more good by staying here, than you can by going anywhere else in the territory of the United States.

I am done, but this subject is a great one, and I have passed over it hurriedly. It is full of detail—full of special points. To me they are all familiar, and if there are any crooked things about them, anything that is not perfectly understood, I will answer any question in relation to it which gentlemen may wish to ask.

QUESTION. Is there not plant food enough wrapped up in our soils if we could only unlock it?

PROF STOCKBRIDGE. The gentleman asks a question which leads on another track. I have not said a word about the physical condition of the soil, though that is very important. I assume that no man will think of such a thing as feeding plants, using a costly fertilizer, unless he has secured the proper physical condition of the soil. What! put a manure that costs from $10 to $80 per ton on land that is so saturated with water that the roots will not take it up, and it must lie dead and dormant? Is there any man who is such a fool as that? Why, you can control the physical condition of your soil, and don't talk to me about feeding plants until you have put the soil in the proper physical condition. Do that and then use your barn-yard manure and your chemical fertilizers, and you will get well paid for your labor. If you don't do it you might as well put them in the fire.

QUESTION. In what condition is the land left for the culture of grass or grain?

PROF. STOCKBRIDGE. It is in better condition than before it was worked. I know somebody will say that if you raise crops in this way you will ruin your land. Not a bit of it. Your land will be better the second year than it was the first. Land manured in this way in 1874 bore 98 bushels per acre of potatoes, and planted and manured in the same way in 1875 made 51 bushels more. Corn planted and manured in this way in 1874 made 104 bushels to the acre. The same land planted in 1875 without manure made 30 bushels of corn in excess of the natural production, as the second result of the manure.

QUESTION. What is the cost of the materials?

PROF. STOCKBRIDGE. They will cost enough in Maine. The sulphate of ammonia and the potash salts come from abroad, and the prices vary with the fluctuations of gold. The variation wouldn't be perhaps more than $3, $4 or $5 per ton. Last year the

materials cost something less than $70 per ton. Sulphate of ammonia is about $100, potash from $30 to $40, and phosphoric acid from $40 to $60 per ton. The material is dear, and yet after the supply of barn-yard manure and compost made on the farm is exhausted, I consider this the cheapest manure that can be bought. A ton of the material is enough to manure four or five acres in a way which is equivalent to the use of six or seven cords of barn-yard manure to the acre. I have said it was the cheapest manure. Let us see. Last year it cost us $21 to make 50 bushels of corn with the natural proportion of stalks. It may cost a little more or a little less this year. You say at once that is 42 cents per bushel. But when I harvested my 50 bushels more than the natural yield, I harvested 94 bushels of shelled corn from the acre, and the stalks are worth $8 per ton. I can make money at that rate with corn at present prices, and stalks at $8 to $10 per ton. The soil will produce something of itself, and it ought to produce enough to pay for the cost of cultivation, the taxes, and the interest on the land. If it won't do this the farmer has no business to own it. The amount produced by the fertilizer is the amount above this natural production. In our experiments the natural production was ascertained in each case by planting a piece of unmanured land of like size and quality.

Mr. LYMAN H. WINSLOW of Nobleboro'. Suppose you had a piece of land that you intended to plant with corn, and had manure carted on it which you regarded as sufficient dressing, would you apply this fertilizer to that land?

PROF. STOCKBRIDGE. I would do this: Plant the land as you have proposed, getting if you like a little sulphate of ammonia to start your crop; then plow up some of your worn-out land that won't bear anything and raise from seventy-five to one hundred bushels of corn to the acre, by the use of chemicals.

PROF. STOCKBRIDGE'S FORMULAS.

The following are the formulas of Prof. Stockbridge for the preparation of his various special fertilizers: Column 1 gives the quantity of the crop, including the natural proportion of roots, stalks, leaves, pods, &c., to be produced in excess of the natural production of the soil. Column 2 gives the quantity of nitrogen necessary to produce this given quantity, and 3 the form in which it may be obtained; 4 of the second element, potash, and either 5 or 6 the form in which it may be obtained; 7 of the third ele-

ment, phosphoric acid, and 8 the form in which it may be obtained. The formulas are based on the supposition that the sulphate of ammonia contains 24 per cent., the sulphate of potash 35 per cent., and the muriate of potash 80 per cent. dry salt, and the superphosphate 13 per cent. of soluble phosphoric acid. Of course, should the articles vary from this standard in quality, the amount used should be proportionally diminished or increased as the articles are stronger or weaker. For example, if the superphosphate used contains 18 per cent. soluble acid, divide the number in column 8 by 18 and multiply by 13.

CROP.	Nitrogen.	Sulphate of Ammonia.	Potash.	Sulphate of Potash.	Muriate of Potash.	Phosphoric Acid	Superphosphate.
100 bushels Potatoes per acre.....	21	105	34	225	–	11	85
25 " Oats (32 lbs to bushel) per acre.	23	115	20	–	40	12	90
50 " Indian Corn per acre.....	64	320	77	–	154	31	248
20 " Beans "	53	265	30	198	–	20	160
25 " Buckweat "	37	185	50	–	100	15	105
20 " Winter Rye "	25	125	24	–	48	16	128
25 " Wheat "	41	205	24	–	48	20	160
2 tons Fodder Corn "	20	100	66	–	132	16	128
100 bushels Ruta Bagas on a given area....	11	55	18	118	–	8	63
100 " Beets " "	11	55	25	155	–	6	50
100 " Onions " "	11	55	9	54	–	4	32
1 ton Green Cabbage " "	9	45	15	90	–	6	48
1 " Mixed Hay per acre	36	180	31	–	70	12	95
1 " Red Clover Hay per acre.....	43	215	40	–	80	11	85
1 " Herds-Grass Hay "	24	120	27	–	54	10	80
2 " Rye Straw "	10	50	31	–	62	8	64

The mixture is purely mechanical, but the more thoroughly the ingredients are mixed the better. Apply the mixture to the surface after plowing, and cultivate or harrow it in. If you feel a little "ticklish" about it, strew it along the line of the furrow, and then go along and plant your crop, but never do such a thing as drop it in the hill.

The following questions were put to PROF. STOCKBRIDGE, and answered as follows:

QUESTION. Do or do not plants derive benefit from the ammonia escaping from barn-yard manure in the process of decomposition?

ANSWER. Barn-yard manure has in it a large percentage of nitrogen. I have already stated that nitrogen in the form of sole leather was good for nothing, because it was not developed. In the form of barn-yard manure it is good for nothing until it is developed. Now I understand the question to be, if this decom-

position takes place in the soil, in what stage of decomposition is that nitrogen most available? I don't care where it decomposes, only to make it immediately available for plants you must decompose it before it is put in the soil. If you do that there should be some material applied that shall absorb the ammonia—as loam, muck, sulphate of magnesia or sulphate of lime.

QUESTION. Is it better that this decomposition should take place before it is put in the soil or that the manure should be applied in a green state and the decomposition take place in the soil?

ANSWER. I suppose the gentleman wishes to start this question—Which is best, a quick or a lasting manure? I say a quick one. No man can afford to use a lasting manure if it is a high priced one. Your plant cannot afford to wait—our summers are short. The better way for the plant is that the manure should be decomposed before it is put in the soil, and then your plant gets a quick growth.

QUESTION. What effect does the decomposition of manure in the soil have on the soil itself?

ANSWER. I am one of those who believe that when the Almighty made this earth—ground up the rocks and made the soil—that he made it with a capacity of being all converted into plants, from the surface to the bed-rock. Of course it would take some time to convert it all into plants. Now, then, the lime, potash, phosphoric acid and the rest, must be developed. If you put into the soil green manures, or anything of that nature, they develop carbonic acid, and insoluble matter is gradually made soluble. There are other changes, but this is the main one.

QUESTION. Does not potash alkali have a tendency to decompose very rapidly?

ANSWER. The effect of wood ashes or potash in the soil is both chemical and physical, and if it is put into the soil a round of changes is started which moves on and on, and does not cease for a long time.

HON. C. J. GILMAN. It is very well known that the porgy fishery is an element of wealth along the coast of Maine, and that we have quite a large amount of what is called porgy-chum. I would like to know of Prof. Stockbridge what is his experience or knowledge as to the mode of applying that manure—whether composted or in a raw condition.

PROF. STOCKBRIDGE. I have seen porgy pomace, or fish guano as we generally term it, used in various ways on the farms of Massachusetts. It is quite generally used there as a compost. The farmers there like to kill two birds with one stone, and the porgy pomace will develop the muck, and the muck makes a valuable compost. I have seen the pomace sown broadcast on the land and plowed in, and harrowed and cultivated in, with good effects in all cases. From my stand point I should never use it alone. It is one of the best practical sources of nitrogen. I think it must be cheaper than sulphate of ammonia. If you put potash with it, it will be more valuable than in any other form I know of.

Mr. PETER W. AYER of Waldo county. I am mortified to think that our pasture land in New England has deteriorated so badly. In my section the farmers adopt a mixed method, and feed their pasture with sheep as well as cattle and horses. It has been our practice to have our pastures in several inclosures, and feed with sheep several years, then change to cattle, and do the same over and over again. Now under that system of pasturing our pastures have not deteriorated in the manner spoken of, though I know that they are not so good as those in the valley of the Kennebec, of the Sebasticook, or of the Sandy river. I know very nearly the size of many farms and the stock they carry, and reducing the sheep to cattle as to the amount they require, I think with us it takes about three acres of land to carry a cow. Now why is it that pasturing with sheep enriches the land? Do they return more nitrogenous matter to the land in their manure than cattle, or does the carcass of the sheep require less of these essential elements to built it up? Also what would be the effect of top-dressing with gypsum?

PROF. STOCKBRIDGE. From the stand point of the gentleman, the manure of sheep is no better on a pasture than that of cattle.

Mr. AYER. I know that sheep will make a pasture miserably poor for themselves in making it rich for cattle.

PROF. STOCKBRIDGE. The question cannot be answered fully in a moment. I said that in Holland an acre of land will carry a cow and a sheep. Why not a cow and a calf? Because the cow and the calf would seek the same plants for their food, and a cow and a sheep wouldn't, and so if we pasture these two on the same land they will not interfere at all with each other. But if you pasture land heavily with sheep alone, they will bite the plants

which they require so closely that they will finally destroy them, and leave the plants that the cattle want, to grow, so that the pasture is improved for cattle. The question was asked why the manure of sheep is better than that of cattle? The difference is in its physical condition. The manure of cattle and sheep fed on the same substance is about the same.

Plaster is used everywhere and for all crops, and you will hear wonderful stories of its effects. Should there be a very great want of sulphur in the land, or a great amount of decomposition going on, the application of plaster would produce chemical changes, and very marked results would follow. If there is nitrogen or ammonia being formed it would convert the volatile gases into soluble salts. Again, if there is organic matter to be decomposed decomposition in that soil would set the lime free and a round of changes would go on that would develop plant food. On a light soil where no decomposition is going on you would not get that result.

SECRETARY BOARDMAN. Will you give us the proportion for the compost of porgy scrap with ashes and lime for a top-dressing for pasture or mowing lands?

PROF. STOCKBRIDGE. I should use them on pasture lands of the second class, for on the steep side hills they are not easily drawn. Take two hundred pounds of porgy pomace, containing about seven per cent. nitrogen as I remember, and mix it with twenty bushels of wood ashes and three casks of lime. I would rather, myself, have the porgy pomace made fine and sow it on, and then sow on my ashes, and not take the trouble to cast on the lime. I should get twenty pounds of potash for the mineral element, and that would make a good top-dressing.

TAXATION.

By Prof M. C. Fernald, Maine State College.

In the history of very ancient times we read of the payment of tolls, of tributes, and of customs. More than six hundred years before the Christian era, land was taxed,* and silver and gold exacted from the people for Pharaoh the Egyptian king.

From high authority,† we learn that as early as the fifth year of the Christian era, "there went out a decree from Cæsar Augustus that all the world‡ should be taxed. And all went to be taxed, every one into his own city."

The general decree of taxation has never been repealed; but in recent times, could the record be made by the inspired writer, instead of saying, "and all went to be taxed, every one into his own city," he would be forced in truthfulness to say, "and as many as possible *fled* from their own cities to escape taxation."

Of more recent origin, however, is the scheme of taxation now existing in the United States. It has been derived in all its essential features from modern Europe, having its origin in the decline of the feudal system. According to this system the lands of a country were held as *fiefs* or grants of the crown. These grants were allowed on condition that their possessors should perform certain stipulated services, among which, by far the most important was the supplying of the sovereign, when he took the field, with a body of retainers equipped and maintained at their own expense.

The slow but sure advance of civilization brought about the overthrow of the feudal system, and on its decline a system of money payments was gradually substituted for personal services, a system which has extended to different governments, until the method of pecuniary contribution may now be regarded as universally established.

It is not material whether we regard a tax as a contribution of the individual, made necessary from his relations as a social being

* 2 Kings, 23-35. † Luke, 2-1. ‡ Roman Empire.

to society—a contribution which the law of his own well being requires—or an assessment made in consequence of the protection which the State affords and guarantees to the citizen in his person and his property. Whichever or whatever view we take of the theory upon which taxation is based, the stern facts with which we have to deal are still the same. The right of a government or State to raise needful revenue, either by direct or indirect taxation, or by both methods, is not a matter or controversy.

Given in our own State a property valuation of two hundred and fifty-five millions of dollars, and an annual direct tax of approximately six millions of dollars, the problem for solution is, to determine in what way this sum shall be apportioned so that every citizen sharing its benefits shall bear his just proportion of it. A does not so much complain that he has a tax to pay, as that B, considering his ability, should not be required to bear his full proportion of the burden, if it be deemed a burden.

It must be admitted that no system of taxation has ever yet been devised, nor is it within the range of human skill to devise a system which will reach with perfect equality every member of society. The scheme which is perfectly adjusted to one set of circumstances may work great injustice when applied under other circumstances.

An examination of the Maine statutes reveals the fact that this problem has received the thoughtful and careful consideration of our legislators, and that the greatest inequalities in taxation arise, not from the nature of the laws, but from their application, or rather their non-application, in individual cases, whereby a large amount of property, by law taxable, escapes the notice of inspectors. We apprehend the nature of the problem in our own State more fully from the following considerations:

In the First Annual Report of the "Wealth and Industry of Maine," by W. E. S. Whitman, Esq., we learn that the average percentage of taxation in fifty-seven cities and towns, in 1870, was .027, while in 1873 it was .024. Assuming the mean, or about .025,* to represent the average percentage for the towns and cities of the State, and the valuation reported in 1873, viz. $242,808,688, as the true valuation, we find approximately the annual revenue raised by direct taxation to be $6,070,217. This

* The State Treasurer, Hon. S. C. Hatch, estimates the average percentage of taxation in the State between .025 and .0275.

amount divided by 626,915,* (population in 1870) gives $9.68 for every man, woman and child in the State.

That we may justly recognize our own position in this matter with relation to that of the citizens of other States, it may be of interest to compare the taxation per capita in Maine with that of some of our sister States. The following exhibit of taxation in several States is taken from the "Report of the Commissioners to Revise the Laws for the Assessment and Collection of Taxes," for the State of New York, in 1871:

"Vermont.—Population (census 1870,) 330,552; aggregate taxation, 1870, (State, county and school taxes official, town taxes estimated,) $1,750,000; taxation per capita, $5.29."

"Ohio.—Population (census 1870,) 2,662,214; aggregate taxation, 1869, $22,232,877; taxation per capita, $8.72."

"New York.—Population (census of 1870,) 4,364,375; aggregate of taxation, $50,328,684; taxation per capita, $11.55."

"Massachusetts.—Population (census 1870,) 1,457,351; aggregate taxation, $21,922,569; taxation per capita, $14.35."

The above States undoubtedly represent the extremes and approximately the mean of per capita taxation of the different States. It will be perceived that the direct taxation per capita in Maine is less than the average for these four States. A per capita tax, however, of $9.68, represents only about one-half the actual tax per capita of our population, provided the people of this State pay proportionally with the people of the other States to the revenues of the federal government. As these revenues, however, are derived chiefly by indirect taxation, they do not enter into the problem of revenue to be raised annually by the different States, and hence for the present purpose may be disregarded.

Notwithstanding the high rate of taxation to which our people have subjected themselves during the last decade, it is gratifying to note the constant and substantial growth of wealth and prosperity. In 1860, the valuation of Maine was $162,158,581; in 1870, $224,822,860; and in 1873, $242,808,688. During the decade from 1860 to 1870, the increase in valuation was about 35½ per cent.; from 1870 to 1873, about .08 per cent. Carrying forward the rate of increase proportionally, the valuation of the State cannot be less than 255 millions, and is probably greater than 260 millions of dollars, conceding the method of determining

* Very nearly correct for the present date.

the valuation to be correct. In this estimate no allowance is made for a temporary shrinkage of values; and, on the other hand, the under-valuation of property for purposes of taxation is not taken into account. Were the latter element considered, and were all the forms of "invisible" property which should contribute to the public charges brought into the estimate, it would be swelled by more than one hundred millions of dollars.

Of the average percentage of tax, which has been assumed to be about .025, from .004 to .005 are appropriated for State tax, about .001¼ for county tax, and the remaining portion, or from .018¾ to .019¾, for town purposes; or, in other words, of an estimated revenue of $6,000,000, about $1,000,000 or $1,200,000 are required for the State, about $360,000 for county purposes,* and not less than $4,440,000 for town and municipal purposes.

It is not to be expected that these several sums can be materially reduced within the next decade or during the period of cancellation of (what are termed) our war debts. While the rate may gradually diminish in consequence of increasing wealth and prosperity, it may fairly be assumed that the aggregate revenue from taxation will increase with each decade, so numerous and necessary are the objects to which this revenue is devoted. Welcome as are all honest and well-considered efforts at retrenchment, yet the thoughtful tax-payer would hardly welcome any *very large* reduction of the aggregate revenue, since he would see involved in it a sacrifice of interests which the people of the State could ill afford.

This point will be more fully elucidated by transcribing from the report (before referred to) of the New York Commissioners: "But although taxation is deprivation, or the taking away of a portion of one's wages or income for other than personal purposes, it is not by any means to be argued that taxation, in itself, is necessarily an evil. On the contrary, it can probably be demonstrated that there is no one act which can be performed by a community which brings in so large return to the credit of civilization and general happiness, as the judicious expenditure for public purposes of a fair percentage of the general wealth raised by an equitable system of taxation. The fruits of such expenditure are general education and general health, improved roads,

* The county estimates transmitted to the House of Representatives by the Secretary of State for the ensuing year (1876) aggregate $383,221.

diminished expenses of transportation, and security for life and property. And it will be found to be a general rule, that no high degree of civilization can be maintained in a community, and indeed, that no highly civilized community can exist, without comparatively large taxation; the converse of the proposition, however, at the same time not being admitted, that the existence of high taxes is necessarily a sign of high civilization. Thus, for example, observations made" . . . . "in the German States, which, since 1866, have been forcibly incorporated with Prussia, show that, notwithstanding the former have been subjected to a greatly increased burden of taxation, they have at the same time enjoyed a greater measure of prosperity; the same being mainly due to an improved administration, of which the increased taxation was a necessary incident. In short, taxation in itself is no more of an evil than any other necessary and desirable form of expenditure; but it is an evil when taxation is rendered excessive through injudicious or wasteful expenditures, or when by reason of ill-adjustment the levy of the tax is made an occasion for the collection from the people, through the enhancement of profits and prices, of a far greater sum than is requisite to meet the public expenditures."

It is hardly necessary to say that the large revenue deemed needful for the purposes of the town, the county and the State, is chiefly realized by a direct assessment upon real estate, upon polls and upon personal property. The manner of its distribution and adjustment is a proper subject of examination, and will be briefly considered in some of its prominent features

Real Estate.—Sect. 2, chap. 6 of the Revised Statutes of Maine, defines taxable real estate in the following language:

"Real estate, for the purposes of taxation, excepting as provided in section six," (relating to exemptions,) "shall include all lands in this State, and all buildings and other things erected on or affixed to the same, and all townships and tracts of land, the fee of which has passed from the State since the year one thousand eight hundred and fifty, and all interest in timber upon any of the public lands derived by permits granted by the State of Massachusetts; interest and improvements in land, the fee of which is in the State; and interest by contract or otherwise in land exempted from taxation."

The real estate constitutes by much the larger proportion of the property that is taxed in the State, the farms alone in 1873 representing a cash value of $105,021,000, or more than forty-three per cent. of the reported valuation. This form of property being open to inspection cannot fail to bear its full burden of taxation. As regards the method of appraisement of both real estate and personal property, it is questionable whether a fallacious and mischievous policy has not been adopted by a majority of the towns in the State, a method which, it is true, has the sanction of adoption by towns in other States, but not on this account worthy of imitation.

The idea has obtained in many towns that an under-valuation of property, as compared with that of neighboring towns, would secure a corresponding reduction of State tax. This policy is fallacious, not to say dishonorable. The State commissioners on valuation are sure to *doom* a town, and rightly, which seeks thus to gain an unfair advantage. In part at least, as a result of this notion, the method of appraising property for taxation at a certain percentage of its actual value very generally obtains. This would manifestly not be attended with special disadvantage if all the towns of the State were to adopt the same percentage, but as matter of fact the rates range from 25 per cent. to 100 per cent. Of 97 towns whose percentages of valuation have been examined, seven are found to be at 100 per cent., one at 25, three at 33, but the larger number ranging from 50 to 75 per cent. The average for the 97 towns is 69 per cent. Regarding this as an approximately correct average for the towns of the State, it is worthy of attention that the assumed tax of two and one-half per cent. on a valuation (of the property in the State) at the average rate of 69 per cent. is really a tax of only about one and three-fourths per cent. on the actual value.

The advantages of uniformity in the methods of taxation are too many and too great to be disregarded, nevertheless the history of taxation hitherto justifies the assertion that uniformity can be secured only by assessment on actual value and not on a percentage value, whatever be the property real or personal. By this method alone would the timber lands and other unsettled lands in the State contribute proportionally with other property to the revenue raised by taxation. The percentage system runs down to its minimum limit in the care of such lands, and hence they are largely under-valued for taxation, while their actual

value appreciates rapidly, as is shown by the fact that many of our wealthiest citizens have made the rise in value of such property the basis of their accumulations.

From events which have recently transpired in our State, it is evident that such lands are still regarded by capitalists as desirable forms of investment. Such property, however, let us not forget, will never bear its just proportion in assessments, so long as the percentage system is maintained. Is it not surprising that in consequence of the fallacious notion of abatement of State tax, or from that *singular* quality in human nature which leads it to underestimate its own possessions when under the inspection of assessors, or from whatever other cause, towns should adopt and maintain a practice so clearly adverse to their own interests, disregarding the principle that property gravitates to localities of low rates of taxation, whereas by the percentage system the rate is unnecessarily high! It is true the amount of revenue would be neither increased nor diminished by assessment on actual value, but the *rate* of assessment would be *real*, would be *uniform* under like conditions, and would have the very decided advantage of always being lower than by the percentage system. Moreover this method would be in accordance with constitutional requirement regarding assessment by State authority. Article 9, section 8 of the Constitution of Maine, reads thus: "All taxes upon real estate, assessed by authority of this State, shall be apportioned and assessed equally, according to the just value thereof." According to the *just* value, it will be observed, and not according to a percentage value.

Poll Taxes.—In chapter 6, section 40 of the Revised Statutes of Maine, it is provided that in the assessment of all State, county, town and plantation taxes, the assessors "shall assess on the taxable polls therein one-sixth part, as nearly as may be, of the whole sum to be raised; but the whole poll tax assessed in one year upon an individual for town, county and State purposes, except highway taxes separately assessed, shall not exceed three dollars."

The outcome of this regulation is, the poll tax in most towns is a fixed sum, viz., three dollars. A moment's examination of the relation between the entire poll tax of the State and the *whole* amount of tax will show that it cannot be otherwise. In 1870 the valuation of the State was $224,822,860. Assuming the percent-

age of taxation to be .025, which will be conceded not an over-estimate, the entire tax, State, county and town, was about $5,620,572; one-sixth of this amount is $936,762. The number of taxable polls in 1870 was 143,195. Reckoning these at three dollars each, we have for their value $429,585, a sum less than .46 of one-sixth of the entire tax, or in other words the aggregate poll tax at three dollars for each poll is about one-thirteenth the whole tax.

An objection to an invariable sum as poll-tax arises from the fact that the percentage of voters assessed for poll-taxes only, is really large—in many places this class of voters outnumbering all the rest. The majority, in each case, have no check in voting away money for extravagant expenditures, inasmuch as their own tax is not thereby increased.

Of the various plans which have from time to time been proposed for remedying this evil, there is none which seems better to meet the requirements of the case then that suggested by the Assessors of Marblehead, Mass., and endorsed by the Commissioners appointed by the Governor and Council of that State, "to inquire into the expediency of revising and amending the laws relating to taxation and exemption therefrom," in their report of January, 1875.

This system provides a minimum and a maximum limit for the poll-tax, and makes the tax increase with the increase of expenditure, and diminish with its reduction. To use the numbers proposed by the Assessors of Marblehead, the minimum limit would be fixed at two dollars, and "when the amount of town tax to be assessed" should exceed "one per cent. of the valuation of the previous year, the poll-tax would be increased twenty-five per cent., or to two dollars and fifty cents. When the amount to be raised should equal or exceed one and a half per cent. of the valuation of the previous year, the poll-tax would be increased fifty per cent., or to three dollars, and when the amount to be raised should equal or exceed two per cent. of the valuation of the previous year, the poll-tax would be increased one hundred per cent., or to four dollars, and thus with increase of the amount to be raised the poll-tax would increase in like ratio up to the maximum limit."

By this method every voter who pays a poll tax only, would have a direct pecuniary interest in keeping down expenditures, and yet would not be so heavily taxed as to endeavor to limit

unduly, needful appropriations. That system of taxation is faulty which does not make every voter feel in some degree the burden of expenditure which he would not unwillingly allow others to bear, and which by his vote he can place upon them.

It is submitted also, that by the present method the polls of the State bear an inadequate proportion of taxation.

Personal Property.—In the Revised Statutes of Maine, chap. 6, sect. 5, we read that "Personal estate for the purposes of taxation, shall include all goods, chattels, moneys and effects, wheresoever they are; all ships and vessels, at home or abroad; all obligations for money or other property; money at interest, and debts due the persons to be taxed more than they are owing; all public stocks and securities; all shares in moneyed, railroad and other corporations within or without the State; all annuities payable to the person to be taxed, when the capital of such annuity is not taxed in this State; and all other property included in the last preceding State valuation for the purposes of taxation."

Equitable taxation of personal property can hardly be expected. The taxing of real estate presents no serious difficulty, but the taxing of personal property is attended with so many and so serious difficulties that conflicting opinions exist in regard to the expediency of this assessment. There are those who claim that it would be better to avoid all "inquisitorial" methods and levy assessments only on real estate or "tangible property and fixed signs of property;" thus exempting a large portion of the wealth of every civilized community.

There are decided objections to such a method; among which may be noted the most obvious, viz: disproportionate taxation, in that those possessed of "invisible" property, who are generally best able to bear the burdens of taxation, escape them most largely. A full discussion of this method would transcend the limits set for this paper, and may well be omitted, since any radical change of State law in regard to taxation of personal property is not at present to be expected, if indeed to be desired. A rigorous enforcement at the hands of assessors, of the law as it now stands, touching "all goods, chattels, moneys and effects, wheresoever they are; all obligations for money or other property; money at interest and debts due the persons to be taxed more than they are owing," would distribute the burdens of taxation

and reduce its percentage in a manner that would be surprising even to the assessors themselves.

It is said that custom makes the law, but custom does not make the statute. The statute exempts household furniture "not exceeding two hundred dollars to any one family." The law of custom in many towns exempts household furniture to five times this amount. The statute demands a tax upon a gold watch; custom generally exempts the watch. The statute in exempting "farming utensils, mechanics' tools necessary for carrying on his business," "mules, horses, neat cattle, swine and sheep less than six months old," discriminates in favor of the man in limited circumstances, and with propriety. Custom discriminates, by permitting larger exemptions in favor of the wealthy; not designedly so, let it be understood, but so difficult is it without a most rigorous "inquisitorial" system to keep trace of invisible property, as money, notes and mortgages, that assessors are wont to allow large amounts of this class of property to evade taxation.*

Massachusetts has pressed the taxation of personal property more vigorously, and perhaps with greater success than any of her sister States; and yet her commissioners on taxation (referred to above) admit the complete impossibility of reaching *all* the property subject to assessment. They say: "That personal property in Massachusetts, declared by her laws to be subject to taxation, does in some degree escape assessment, it is impossible to deny. The most vigilant of assessors cannot find it all, and there are not wanting those in every community willing to invoke the name of their Creator to the truth of a statement which is a falsehood and a fraud. There are not wanting officers who shut their eyes to the facts they have sworn to observe, in the supposed interests of the locality of which they are residents, and help the possessors of wealth to act the lie they dare not utter."

The Maine statutes, chapter 6, sections 65, 66 and 67, furnish to assessors essentially the same method of ascertaining the per-

* A gentleman, who is a shrewd observer, and who has given much thought to this subject, furnishes the following statement:

"The aggregate value of personal estate is largely underestimated. The amount in bonds, bank stock and fire risks shows this to be the case. Now the personal property of the State is estimated at about fifty per cent. of the taxable value of the real property, whereas reliable data show that the two are equal, so that at least $70,000,000 of personal estate escape taxation."

This difficulty is by no means limited to our own State, but obtains wherever such property is subject to taxation.

sonal property of individuals as do the Massachusetts statutes. The system of "listing" is the one required by law in both States.

If those subject to taxation fail to make and bring in to assessors, after due notice, "true and perfect lists of their polls and all their estates, real and personal, not by law exempt from taxation, which they were possessed of on the first day of April of the same year," they are barred from the right of application to the county commissioners for abatement of taxes, unless it appear that they were unable to offer such lists at the time appointed. Moreover, assessors may require those presenting lists to take oath to their truth; and thus, if lists be not furnished under oath, assessment can be made according to the best information assessors can obtain.

If a man is "doomed" heavily by the assessors, he simply pays for the luxury of not furnishing requisite information. Only by the persistent practice of "*dooming*" heavily, in case sworn lists are refused, can invisible property be made to bear anything near a just proportion of taxation.

It is a question of alternatives with the inhabitants of towns, whether they will inaugurate a vigorous policy and elect officers with the understanding that they shall vigorously apply the law and force a tribute from invisible property which now largely escapes taxation, or allow so large an element of wealth to evade its proper proportion of the common burden.

In connection with this subject it may be well to consider the propriety of a change in the tenure of office in the case of assessors or selectmen of towns where *they* are made assessors. By not a few has the suggestion been made to choose selectmen for three years, as school committees are chosen, one going out of office each year, so that it will become the duty of each member of the board to make himself familiar with the duties of the position—a task generally devolving upon the chairman. It is claimed that a more rigid enforcement of the statutes could thus be secured, than is secured while the members of the board expect their places will be taken by others at the end of the year.

In treating of personal property subject to taxation, there is no more perplexing topic than that of the disposition of mortgages in relation to assessment. It is conceded that real property should be taxed wherever found, but it is claimed by many that if the property is taxed, and also a mortgage upon it, it is double taxation.

If A buys a farm worth $10,000 and can pay $5,000, and mortgages the farm to B for the remaining $5,000, evidently A's ability in this transaction with reference to assessment is $5,000; B's ability with reference to the same is also $5,000, for he holds a note and other security for that amouut. Now to tax A for only $5,000 would be in violation of a principle generally accepted, that real estate has an ability with reference to taxation, represented by its value, however owned or encumbered. In the State of Connecticut, it is true, A would be allowed an "off-set" or "deduction of the amount of the mortgage, upon making it certain that the mortgagee shall be taxed in the State for the amount deducted;" but in most of the States A would be required to pay tax on the entire property notwithstanding the mortgage. The question at once arises, shall B be taxed for the amount of the mortgage? If taxed, is it not a case of double taxation? If not taxed, does B bear his part in the scheme of taxation in proportion to his ability?

Again, if B is taxed on the mortgage will he not in consequence obtain a rate of interest for the money loaned, which will virtually impose the tax on A, and thus make A with an actual ability of $5,000, pay a tax upon $15,000? These are questions often argued, but never settled. Like Banquo's ghost, they will not "down" at our bidding. Whatever view be taken, we find ourselves between two horns of a dilemma. If deductions are allowed in consequence of mortgages, the door is opened for an infinite amount of fraud and deception. A practical difficulty arises also when the land is in one town and mortgage is held in another town, in consequence of the different rates of taxation. The case is still worse if the land is in one State and the mortgage is held in another State. Considerations like these have induced most States to levy the tax upon the full value of the land in the town where it is located. But what shall be done with the mortgage? Shall it be taxed or shall it be exempted? The answer to this question given by the Massachusetts Commissioners on Taxation, (1875) which is but an endorsement of the Massachusetts system in relation to this subject, seems eminently wise and just. The system which they recommend does not tax mortgages as such, but as credits. A mortgage may be given to secure against a contingent liability or to insure the performance of a certain act, and would not be taxed to the holder, until "by some breech of con-

dition there becomes an obligation or credit due to the holder of the mortgage."

In the case supposed the mortgage or note which the mortgage secures, held by B, is a credit for $5,000. He is taxable upon it as a credit. Should A prove insolvent and B take possession of the property, the mortgage and note still held by B are worthless as a credit and hence cease to be taxable. He is now assessed "upon the land of which he is in possession and in respect to which he has ability." By this method the assumed basis of taxation is the value of property held—a principle in itself *just*, and its application *practicable*.

Income Tax.—Political economists generally agree that the true theory of taxation is that which derives all revenue for public purposes by an assessment upon incomes rather than upon property real or personal, inasmuch as the net income of individuals is an exact measure of their ability to contribute to the public expenditures. There may be practical difficulties in the way of adopting such a method of taxation as a whole, but it does seem as though it ought to supplement any other method, otherwise many persons escape taxation whose ability is equal to that of their neighbors, who in consequence have more than proportional burdens to bear. A earns $5,000 in a year and invests it in a farm, on which he afterwards pays annual taxes; B earns $5,000 in a year and invests it in United States bonds, exempt from taxation, and thus evades a contribution to the common charges. A tax on income secures a contribution from each individual according to his ability. Such a tax should not be limited to money earned by a trade or profession, but should apply to all incomes from whatever source.

The objection on the ground of inequality, to taxing incomes derived from business requiring capital which is taxed as property, is met by allowing a deduction from the gross income of a certain per cent. (six per cent., for example) of the assessed value of property from which the income is derived. An exemption of perhaps a thousand dollars, or at least an amount sufficient to cover the ordinary living expenses of an average family, would be in accordance with the theory upon which exemptions in general are made. The "inquisitorial" system obtains not more in the taxing of incomes than in the levying of a tax at all on invisible property. Unless the system of taxing personal property be

dispensed with, there is no valid reason for excluding an assessment on incomes, while there are the best of reasons in the equalizing of the burdens of taxation in favor of such an assessment. The assessment and collection of the tax present no greater difficulties in the one case than in the other.

Railroads.—The real estate of railroad corporations is taxable in the towns where located, but the track of the road and the land on which it is constructed is not for this purpose deemed real estate. Until recently no franchise tax has been required of the railroads in this State. In accordance with the recommendation of Governor Dingley, a legislative enactment was made in 1874, and approved March 4, 1874, requiring that "every railroad company incorporated under the laws of this State, or doing business therein," . . . . "shall annually pay a tax of one and one-half per cent. upon its corporate franchise," as determined by the Governor and Council. A portion of this tax when paid is to be credited to towns where shareholders reside and the remainder to be retained for the use of the State. From the report of the State Treasurer for 1874 we learn that, "The total amount of the tax assessed upon the several railroad companies for 1874 was $105,059.23. About $40,000 of this amount, when paid, will, under the act, be placed to the credit of the cities and towns where the shareholders reside, the balance accruing as revenue to the State." The report of the State Treasurer for 1875, (received since writing the foregoing statement,) does not furnish occasion for material change in the above figures.

The levying of this tax has given rise to cases of litigation, but when these are once settled it may doubtless be depended upon as a source of increasing revenue to the State. Many of our sister States raise a portion of their revenue from a tax on corporations, and there are equally good reasons why a part of the revenue of this State should be derived from the same source.

Insurance Companies.—By legislative enactment, approved March 4, 1874, foreign insurance companies doing business in this State are required "annually" to "pay a tax upon all premiums received, whether in cash or in notes absolutely payable, in excess over losses actually paid during the year, on contracts made in this State, for the insurance of life, property or interests therein, at the rate of two per cent. per annum." The revenue from this source may not be large, but it is eminently just, and to the extent of its amount will relieve direct individual taxation.

Savings Banks.—The original design of these institutions was to furnish places of deposit for the savings of persons of limited means, where the money would be secure and would make a moderate gain for the depositor, thus favoring habits of thrift and economy. In this regard they have undoubtedly accomplished a beneficient result.

In view of their design the privilege of exemption from taxation was practically accorded (although not by legal enactment) to all deposits in the savings banks of this State until 1872. From the fact that to a limited extent, at least, these banks came to be regarded as also places of investment for the funds of the capitalist, or a cover to shield them from the burden of equal taxation, the propriety of exemption was no longer conceded, and in 1872 a tax of one-half of one per cent. was imposed upon all deposits, and in 1874 this tax was increased to one per cent., one-half of which is devoted to the common school fund and the other half directly to the use of the State. From this source in 1875, a revenue of more than $300,000 was derived. The growth of these institutions in this State is indicated by the following facts and figures: In 1867 the amount of deposits was $5,598,600.26;* in 1868, $8,032,246.71;* in 1869, $10,839,955.26;* in 1874, $31,051,963.73;† in 1875, $32,083,314.28.†

In 1869 the number of depositors was 39,527, giving an average amount to each depositor of $274.24; in 1875 the number of depositors was 101,326, and the average amount to each depositor $316.63. The large number of depositors indicates the important work these banks are doing, and the average deposit shows either that a large majority must have stored in them only small sums, or they are but little used in this State by capitalists and for screening money from local taxation. Nevertheless, so long as only limited amounts deemed justly taxable really escape local assessors, they serve as occasions for complaint, and help more and more to loosen the hold of assessors upon invisible property. Two plans for their assessment are more or less discussed. The argument for the plan in favor of local taxation is of the following character: Notwithstanding the very considerable revenue which accrues to the State from the tax on deposits, it is a question worthy of careful consideration, whether more satisfactory results

* Report of Hon. A. W. Paine, Bank Examiner, 1869.

† Report of Hon. W. W. Bolster, Bank Examiner, 1875.

would not be secured by furnishing to local assessors the means of taxing all deposits by one individual above $500, whether these deposits be in one or several banks.

By exempting $500, it is claimed, the original design of favor to those in limited circumstances would be preserved, while the large deposits, where such exist, would bear the assessments they have been seeking to escape, or be driven from the banks, leaving them, according to the original intention, for small deposits. It is also urged that the revenue from the State assessment on deposits is of an unstable and uncertain character. In 1872, the tax was one-half of one per cent., in 1874 it was increased to one per cent., but it is now proposed by the Bank Examiner to reduce the rate to three-fourths of one per cent. What changes are in store for the rate in the future cannot now be foretold. It may be increased to two per cent., and may be entirely remitted.

When these deposits above a fixed sum are open to assessors for taxation, they will then bear this burden in the different towns and cities in the same proportion as other forms of property, and thus satisfy the very just demand for equal taxation, and furnish to different localities the precise revenue from this source, to which they are entitled.

This result could be practically secured by enactment requiring the officers of savings banks to make returns to local assessors of the names of depositors in the different towns and cities of the State and the amount of their deposits. On the other hand, it is claimed that the plan of municipal taxation of these deposits would devolve a vast amount of labor upon the bank officers, that from the variable rate of taxation in different towns that tax would be inequitable, that the system would inevitably be brought into confusion, in a word, that the whole scheme is impracticable, whereas the plan of State assessment is simple, the money easily collected, and the revenue from it vastly greater than would be derived by the other method were an exemption allowed, inasmuch as such exemption would cover the greater part of the sum invested in these banks by most of the depositors. It is also claimed that by devoting this revenue to the public schools, and to an allowance on the State tax, the poorer towns having no deposits in savings banks receive the benefit of a portion of this tax at the expense of their more prosperous neighbors. The arguments on both sides are pointed and forceful, and the two plans by widely different methods are far reaching in their results.

From the limited examination it has been my privilege to give to this part of the general subject, the conviction impresses itself more and more fully upon my mind, that if the present rate of one per cent. on all deposits, or one more nearly approximating the average rate of taxation in the State *can be maintained*, it would not be advisable to change the present method,—but rather than admit any abatement of the present tax, it would be better to open the deposits, either with or without exemption, to local assessment.

Discount for prompt payment.—In many towns the custom prevails of discounting ten or more per cent. for the payment of taxes on or before a specified date—generally the first of August. The advantages claimed are, low compensation for the collector and a large percentage of the tax in the treasury at the specified time; and it cannot be denied that these are real advantages provided they have not been too expensively purchased. On the other hand, it is worthy of note that "the allowance of the discount works inequality between the tax-payers who can avail themselves of its provisions and those who cannot." Where a discount is to be allowed, an increased assessment must be made, and the unfortunate feature of the case is the fact that those who are least able have proportionally the larger burden to bear. It is in the nature of such a discount that the wealthy can avail themselves of it while the poor cannot.

On the ground of economy the practice cannot be defended, since a discount of ten per cent. for payment within four months (from April 1st to August 1st) is virtually the payment of interest at thirty per cent. per annum. Money can be hired by towns at a lower rate of interest. Moreover it is a questionable policy, that of bestowing a money reward for the discharge of a duty. The demand upon the tax-payer is a just demand for a certain sum known by him, and the "power of the State is behind the tax-gatherer" to insure its collection, hence the practice of discounting is unnecessary.

If a charge of twelve per cent. interest were made after the specified date the conditions of the case would be entirely changed, with equally good prospect of bringing a large portion of the tax at the required time into the treasury. Those who would avail themselves of the discount under that plan would not incur the payment of a high rate of interest, and those who should be

obliged to pay interest would have before them a constant motive to make payment at the earliest day possible; whereas on the discount plan, after the specified date, the only incentive is to put off the day of payment as long as possible. Again, the payment of interest would be in the nature of a penalty for the neglect of duty, and hence consistent with all our other relations to the State, which visits with punishment wrong doers, but does not offer money bounties for right doing.

Exemptions from Taxation.—The propriety of exemption in the following cases is generally conceded, or at any rate seldom opposed. Household furniture, not exceeding two hundred dollars to one family, wearing apparel, farming utensils, mechanics' tools; mules, horses, neat cattle, swine and sheep less than six months old; the polls and estates of Indians; the polls of persons under guardianship; and the polls and estates of persons who by age, infirmity and poverty are unable to contribute toward the public charges.

The matter of exemption of manufacturing establishments is under the control of towns, and hence need not be considered further than to remark, that a wise economy will not unfrequently dictate the exemption of such property for a term of years. The principal exemptions remaining to which attention is directed are the following:

1st. The property of the United States and of this State.

2d. The real and personal property of all literary institutions, and the real and personal property of all benevolent, charitable and scientific institutions incorporated by this State.

3d. All houses of religious worship, and the pews and furniture within the same, except for parochial purposes; and all tombs and rights of burial, and property held by a religious society as a parsonage.

Over the property of the United States the commonwealth has no control, and hence neither the power nor the right to tax it. If the National Government exempts from taxation its securities, the State has no alternative but to accept the condition. Just occasion for complaint arises, however, when in the use of these securities they are made to extend their exempting power to other classes of property; as when a merchant or manufacturer, just before the day of assessment, invests his surplus funds in United States bonds, and directly after the assessment disposes of the

bonds and reinvests the funds as capital in his business. A high morality, if not common honesty, would dictate that investors in these bonds should be content with the exemption accorded to them, and not attempt to make them the instruments by which larger amounts of property than they represent may evade taxation. As regards the propriety of exemption in the case of the bonds themselves, it cannot be forgotten that at the time they were authorized, their acceptance by the people involved questions of patriotism, and faith in an imperilled government.

It may be a source of some satisfaction to taxpayers, to remember that the government securities are largely held in foreign markets, and that five hundred million dollars' worth of these bonds have recently been replaced by securities bearing a lower rate of interest. Exemption extends to the property of the State also. The fallacy of the State's taxing itself is one not likely by any one to be seriously argued.

The eminent fitness of exemption in case of benevolent and charitable institutions is not a matter of controversy. Literary and scientific institutions have been regarded as equally entitled to this privilege. "A general diffusion of the advantages of education" was deemed so "essential to the preservation of the rights and liberties of the people" that the framers of our State Constitution did not fail to require that provision should be made "for the support and maintenance of public schools," as also for the encouragement and endowment of "all academies, colleges and seminaries of learning within the State." This fostering care of her educational facilities has been extended through her history as a State to the present time; and no small degree of her prosperity, her advance in wealth and the comforts of life, the intelligence and sterling virtues which characterize her people, can be traced to this cause.

In 1874, the tax levied for her public schools amounted to $1,387,998,* and whether large or small this sum be considered, she will not be so far neglectful of her own high interests as not to make liberal provision for the education of her people. It must not be forgotten, that in the main her higher seminaries of learning have been endowed and maintained through private munificence, and that the money thus devoted to public uses is forever removed from the opportunity of reproducing itself, except in the intelligence, the graces and higher culture of her citizens.

* In 1875 the amount was nearly as large.

This property deserves very different treatment, as it holds very different relations to the State, from that which is controlled by private parties for individual ends.

The State will be slow to repress, by taxing such property, the liberality of any of her people who by their generous gifts relieve her of a part of the burden which otherwise her own best interests would demand that she assume. As regards local assessment no injustice is done, as is shown by the fact that towns will give large sums to secure in their midst the location of a literary institution.

It is easy of demonstration that the loss from exemption in such towns is more than ten-fold made good in the enhanced value of surrounding property, and in the direct and reflex advantages from such institutions to their citizens. Not until the State can afford to double her prisons, to double her jails in every county, and her poor-houses in every town, can she afford to tax the generosity which through these institutions contributes so largely to her highest interests.

The argument in favor of exempting the property of literary institutions applies to a certain extent with increased force to the property of religious institutions. Whatever religion may do for or teach in regard to the future life, the State has to do with it with relation to the present life,—and she cannot afford to do without so potent an auxiliary in the conservation of social order, in freedom from crime, in the preservation of moral purity, and in all that relates to her own sure and high prosperity. Every civilized nation and state in the history of the world has evoked its aid and more or less prominently contributed to its support and extension.

So far, however, as the purposes of the State are concerned, a church edifice costing from $10,000 to $20,000 contributes as effectually to the end in view as one costing $500,000, and perhaps more effectually. On esthetic principles the more costly building may be the more desirable, but that is not the immediate purpose to be subserved, and hence need not be considered. The argument for exemption, therefore, applies only to a certain amount of church property, and that, the amount by which the interests of the State may be directly subserved.

It may be said that railroads and steamboats, and telegraph lines, likewise subserve the interests of the State. It will be answered that railroads are established, steamboats built, and telegraph lines constructed, to subserve private interests, the

public good not being the chief consideration, and the money invested in them serves for private gain and emolument, whereas the money devoted to benevolent, literary and religious institutions, is all a tax, devoted wholly and purely to public services and for the general weal, and is forever removed from conditions of private gain or advantage.

No one is more conscious than the writer that many topics, as domicile, the taxation of consigned goods, of property in transit, of bank shares, revenue from licenses and fees, which might properly be treated of under the general subject of taxation, have been necessarily omitted. Moreover, the discussion of several topics under consideration, has been too brief to be complete. In the treatment of them, it has been designed that this paper should be suggestive rather than exhaustive.

In the way of recapitulation, it may be well to bring before us in brief review the several specific points which have been favored.

1st. Assessment at *full value* (and not at any percentage thereof) of all property, real and personal, subject to taxation.

2nd. The taxing of polls at a sum made dependent upon the rate of taxation in the different towns, with perhaps fixed minimum and maximum limits.

3d. A vigorous application of all honorable methods, to the end that personal estate, especially "invisible" property, shall bear its full proportion of taxation.

4th. The taxing of mortgages when they represent credits.

5th. The election of assessors for three years; one each year.

6th. An income tax on the amount of income above one thousand dollars. When the income has been derived from business requiring the use of capital which is taxed, a deduction to be made from the gross income of six per cent. of the assessed value of the property from which the income is derived.

7th. The tax continued on corporations, including railroads and insurance companies.

8th. The taxing of deposits in savings banks above five hundred dollars, (or without exemption,) like other property, in the towns or cities where the depositors reside, rather than any abatement of the present tax of one per cent. on all deposits.

9th. No discount for prompt payment of taxes, but the substitution of interest in case of neglect, after a specified date.

10th. The exemptions now authorized by law, with perhaps the exception of church property above fifteen thousand dollars.

During the preparation of this paper, whenever farmers have been asked what class of our population is taxed most heavily in proportion to property, they have invariably answered, *farmers*. Whenever manufacturers have been asked the same question, they have invariably answered, manufacturers; and thus it is, each class regards itself most heavily burdened.

So far as the positive requirements and exemptions of the statutes are concerned, it is safe to say that there is no very material favor of one class above another. In the usual application of the statutes, however, that class whose possessions in the line of vocation are most open to assessors under the present constitution of society, is at an immense disadvantage, a disadvantage which must continue until effective measures be adopted to secure a due proportion of revenue for public purposes from "invisible" personal property.

The arguments of this paper, however imperfect in other respects, have not been directed too earnestly and emphatically toward the policy of equalization of taxation, by insisting upon the importance of bringing the valuation of all property to a common standard, that of actual value, and of distributing the assessment over the largest possible amounts, real and personal, visible and invisible. Perfection in this, as in all things human, is practically unattainable, and the nearest approximation to it can only be had by that toning up of public sentiment which shall visit the man who defrauds his neighbor by false returns for taxation, with merited punishment; which shall require at the hands of public officers the most conscientious and impartial discharge of duty; which shall recognize truthfulness and honesty as among the highest virtues in public as well as in private transactions, and which shall inspire in every citizen a readiness and willingness to bear, according to his ability, his full proportion of the common burden. Toward such a condition of society let it be our endeavor to direct our efforts, remembering that under wise laws, faithfully administered, the State and her citizens attain their truest and highest prosperity; that the blessings we enjoy, of protection, of opportunity, of social advantages, of good government, of civil and religious liberty, can only thus be maintained in their integrity and fullness, and be transmitted unimpaired, in long succession, to all the coming generations.

THE MANAGEMENT OF PASTURES.

By Prof. Levi Stockbridge of the Mass. Agricultural College.

As you remember, I had the honor last evening of addressing you on the subject of plant nutrition. At that time I honestly *thought* that that subject was a very important one. To-day I am to address you on the subject of pasture land and its improvement, and now I *know* I am speaking on one of the most important subjects that can be brought to the notice of New England farmers. Not only is it an important subject to the individual farmer, but it is a question of national importance. We shall see that it is such when we consider the pecuniary value of the grass and hay crop. In stating the value I shall not pretend to be exact, but I think the value of the annual hay crop of the United States is something more than $300,000,000. If we had the value of the pasture grass it would swell the aggregate value to more than $600,000,000, more than the value of any other single crop. Corn, in the best corn year we ever had, reached the value of $600,000,000, and the average crop of grass in the United States is equal to that enormous sum.

But aside from its pecuniary value the hay crop of the New England States has a value that cannot be estimated in dollars and cents. In maintaining the fertility of our mowing lands, and in its general influence on agricultural prosperity, there is no crop which can compare with the grass crop. And yet we are obliged to come together to-day and say that the pasture land of New England has gradually deteriorated from its original condition in its power to produce grass, until to-day it has not the nutritious grasses which alone can make good animals, good butter, good cheese, but hardly more than brakes, brush and brambles. These are the prime crops so far as my observation has extended. Now it is utterly futile for a man to call a piece of ground a pasture, turn animals into it, and expect them to make good meat, butter or cheese, where the animals live on browse.

But these pastures were not always as poor as they are now. Formerly that wasn't considered a good pasture that wouldn't support a cow to every two acres, but now it takes about eight acres of the average pasture land of New England to support a cow, and then the cow comes home at night looking disappointed, as if she had found nothing to manufacture milk from. What is to be done? Here we are getting a little milk and the products of the dairy decreasing. The question forces itself on us—what is to be done? In discussing the question from this standpoint I shall have to go into practical details which, however important, are not always interesting.

In my humble opinion the corner-stone in regard to the improvement of pasture land must be put in the head of the farmer himself. To improve the pasture land of Maine, the chap I should go after is the farmer. While I am not prepared to endorse what has been said about the ignorance of the farmer, it is so far true that in seeking to make great reforms on the farm you must first seek to reform the farmer.

Now farmers of Maine, judging by your practice, what is your opinion of your pasture lands? Do you prize them as valuable property? How do you treat them as compared with your tillage and mowing lands? The farmer seems to think that the pasture is waste land—outside of all husbandry, outside of all tillage, outside of all manuring, thrown out to be pastured by the cattle, and taken care of by the Lord. That is about the general idea which prevails among the farmers of the community. The pasture land may be a piece of swamp—it is all right, it is nothing but pasture. As to going to work on it, and embracing it in the system of tillage of his farm and increasing the production of it, *that* is entirely outside of the farmers thought, as exhibited in his practice. Now the farmer is the fellow I am after; he is all wrong, and the pasture land will never be improved until he is set right.

Now contrast if you will our general idea of the management of the pasture with the idea of the farmers of Holland. There the pasture receives the same or better care and attention than the land from which they get their hay, and in so high a state of fertility do they keep it, that on the average, an acre of land in Holland carries a cow and a sheep—and a cow in Holland means a cow; it don't mean one of your little scrawny, half-fed animals, that we see on our New England hills, but a great, sleek, splendid Holstein. The pasture land there is better cared for and has

more done to maintain its fertility, than any other part of the farm. If we cannot attain to that point here, let us approximate to it. When we have learned the farmer to prize his pasture land, we are prepared to go a step further, and, taking these pastures as they are, see if we can find a way to improve them. The pasture lands of New England were once among the richest lands in the country. They were once fertile, they are now sterile. In tracing the process from fertility to sterility, we ought to find out what we must do to bring about a return to the state of fertility. Now let us trace the process through from the top downward.

The time was when this pasture land was covered with wood. The soil was rich with the accumulation of leaf mould. The farmers unwisely swept off these forests as with the besom of destruction. When they did, that they took the surest course to destroy the agricultural prosperity of the country. They were destroying the climate. The forests were needed to protect alike from flood and from drought. When the forests were destroyed they next did the surest thing to destroy the soil itself. When they burned the refuse wood and timber, they burned not only that, but the top soil itself to ashes. They destroyed all that material which should have developed nitrogen, and that which gave the soil its power to absorb and retain water when they thus burned up this organic matter. Then there was only left a rich mineral soil. The ashes gave it fertility for a time. But if you destroy its absorbing power no soil can long retain its fertility. For a short time the wood ashes gave a slight absorbent power. The land brought into pasture yielded abundantly for a series of years. Then nitrogen failed to be developed in the soil, and that is an element essential to the production of flesh and milk.

Now for the next step downward. A large part of the pasture land of New England is hillsides. These are subject to tremendous freshets. The organic matter having been destroyed by burning, there is nothing to hold the mineral matter, and it is washed away, down into the brooks and rivers. Here then we have another cause of the deterioration of the pastures.

The next cause is that you have put animals on your pasture land, and during a series of years you have built animal carcasses out of the soil. Now a word or two about this. If I grow an animal from the products of my soil I have constructed an animal structure out of the soil of my field. For every full grown ox you raise you have taken from the soil 130 lbs. of phosphate of lime

and 150 lbs. of nitrogen. And so with potash and the other elements of the animal carcass. That animal is a soil product. We are apt to think otherwise. If we grow an acre of corn, *that* we know is a soil product, but an animal, why, that is like Topsy—it is something that growed, that is all we know or think about it. But it grew from the soil as much as did the corn. All flesh is grass. Now the growing of animals year after year and sending them away has been a great source of deterioration to our pastures. Not in one year, but in the course of 150 years, has there been a great drain.

The next source of deterioration of which I shall speak is the production of dairy products. The great farm crop of New England has been the products of the dairy,—cheese, butter, milk. In the vicinity of all our large cities the supply of milk sold from the pasture lands causes an immense drain upon them. Now, then, I say the milch cow, for the pasture, is the worst animal that ever trod it or ever can. A milch cow that gives a large quantity of milk is an enormous feeder. You could not, with all your Yankee ingenuity and skill, devise a machine that could deplete your pasture lands so fast as does this machine for producing milk which you drive into them empty every morning and drive out full every night. Assume that your cow gives 15 quarts of milk a day for five months in a year—they often give from 22 to 26 quarts a day, but call it 15—she has carried away in the milk 30 lbs. of nitrogen, 8 lbs of potash, and 10 lbs. of phosphoric acid. But this machine cannot produce milk unless you keep the machine in order, and provide for its wear and tear. There is a waste in the system that must be supplied, and this supply comes from the pasture. Then there is the indigestible part of the food—the refuse, which we call manure. Now in these three—in milk, in waste of the system, and in manure—your cow carries off every year, 70 lbs. of nitrogen, 20 lbs. of potash, and 40 lbs. phosphoric acid. How many years have you been running this machine at that rate? Through how many generations of cows have the farmers followed this practice in New England? Multiply and see what is the whole amount of which your milch cows have robbed your pastures. In 30 years each cow has carried away 2,100 lbs. of nitrogen, 600 lbs. of potash, and 1,200 lbs. of phosphoric acid. I am well aware that during this period your tillage and mowing fields may have been improved by the manure that has been robbed from the pastures.

Now you can look back and see what has been done by keeping milch cows, and fattening beeves upon the pastures without manuring them, by burning over the land, and depriving it of its absorbent power, and by cutting off the wood.

Now we have got to the bottom of the whole thing. So far as the pasture land is concerned, we are in the "slough of despond." I often hear it said, such and such a farm used to carry thirty head of cattle, but now the buildings have got bad, the lands have grown up to brush, and the inhabitants have left and "gone West;" and unless we take the back track we have got to give it up and go "out West," there to be the same scourge we have been to the hills of New England.

But let us stop here awhile and see if it is not possible to reinvigorate these lands, and if it is, let us try to go back up the hill. We all like to slide down the hill, but it is hard work to get back. If we are not afraid of the work, now comes the practical question—"What are the steps to be taken to get back?"

For the purpose of improvement, we will divide the pasture lands of Maine into three classes, each of which requires a different mode of treatment.

A large proportion of the pasture land of New England is hillside and mountain slope. We have much of such pasture in Massachusetts, and I suppose you have in Maine, though being in Maine for the first time, I have been surprised to have seen, so far as I have gone, so little land of this character. These hill-sides are almost unapproachable, but sheep and cattle scale them. My opinion is that the Almighty, in his kindness and care for his creatures, never intended that such land should be swept of its forests. I believe he intended it to grow wood. I believe that the farmer has undertaken to turn the natural course of things backward—has undertaken an impossibility in undertaking to make these lands grow grass, and that he should give them up to grow wood every acre of them. Not that he should *abandon* them to wood, but that he should plant them with the seeds of trees adapted to the climate and locality, and seduously care for them. I believe in the progressive idea of the abandonment of useless fences, but these lands set apart to wood should be kept fenced; the farmer should surely keep all cattle out, and, if possible, the partridges and rabbits, until these slopes are covered by forests. Not by accident but by design has the great system of Nature been determined; and if the farmers will conform to it in this

regard, the trees will grow up and break the wind currents, turn the courses of the atmosphere, and keep up the perennial flow of our streams. It will be profitable too as a crop, for the wood of course should be cut at maturity as should any other crop.

But there are immense stretches of pasture land which require different treatment. They are on what we call the foot-hills. They are not so elevated and precipitous as those we have been considering, but are too rocky to be plowed. "Why don't you plow your pasture lands?" asked a scientific agriculturist of a New Hampshire farmer. "Plow them?" was the answer. "I'd like to see you run a plow-share through them. Why, we have to sharpen our sheep's noses so they can get them down between the rocks." There is a great deal of this land in these little valleys between the hills upon which, if there is nutrition for it, any sort of grass will grow. What shall be done to renovate this land? Now here I come to tell you what to do. It is nothing but fun for me to stand here and carry on farming. I can grow almost any crop I want to, and I can renovate one of these old pastures as easily as I can do anything else, though it is a different thing, to be sure, when I go into the pasture and bring myself down to the work. Now be patient while I get the brush out of this pasture.

The first trouble is it is rocky. The second is that everywhere that a shrub can get hold it has taken root, and the land is full of bushes, briers, brambles, anything and everything but what you want. The first thing to do with such a piece of pasture land is to get the brush out. Now that means something with me. I can remember when on an old Massachusetts farm, it was every year the work for us boys to mow the brush in the pasture. Every year there were the same brush scythes to be wielded, the same brush to be cut, I verily believe the same bumblebees and yellow wasps to battle with, and the same boys to do it. If you want to educate a boy to hate farming, put him into an old pasture to mow brush and fight bumblebees, and you'll do it.

Now then, we want to get rid of the brush. If the owner of the pasture really means to get rid of it he won't put the boys there, but where the bushes are of sufficient size he will take the team and his best hired man, and when the boys see that he means business, they will take hold with a will. Pull them all out, pile them up, and burn them. There is work in it no doubt,

but I tell you it will pay. Most men think the work is done right there. But if you stop there you will find the brush will grow again. But if you sow grass seed and drag it in, and there is no land so rocky but you can run a drag over it, then you have made clean work of it.

There is some pasture land that hasn't got brush on it, but it is sterile. There is no nitrogen in it; there is very little phosphoric acid in it, because the cattle have consumed them in milk and bones. You cannot draw compost or barnyard manure on it. Is there anything you can draw on it which shall enrich this land on which you have done no burning? Do you say that your other fields require all the dressing you can get? If you can afford to make grass anywhere, you can afford it in your pasture. You can make it cheaper there than in your mow field, because your cattle will gather your crop for you.

You must absolutely top-dress it. You have robbed your land of its mineral elements and its nitrogen, and you must top dress it to make it bear a crop. Now what will you use? I have heard somebody say here in Brunswick, "I can buy all the wood ashes I want at twenty cents a bushel." Wood ashes at twenty cents a bushel, and you complaining that you havn't anything to put on your land, and talking about going West? Give me wood ashes at thirty-five cents a bushel, and I will take the poorest farm in New England and get rich. You don't want anything else if you can get that. That is just what you carried off; if anybody else is fool enough to do the same, go and buy them. You can richly afford them at twenty cents a bushel. But that is not enough. There is no organic element in ashes, simply mineral material. Sow 20 bushels of ashes, which at 20 cents per bushel will cost you $4, with 50 pounds of sulphate of ammonia, which will cost you perhaps $2, and for $6 you have a dressing for an acre of land that will last you two, three or four years. I say, sulphate of ammonia. Here in Maine you make tons and tons of porgy pomace. I don't know whether porgy pomace is the best form, but what I know as fish guano—the dried pomace from the factories—you may use as well as sulphate of ammonia, and perhaps it is cheaper for Maine. Use that on your pasture land with wood ashes and I warrant that you will be the richer for your outlay, either in your dairy or in the growth of your animals. If you havn't wood ashes and wish to put on a compo-

sition somewhat similar, use the following materials for this class of pasture land of which I am speaking, which cannot be plowed but which can be worked. A mixture of

Sulphate of ammonia,	180 lbs.
Muriate of potash,	70 "
A good nice superphosphate,	100 "

Mix and put on to two acres and you will find it will wonderfully improve the quantity and quality of your grass.

QUESTION. Would you seed it?

ANSWER. Not if it was seeded. If there was no grass seed in the land, if it had all run to white-weed, I should want grass seed; I should use a mixture of the clovers, blue-grass, red-top, and a little, and but little, herds-grass.

In the third and last class of pasture lands, I place those lands that can be plowed, whether used for pastures exclusively, or used in rotation, one rotation being that for a season they are fed with cattle.

Now I believe in renovating land by plowing. I am an advocate of tillage, while I am an advocate of feeding plants. I tell you God's sunshine and air renovate the soil. Much of our pasture land we cannot plow, and now we have come to a class that we can plow. I would plow and pulverize it, and let the air into it, and break it clod from clod, and particle from particle. Twenty, thirty, forty, fifty years, it has been in sod. If there is any clay in it it has become impervious to water and air.

Some men say, "I never plow pasture land, I could never get anything from it afterwards if I should." Sheerest nonsense that ever was if you know your business. If you plow this land and work and improve it, every principle of tillage is on your side; and if you don't get a good turf, it is because you have sown too coarse grass, as will be the case if you have nothing but herds-grass. It is your fault if you don't give the soil good tillage and seed it with such grasses as it needs.

Till the soil thoroughly and manure it. Now the question comes—"What shall I manure with? I havn't any manure that I can spare." Be righteous and just. You have robbed your pasture land for years. It was fertile once; it is sterile now. Your milch cows have been driven on it hungry every morning, and have returned full at night. Be just. "But I havn,t any manure." I suppose you havn't. After saving all you can, and using every available means to make it, there is still a great

deficiency. Here comes in the benefit of the discoveries of modern science in supplying additional means of fertilization after ordinary supplies are exhausted. I verily believe, yea, I know that the fertility of the class of lands I have spoken of can be restored.

I would make a composition like the one I have given here as a top-dressing. I wouldn't plant it and crop it. I would till it thoroughly and put on composition, and then I would sow some herds-grass, blue-grass, red-top, red and white clover, and then I would sow about two bushels of rye to the acre, and this I would do if I had but a single acre of such land on a twenty acre lot. I would do the work well, and then ask God's blessing on it, and wait for it. What would be the result? The rye would come up, the cattle would go on and eat the rye, the rye would protect the grass. In the second year the grass would be up, and I would have part of a crop of rye, and a well grown crop of grass.

Now, gentlemen, I have seen this thing done. I have seen land brought up from where it took five or six acres to keep a cow. I don't say that you can't make more doing it on some land than on others; but there is no land, unless it is like the driving sands of Sahara, that cannot be renovated.

Thus I have gone over the different classes of pasture, and prescribed a method of treatment for each. Now a word as to feeding your pasture lands. You put on the land a stock greater than your pasture is capable of bearing, and the grass is gnawed down so close that sometimes some of the soil is taken with it. The surface of the ground is left bare and the bulbous roots of the grass are exposed to the cold of winter. Put no more stock on the land than it will carry, and don't let a foot step on it after the fifteenth of October. Some one will ask—"Shall I turn them into my mowing land?" No; turn them into your barn or barnyard. You cannot afford to feed pasture land, if you mean to do business on it, after the fifteenth of October, and for this reason: There should be sufficient growth of grass on the land after you have done feeding it for mulch to the new grass. You should be husbanding the resources of your soil so as to leave it strong and vigorous for next year's work. A stool of grass on your pasture land is the same as a stool of grass on your mowing land. Would you think it good policy to have the roots of the grass on your mowing fields all exposed to the frost of winter? If it would not be good policy there it is not good policy in your pasture. I

repeat, put no more stock in your pasture than it will feed well. Would you say it would be good policy to put twenty head of cattle in your barn if the feed you had in it wouldn't carry but fifteen? For every animal that you put in your pasture more than it will feed well you sustain a loss, not only in the growth of the animal but in the quantity of your dairy products, for the extra animals do not begin to pay for the extra work they make.

Thus, gentlemen, I would attempt to improve the pasture lands of New England. I know it is a slow process, but if we would raise fine cattle and give the products of the dairy in profusion, we can only do it by restoring to our pastures the fine, succulent grasses that alone will produce them. In improving my pasture I would like to select my stock. There must be some stock and there must be somebody to raise it. I would like to let somebody else manufacture the animal carcass and let me have it to fatten. Then the animal will only take away from my farm carbon, which I can afford to have him do. So I will reach out to New York or to the West, and buy cattle from somebody whom I don't know and whose farm I shall never see. I will let him furnish these other elements and I will furnish the carbon. But if I cannot fatten cattle to advantage I must come to the next best thing, and here I don't know what to do. Next to fat the best product that was ever carried from a pasture is butter, for in selling butter I sell nothing but carbon, and this depletes the soil less than anything I can sell. But in selling butter I am stealing from Peter to pay Paul, and that I don't like to do. While I am selling from the farm only carbon, I am taking the elements of fertility from my pasture and putting them on my field; but let me be honest, and if I can do no more I can at least top-dress all my pasture lands every other year.

In conclusion, gentlemen, I will say that I believe that, taking these two classes of pasture land, clearing and top-dressing the one, and plowing, tilling, manuring and seeding the other, and by care of the ground and the stock we put on it, being sure to return what we have taken from them, I am very sure that we shall yet see the grass grow in the pastures of New England which our fathers grew there a hundred or more years ago.

BEET SUGAR.

By George E. Brackett, Belfast.

The prominence given to the subject of beet sugar, in the inaugural address of Gov. Connor, and his recommendations and suggestions in regard to the feasibility and advisability of the culture of the beet in Maine for the manufacture of sugar, is my excuse for calling the attention of the Board of Agriculture to the matter at this time.

While I am not yet prepared to fully agree with our Executive in so heartily and fully recommending this comparatively new industry to the farmers and citizens of Maine, yet I would not be one of those factious spirits who oppose a movement or project simply because it is new. No doubt the Governor had all the data before him, deductions from which warranted him in his recommendations. I confess, I am not fully read up in the progress and condition of the beet sugar industry during the past few years. I understand from report that an attempt was made to introduce the business into Maine years ago, but where and with what general results I am not advised.

But it is undoubtedly a fact that the beet sugar industry is an important one in the old countries, although yet in its infancy in the United States, and being such we cannot afford to ignore or overlook it in our agricultural economy. If the State of Maine is specially adapted to beet cultivation and the manufacture of beet sugar, we desire to know it now or as soon as may be, and *vice versa;* in either case discussion and consideration of the question will soon inform us.

The advocates of beet sugar manufacture claim the advantages of its introduction would be: To insure superior methods of agriculture, increased crops, more remunerative prices, home markets and enhanced value of farms. It would also tend to create industry, diversify labor, reduce the price of sugar and bread, and render us independent of foreign countries. Greatly to be desired results are these I grant, and such as towards the attainment of which it is our bounden duty to strive.

The great sugar producing plants of the world are, in their order, sugar-cane (*Arundo saccharifera*), the beet (*Beta vulgaris*), the date-palm (*Phenix sylvestris*), and the sugar-maple (*Acer saccharinum*). According to statistics of a few years ago, which no doubt still hold good in ratio, the total production annually of sugar from these plants is about in the following proportion:

Sugar-cane	71.42 per cent.
Beet	22 50 "
Palm	5.00 "
Maple	1.08 "
	100.00

It will thus be seen the beet furnishes nearly one-quarter of the sugar produced in the world.

France and the German States are the great beet sugar producing countries of the globe, their production being nearly, if not quite, equal to their consumption. There are over 2,000 beet sugar manufactories in Europe, of which France has over 600. The German States and Russia include the bulk of the remainder.

Several attempts to manufacture beet sugar on a small scale have been made in the United States, but if California be excepted, and perhaps some trials in Illinois, I am not aware that they have been crowned with commercial success, although they have proved that the best quality of sugar can be made from the beet. As long ago as 1839, the "Northhampton Beet Sugar Company," located in the rich tobacco growing soil of the Connecticut valley, proved this beyond a doubt. But it was not a financial success. They manufactured sugar of an excellent quality, 100 lbs. of beets producing seven pounds of sugar and three and one-half pounds of molasses. In 1864 the "Germania Sugar Company" commenced operations in Illinois, but I do not learn they were so successful as to make the enterprise a permanent one. They cultivated 600 acres of beets in one season which produced from 8 to 9 per cent. of sugar.

The beet plant adapts itself very readily to climate and circumstances, although a first-class soil is absolutely indispensable to its successful cultivation. The deep, rich, argentiferous soils of California are no doubt the best adapted to its production of any in this country, and the black, greasy, prairie soils of the western States, come next. Whether the farmers of Maine can compete

with them, except at large cost for special fertilizers, is a question for consideration. That we can grow the beet to perfection in our State is a fact proven by repeated experiment, as also that large crops can be obtained, and thus the question is one of comparative cost.

The variety of beet required for the manufacture of sugar is that which is richest in sugar and contains the smallest percentage of alkaline salts, and the white Silesian or white sugar is the kind in general cultivation. Colored beets are objectionable. The special qualities desired and which seem to be united in a greater degree in the white Silesian than any other variety are a pear shape, no lateral roots, smooth, white surface, white, hard flesh, and must grow beneath the soil. They also do not grow too large, five to eight lbs., being most desirable.

According to Prof. Payen's analysis, the average beet contains:

Water	83.5 per cent.
Sugar in solution	10.5 "
Albumen, caseine and nitrogenous matters	1.5 "
Cellulose and pectose	.8 "
Miscellaneous	3.7 "
	100.00

The average percentage of sugar in the French beet is 11½ and the American and German about 13. In France the average per cent. of sugar extracted from the beet by the machinery used is 7 per cent., though improved methods in many cases produce 11 per cent.

As to the cost of raising beets in Maine, any farmer on this Board can probably give an intelligent answer. The Department of Agriculture estimates they can be raised at a cost to the manufacturer of $2.60 per ton. This, it is presumed, refers to wholesale production under most favorable circumstances. The average price paid by European manufacturers is $3 per ton. A western writer on the subject says the factories there can be fully supplied at $4 per ton, outside price, and western farmers contract them at $3.50 per ton.

The yield per acre is of course variable, depending largely upon the soil and cultivation. In Germany, the average production is 17 to 20 tons per acre; while 50 and 60 tons are not uncommon. Twenty tons per acre is reported as the average in our Western States.

One of the strongest arguments in favor of beet culture is, that to be successful, it leaves the soil in an improved condition, especially for a grain crop to follow. Being a "hoed crop," the soil must necessarily be kept mellow and free from weeds; and to produce a paying crop, it must be very highly manured, which leaves it in fine condition for a crop of wheat. Another reason is, that the growing of beets is specially adapted to secure the retention upon the farm of nearly all the elements removed from the soil by the plant. The sugar which is extracted from the beet is drawn largely from elements present in the air. If, therefore, the beet refuse or residuum left after manufacture is returned to the soil, it loses but little of its fertility, and the next crop in rotation finds ample sustenance. Again the forage is of great value as stock food. The leaves are highly prized, especially for feeding to milch cows, and the pulp or refuse of the rasped beets after the juice is expressed is claimed to be a very rich food for cattle, sheep, swine or fowl. The average amount of pulp or beet refuse is some 20 per cent. of the original weight of the beet, and at the beet sugar mills in Europe it sells at $2.50 per ton.

Taking into consideration our present national condition, our pleasant relations with sugar producing countries, and the cheapness and facility with which cane sugar is produced and sold, I am not sure as to the desirability or practicability of entering upon the cultivation of beets and the manufacture of beet sugar in Maine. If a change from our amicable relations with other nations was imminent or even in the near future, it might become a matter of more specific importance.

It occurs to me that we have already with us and in our midst in Maine, an industry productive of the same immediate results which is worthy of encouragement. I refer to the manufacture of sugar from the sugar maple, which according to the figures above given, yields only a little over one per cent. of the total sugar products of the world, but which it seems to me is capable of being largely improved, enlarged and extended, especially in our own State. The crop is a permanent one, no annual planting or cultivation being required, only the harvest and the manufacture of the product, and the market has never yet been overstocked. We may safely predict that maple syrup and maple sugar will command a remunerative price for years. I think this industry worthy of more attention than has been bestowed upon it.

Briefly, in conclusion, allow me to say these remarks are presented only in a suggestive sense, and in no wise recommendatory or argumentative, but it has seemed to me, from the prominence given the subject by our Chief Executive, not only appropriate, but in some degree obligatory on us as a State Board of Agriculture, to at least refer to and call attention to the subject at this time, that it may be more fully examined and discussed at future sessions, and by this means the attention of our citizens called to the matter, so that if it be of practical value to the agriculture and well-being of Maine, we may be prepared to take the proper and necessary action in the premises.

DISCUSSION ON FEEDING DAIRY COWS.

The Discussion reported below, occurred on the forenoon of Wednesday and afternoon of Thursday, but is here put into connected form for better reading.

HON. C. J. GILMAN of Brunswick. It seems to me that we in the State of Maine, are to do more with our dairies in the future than we have in the past. I think the indications on that point are very decisive. We have the very richest of feed, and I have no doubt that the production of butter and cheese is to be a source of great income. The animal that is to produce our butter and cheese is the cow. Now how shall that cow be fed so as to produce the most at the least cost. [The speaker here read an article from Prof. Arnold of Rochester, N. Y., in relation to the well known experiments made by Mr. Miller and Mr. Laselle in feeding dairy cows with corn meal, with and without hay, and continued] Now, I don't propose to recommend the supplanting of hay by corn meal, but it does seem to me that most of us having stock, have been somewhat negligent in regard to this matter. If we can take three quarts of corn meal, weighing 4.68 pounds, and get out of that $3\frac{2}{3}$ pounds of absolute food, and if you can purchase that and cut down your hay one-half or two-thirds, and have your cow in better condition, it seems to me we ought to look at the points of economy presented thereby. Call it 200 days a year that you have to keep your cow at the barn. Feed ten pounds of hay per day, and in 200 days your cow will consume a ton of hay. Three pounds of meal per day at the rate of 75 cents per bushel, would be $4\frac{1}{2}$ cents per day for 200 days, or $9.00. Now, assuming that the average price of hay is $14 per ton, you will have $9 for concentrated food, and $14 for hay. I think I hear some one say—"It is impossible to carry a cow through on a ton of hay." But have you, gentlemen of the Board, given the thing a fair trial? Have you examined it personally? If you feed three pounds of concentrated food per day at 75 cents per bushel, you carry your cow through for $23. If you feed three

quarts, of course the cost will be increased. If we can carry a cow through for $25, I think we can demonstrate that there is profit in the dairy system. But how can you carry a cow through the winter on one ton of hay? I acknowledge that you can't do it by feeding in a helter-skelter way. The feeding must be regular, and you must have your arrangements to know that you feed just so much per day. It has been demonstrated by Prof. Arnold that much of our hay is not digested, and does not become available to stock. If you take the best hay, that which is of good quality and thoroughly cured, I acknowledge that you can keep an animal well on it; but when we have many acres to cut we cannot always secure this crop in the best condition. Therefore it is fair to assume that a large percentage of our hay crop, cut in the last of July and August, is not the best product, and so I say that a great deal of the hay fed out to our stock is not thoroughly digested. Now, is there a well defined idea among our farmers as to the best method of feeding stock? I am of the opinion that it is the best way to reduce the bulk of hay, and exchange it for concentrated food; that the animal will do better, that the manure heap is better, that the yield of milk will be greater and richer. There may be a question whether it is best to furnish this concentrated food in the form of corn meal, oat meal, or shorts? I suppose the best product to give cows would be oat meal, but we cannot always do it.

Mr. WASSON being called upon by Mr. Joyce of Brunswick, in reference to porgy chum as food for stock, stated that as food for dairy stock it should be ground fine; that while he did not know as it would increase the yield of cheese, it would make a marked increase in the yield of butter; and that after a cow is dried up, he believed that more fat could be put on her by feeding porgy chum than anything else. In reference to general feeding, Mr. WASSON said:

It is conceded as a fact that the agricultural future of Maine is largely in its dairies. I want to supplement that statement by saying, that I don't believe that among the best farmers of the State, that man lives who has developed the full capacity of his cow for producing milk, butter and cheese. By the census returns of the State we find that the average annual production of butter per cow is less than 100 lbs.; among the best farmers of the State we find that it is from 200 to 450 lbs.; and we occasionally see in the columns of our agricultural papers the statement of an instance

in which the high figure of perhaps 600 lbs. has been reached. I think my friend, the farmer of the Agricultural College, has done and is doing good service to the State by his experiments in feeding stock; and when we give these gentlemen there the means and opportunity to complete their experiments, we shall find that there is a golden chain that attaches the college to the State, and we shall attach more importance to the Institution and its results than we do at present.

A few years ago, when our hay crop was cut off, the farmers were obliged to feed meal in order to bring their stock through the winter. The consequence was that in the months of February, March and April, the farmers and farmers' wives were saying: "What is the matter with the cows?—they are producing more than they ever did before." They were astonished to find that they were producing in flavor and grain a summer butter in winter. It was because sheer necessity, mother of most of our inventions, had compelled them to feed meal. A few years ago a neighbor of mine was driven into ascertaining on a small scale a fact which my friend (Mr. Farrington) is learning on a broader scale. For the sake of ascertaining the comparative product of three cows, he put the best cow on the best hay, and the poorest on hay and provender, part oat-meal and part corn-meal, and the result was that with these different kinds of food the poorest cow made more than double the butter that the best did. Now I believe that we must investigate this question of the capacity of our cows, and ascertain what treatment and what feed is necessary in order to develop their full capacity, before we can realize the net gain which it is possible for us to realize from our farms.

Dr. Tuck of Farmington. I don't understand that the gentlemen who propose to drive their cows in winter to give the utmost quantity of milk, propose to continue their rations of concentrated food through the summer; but that they will turn them out to grass during that season and let them get their living there. Under that treatment I think the more meal the cow gets in winter the less will be the income derived from her during the summer. If you continue the meal through the summer, I have no doubt you will get a large quantity of milk; but the idea is prevalent in my section, that the tendency of very high feed is to make a cow gargety, short-lived and sterile. My observation shows me that the more concentrated food fed to sheep in winter

the less they will gain in summer. I cannot state as a certainty that that applies to a cow, but I think it does.

Mr. WASSON. Poultrymen tell us that the hen has the capacity to produce a certain number of eggs, and that when she has produced that number, she stops. Is it not, in like manner, true of the cow, that she has the capacity to produce a given quantity of milk? Suppose that capacity is a thousand pounds; the point is, that we are too long in getting that thousand pounds. Might we not as well obtain it in two years, and when we have reached the limit of production, give the cow to the butcher?

Mr. A. L. BRADBURY, Member from Franklin. My experience in feeding milch cows is quite limited. I think for any stock the winter feed should be no better than the summer feed. Of late I have adopted the plan of feeding a poorer quality of hay, or straw if I have it, the first thing in the morning, and following, before they have quite finished that, with a better quality, and following that with a better still. In this manner I can educate my cows to eat all kinds of fodder that I raise on my farm. I find that I can get my cattle to eat more hay in this way than by feeding them exclusively with poor hay, and that they will eat it cleaner. I find if I take about one-quarter straw I can make my cows do about as well as if I feed all hay. For provender, I feed shorts if I want quantity of milk, and meal if I want butter. Straw contains but a very small quantity of nitrogen, and to make amends for the want of it, I feed shorts, or oats and peas. Why I say oats and peas, is because we can raise them in our climate anywhere and don't have to go abroad for them. Oats and peas contain nitrogen, and a small quantity of oat and pea meal will give the nitrogen required to make up for the straw. If I am feeding clover hay, I feed but a small quantity of the oat and pea meal each day. This method I find so far very satisfactory. I adopted this plan last winter, not before. I water twice a day.

Mr. FLINT, Member from Somerset. I have had some experience in feeding dairy cows. I think that the sugar beet is a valuable article of food for cows, and indeed for all stock, and where potatoes cannot be raised to advantage, the beet so far as tried does well. I know of eleven tons having been raised on a quarter of an acre. I think cows should be fed in winter as you propose to feed them in summer. There is no reason for feeding them any better, and there is every reason for feeding them just as well.

Mr. REYNOLDS, Member from Oxford. I have a small dairy, and intend to keep more cows than I have for the past few years, for I am satisfied that it is very profitable. My mode of feeding is much the same as Mr. Bradbury's. Potatoes, in my experience, are good to give a flow of milk, but you want meal to go with them, to give a better quality to the butter. Roots I find to be an excellent provinder, and perhaps the beet spoken of is better and sweeter than the potato.

Mr. GILMAN. I would like to know whether the practice of feeding concentrated food, like Indian meal, or meal and shorts, has been found to be injurious to stock where it has been continued for a series of years—whether it has a tendency to produce garget?

HON. TIMOTHY WILLIAMS, Member from Knox county. I have been in the habit of feeding my cows in the winter on hay and fine feed. I get the best quality of fine feed, that which has the most flour in it. I cut the hay in the morning, heat the water, pour it on scalding hot, and mix the fine feed with it. I never knew it to injure a cow. I give about four quarts per day to a cow. I calculate to keep my cows in winter in the same way always. I never turn out my cows in the spring until there is plenty of grass. I never had any gargety cows. I have always had a good flow of milk from my cows, and made a good quantity of butter. A year ago last June I had two cows, and the neighbors wanted to know how much butter they would make during the thirty days of June. We kept an account of it, and besides the milk used in the family they made 135½ lbs. of butter, or 2¼ lbs. apiece per day. We called that pretty good, until I went up to the State fair and saw a man who told me that he did a good deal better. Since that I havn't told my story. To feed a cow about as high as you can and not injure her is, I think, the true idea of feeding.

Mr. D. M. DUNHAM of Bangor, Member at Large. When we met at Waterville, some of you will recollect that Mr. Percival told us that he made some 900 lbs. of butter from two cows. We wanted to know how he had kept them; and one part of it was, that he allowed them to drink no cold water in the winter. Mr. King had some good stock at our fair one year. I was inquiring in March about some steers, and he told me they were seven inches larger in girth than when he showed them at the fair. He said he had given them what good hay they wanted to eat, and what warm water they wanted to drink. If I wanted my cows to

do well in the winter, I would take care to provide them with water as warm as I should wish them to have in the summer.

Mr. STARRETT of Warren. I know of a very successful farmer who built a shed over his well, and set a boiler so that he could heat water to use in feeding his stock; and to take the chill off the water that his cattle drank. He considered it a decided advantage.

Mr. MALLETT, Member from Sagadahoc. I wish to say that we want to arrive at something definite in this discussion about feeding cows; we want to know not only what to feed to make the cow a milk producer, but what to feed to make her a butter producer. We have present with us Mr. Work who is a milk producer and Mr. Gowell who is a butter producer, and each feeds his cows with reference to this point. I think we may hear from them with profit.

Mr. WORK. I would say in reference to feeding cows for milk that I have never used any science, and have never tried to determine which is the best way. I have been in the business about eighteen years, and for the last eight or ten years I have used shorts or bran and Indian meal—one quart of meal and four quarts of shorts a day. I don't know that it has made much difference whether I have used warm water or cold. I have given them both, winter and summer. I give my cows about all the good hay they can eat. I change the hay occasionally, and if they get a little cloyed I put them on coarser hay. I have thought that for all the grain I have fed, my cattle wanted as much hay as though I had not fed it; it would seem just to give them an appetite for the hay. I have kept cows until they were twenty years old, and I never knew of any of them being injured.

Mr. GOWELL. I have a small butter dairy of five cows—Jerseys and grade Jerseys. My pasture is stocked with sheep up to about its full capacity, consequently I feed one quart of Indian meal daily, or the amount of shorts which is equal to it. I save the manure at night, and feed what hay they require during the season. In its season they receive fodder corn. The butter production is a little over two hundred and fifty pounds per year to a cow. I fear that if I were in the habit of feeding my cows as heavily as Mr. Work does, I should in time ruin them. I have constructed a tank under my tie-up to hold both the solid and liquid manure. I feed some four tons of shorts during the winter. I think a ton of shorts to be more than equal to three tons of hay.

I hope that in future there may be something that will save the farmers the expense of Western shorts. If there is to be a new departure, I believe it will be in this direction.

Mr. W. W. HARRIS of Portland. I am a little interested in the milk question. I keep a few cows and sell milk. I sell to the retailer, who sells again to the customer, and so I only get about half the money. My cows are natives, and the way I keep them I average a fraction over $100 per year from them. I use a car load of shorts a year—twelve tons—have it delivered on the car at my farm. I keep six or seven cows. I feed some meal and some beets. I feed shorts liberally, and think they pay. My idea is, that if you mix your concentrated feed with your hay for cows giving milk, you want about as much hay as the cows would eat without it.

Mr. WORK. I have ten grade cows, some of them pretty high grades. I find they will bear more grain than any other class of stock I ever kept, and do better. The best cows I have are half or three-quarters Jersey. I feed liberally. I feed an old cow more than a young one, and a cow in milk more than a cow that is dry.

Mr. MALLETT. I was thinking, while listening to the remarks made, how things have changed within the last ten years, in regard to cows. We have thousands of acres of meadow land in this vicinity; we are of rather a lazy nature, and I don't know but it is superinduced by this meadow hay. I think at any rate we don't raise as much English hay as we should if we had not relied on the meadows. This meadow hay was poor fodder for milch cows fifteen or twenty years ago, and we never thought of milking through the winter a cow that was to calve in the spring. If we wanted to have milk in the winter we had to have a farrow cow. There is just about as much difference in the cows to-day as compared with those of that time, as there is in the feed. There is no necessity of keeping a farrow cow now; the cows give milk through the winter by giving a little provender. A portion of my cows I don't dry up at all. I have a cow that I suppose there is not provender enough in Sagadahoc county to make her give milk all winter if with calf. There is that difference in cows.

Mr. WORK. If I am a little short of milk I add a few shorts to the four quarts, but don't vary my one quart of meal. I can't tell how much hay I feed, but what the cows will eat. I have four cows in my stable that have not been dry for four years.

Mr. GILMAN. The farmers ought to know how much hay they are feeding to their cows, and they ought to find out by experience whether they are feeding too much or too little.

Mr. WORK. When I used to feed three quarts of shorts a day, I got nine quarts of milk. Now, if I don't get fifteen quarts I think the cow isn't a good one. [In answer to questions.] I water twice a day in cold weather. Almost any breed of cows will give milk the year round; there is a good deal in the training. I should prefer to have a cow go dry two months before calving. I don't use the milk for four or five weeks after calving.

Mr. GILBERT WOODWARD. I have never done much in the dairying business. I agree with what these gentlemen have said about feeding cows. I prefer to have my cow go dry about two months. I don't think it profitable to have cows give much milk in winter. It is a good deal of work to attend to it. I keep a small number of cows, preferring to sell my hay rather than manufacture it into butter. I have good facilities for dressing—use marine dressing mostly, and some commercial manure, and I can sell three-quarters of my hay and keep my farm up by so doing.

DR. TUCK. There is a question whether the same rule is applicable to the keeping of all dairy cows. I have seen a great deal of difference in the effects of the same kinds of feed on different cows. I have seen cows that fed on corn meal would dry up milk and take on flesh. I had a cow that yielded twenty-nine or thirty pounds of milk per day without meal. I commenced to feed three pints of meal, and not getting the increase I thought I should have, I thought I would try shorts. I dropped one pint of the meal and fed two quarts of shorts without any increase in the quantity of milk. That set me to thinking that my cow didn't dispose of her feed very well, and I think if that was the case with that cow might it not be with many others? Why doesn't each cow require a particular food?

Mr. FARRINGTON of Orono. I heard a man say once, that the best thing he could get for his cow was hemlock boards. Pretty hard feed—but of course he didn't mean to be understood literally. Three years ago, when we kept the cattle in the old barn at the college farm, we used to give a heavy feed to our cows. We felt obliged to because lots of people go there, and unless our cattle are in good condition, of course they find fault with us. We fed three quarts of meal and shorts. Last winter we kept the cows in our new barn—doubtless you have heard of that barn. The

barn is tight and close, and we could keep it as warm as we pleased. Last winter we fed half the grain we did the winter before. Our cows came out in good condition, but not as good as we thought they ought. This winter we have fed a little more than half what they did last, and the cows are in splendid condition. The treatment in other respects was the same. Now, I believe that the nourishment required to compensate for the poor condition of the barn was so much, that when the cattle were put into comfortable quarters, one-half of the concentrated food to which they had been accustomed was too much for them, and one-third or one-fourth of it keeps them in good condition now. One point more I wish to bring out. A good deal of fault has been found with the trustees of the college for expending so much money on the barn. Now, in keeping thirty or thirty-five head of stock, if we can save three or four quarts of feed a day for each animal, are we not saving the interest on the cost of that barn?

Mr. LYMAN H. WINSLOW, Member from Lincoln. I am not a dairyman, though I keep a few cows. The reasoning of some of the gentlemen reminds me of a little incident. A man bought twenty gallons of cider of one of my neighbors. He put three gallons of brandy, four pounds of sugar and three pounds of raisins in it, and sent it to a friend of his. His friend put four gallons of brandy, three pounds of sugar, and four pounds of raisins in it, and sent back word to him that it was the best cider he ever saw. Now, you can experiment in cheap food if you want to, but if you want to get good milk and make good butter, put in your brandy and sugar, and raisins. I don't believe in giving a cow dry food altogether to digest; and I would raise some roots to give my cows in winter. I would experiment a little in the details of feeding, and then I wouldn't have to ask anybody for advise.

ON CO-OPERATION.

By D. M. Dunham, Bangor.

There is within the breast of every one a desire to be independent. This desire in itself is right, and tends to elevate society. It is only when it drives us to commit frauds against our neighbor, to pull down his property or character in order to build up our own, that it becomes a dangerous element. Were it not for selfishness, or a desire to be independent, there would be no accumulation of property. The forest which once covered our hills and valleys, would never have received the sturdy blows of the settler's axe, and given place to cultivated fields, orchards and gardens; the beautiful villages which everywhere dot our land, and the cities which teem with manufactures and commerce, would never have been known; no vessel would ever have been placed upon the ocean for the exchange of the commodities of different climes; no railroad would have spanned the continent or telegraph encircled the globe;—nor with all the desire for independence would any of these have been accomplished, were it not for co-operation. We all like to be independent, and yet how little one man can do towards independence can only be realized when we place ourselves in imagination outside the pale of civilization, and plan with our own head, and create with our own hands the necessities and comforts of life. Placed in this position, we should soon tire of ourselves and our independence, and say "Place me back where I may co-operate with my fellow man, and receive not only the benefits of the present generation, but the inventions of men for thousands of years gone by." No great achievement has ever been won by any man independent of others. The great inventions and enterprises of the day, although many of them bear the name of one man, have really received the co-operative study and experiments of many men for many years.

It is a law of our being, that we must bear each other's labors, joys, and sorrows, if we would reap the golden harvest of peace on earth and good will toward man.

Thus we see that a desire to be independent begets co-operation, and co-operation brings the necessities and luxuries of life. "Live and let live," is a saying trite as true, and when we strive to pull down another's occupation, character, or property to build up our own, we find that we pay more attention to pulling down than building up, and our building is of poor material and shabbily done; but when we set about any enterprize and seek the co-operation of our fellow-men, the combined wisdom secures results not otherwise obtained. The mechanic co-operates to build houses, mills and machinery; the engineer co-operates to build railroads and canals; the capitalist co-operates to form banks, insurance companies and other means of investment which it would not be practical for one man to do alone. So we see that other pursuits, although needing co-operation less than farming, actually co-operate more Most other pursuits and occupations do not require so much general knowledge as that of farming. To be successful the farmer must understand the nature of his soil and the adaptation of different crops thereto; he must study the analysis of each, that he may tell what crops to grow in rotation to secure the best results; he must know the nature and requirements of domestic animals, so that he can tell which is best adapted to his wants, and yield the most profit. The various experiments that must be made to enable the farmer to carry on his business to advantage could not be crowded into the longest life, but by a system of co-operative experiments, more can be done in a single year for his benefit than he could learn alone, should he live to the age of a thousand years.

In view of the great need of co-operation among farmers, let us look and see how the matter really stands. Although farming is the oldest occupation on the globe, and one in which more than half the people in the civilized world are engaged, yet in no branch of industry is it so hard to fill one's shelves with text-books adapted to their wants, as in that of farming. While we see co-operation to form numerous schools adapted to the wants of the professions and see them liberally endowed and supported, we see but a single school in the State which may be called a farmers' school, and the co-operation in this case seems to be rather against than for it—an agricultural school in name—but how many of our farmers know whether it really is such? It should be visited, if not by every farmer in the State, at least by a representative from every town, who should make himself

familiar with its work, and report to the farmers of his locality the result of his investigation; and if it be found that the present managers are not fitted for the place, or are recreant to duty, the farmers have it in their power to right the wrong, and make it in reality what it is in name, the Farmers' School. They must insist that this school shall be well sustained, and that its studies shall be such as will fit its students for industrial pursuits and dignify labor, and in no way can this be brought about but by persistent co-operation among farmers.

There should be a co-operative effort among farmers to induce other industries to locate in their midst, at least to an extent sufficient to supply home consumption; for the nearer one can bring a market to his own door, for the products of his farm, the better he will be paid for tilling the soil. We have in Maine co-operative dairying; and the result has been not only an advantage to the individual but to the State, for any productive industry benefits not only those directly interested, but indirectly the whole community in which it is located.

The farmers want to co-operate to get out of the old ruts in buying and selling; but in getting out of the old ruts and leaving the snares of the speculator, they want to see to it that they do not get into the quicksands of the capitalists, and thus find their last state worse than the first.

Labor and capital should go hand in hand, each is dependant upon the other, and for the good of the community there should be no strife between them; but selfishness in the advocates of each, too often taking a narrow view, become jealous of each other and stir up strife between them, and it is generally the case, when the two come into a contest alone, that capital wins, and when capital has gained absolute power in any place it reduces the price of labor to the lowest living point. Here comes in credit as a competitor with capital, and in a government like ours, where the people are king, with credit and labor on one side, and capital on the other, there need be no fear if credit and labor co-operate; but when capital sees credit and labor co-operating it becomes jealous, and strives to throw in questions that will stir up discord and dissolve co-operation. Thus we see the Patrons of Husbandry, a co-operative body calculated to elevate the farmer socially, morally, intellectually and financially, as no organization ever has since the world began, met by capital, who trembles for fear the rates of interest may be reduced, and plays the part of

Satan when he took our Saviour up into an high mountain and showed him all the kingdoms of the world, and the glory of them, and said "all these will I give you if you will fall down and worship me."

So when capital sees the Patrons of Husbandry organized to co-operate in all that pertains to the welfare of the farmer—as Satan quoted scripture, so it quotes agriculture, and in the shape of the money lender says: "Your mission is a glorious one:—if the farmers will do away with credit and make money king, even I will bow down and worship at the shrine of the farmer." In the shape of the railroad king it says to the farmers of Maine: "If you will stop raising bread and buy it all in the West, so that I may receive tithes on all you eat in the shape of freights, I too will rise up and worship the farmer." In the shape of the professions, it says: "If you will keep your sons and daughters from a desire for education, and grind them down to hard, uneducated labor, so that all the money appropriated for schools may be used for our benefit, we will sing pastoral songs in praise of the farmer, that shall resound from the Atlantic to the Pacific coast."

Were the competition of credit with capital done away, money would be king, and such a king as would not strive to dignify labor. Were the credit system done away, in twenty years we in Maine would be a community of lords and serfs. There is perhaps in Maine, an average amount of property among farmers; and yet, should we adhere strictly to the cash system the coming season, a very large amount of land prepared for a crop would lie idle for want of seed. The young men, instead of buying land, and becoming tillers of the soil, would have to commence a life of servitude, at the number of hours per day, and rate of wages, dictated wholly by capital.

Thus we see, that however desirable individual cases of the cash system may be, the great business of the world, in order to bring general prosperity and protect labor, and the productive industries from the tyranny of capital, must always be done very largely on credit; and just so far as the farmers co-operate to do away with the credit system, they co-operate against general farming and in the favor of landed estates and capital.

THE DEMANDS OF AGRICULTURE ON VETERINARY SCIENCE.

By B. M. Hight, Skowhegan.

Maine has a fine reputation for good stock. Our horses are celebrated all over the country, and we need only to glance at the pages of Mr. Thompson's "Maine Bred Horses," to realize or be convinced of this fact. The cattle of Maine are yearly becoming more and more desirable in all that pertains to good breeding. At any county fair one may see fine horses, cattle, sheep, hogs, and improved breeds of the feathered tribe. The farmers in every town vie with each other in friendly rivalry to produce the best of the several classes. Very great advancement in the past has been made in the direction of improved stock, and while much has been accomplished much more remains to be done. But while the farmers of Maine are not backward in efforts to improve the breed and blood of stock of every class, there is one thing in which they are backward; they are indifferent in the matter of health of the animals in their care, and which they are seeking to improve in respect to breed and development. We can suggest this neglect by reminding you that there are very few Veterinary Surgeons in Maine. There are none in the smaller towns and villages. There is a thought of importance connected with this matter: all animals common on the farm are subject to disease and accident. The horse has a very sensitive organization and hence is liable to frequent and dangerous illnesses. Cows have various ailments; sheep and hogs come in for a share in the common portion, and even the egg producer is not always well.

In 1873 the epizoötic passed through the whole State; many valuable horses died from the attacks, mainly because its nature was not understood, and the village "horse doctor" found his usual panacea entirely powerless. Now the farmers have learned that care in the matter of taking cold, clean stables, proper food, and the other things that belong to general health, with kind attention, will carry a horse safely through common attacks of

this disease. It is but fair to assume that if in our small towns veterinary surgeons had been available, many cases that proved fatal might have been cured. But farmers and horse men were obliged to doctor their horses themselves, and thus grope in the dark, or else employ a so-called horse doctor who probably knows less than themselves, and who, if striking in the dark, were quite sure to hit the horse a death blow; curing the attack by killing the patient. I could mention a number in my own town, including a good one belonging to myself, sacrificed to a lack of knowledge of their ailments. These horses were drugged or fed on lobelia and other nostrums, until the medicine for the horse was worse for them than the disease. Very many are called upon to doctor the horses or cattle of neighbors because the owner is not posted on their diseases. Cattle owners or farmers will run for a neighbor when any disease shows itself among their stock; or will send for a bogus cow doctor with his box of secret medicine, whose knowledge of animal pathology in nine cases out of ten is mere pretence. Stable men usually keep nostrums by them, but there is this truth to all their operations: they can generally only *guess* when to use and what to use in a given case. Apothecaries are often asked to prescribe for sick animals, and for the accommodation of the farmer and horse men they keep a book of some kind on veterinary surgery by them. But though we have so many who either from choice or the force of circumstances, prescribe for sick animals, still it is a just cause for complaint that we have so few available educated, trustworthy veterinary surgeons in Maine. Every reasonable and rational man with diseased stock, would gladly employ a capable doctor if he could be obtained. But as it now is we are obliged to shift for ourselves in the best manner we can; and this often a very poor one. All who are stock owners or raisers will acknowledge the correctness of the thought already suggested. The evils hinted at are patent to all. What and where is the remedy? We certainly have no right to sit down and fold our hands, calling it an evil which cannot be remedied and hence must be endured. It is one of those things which cannot and ought not to be endured, and hence *must* be cured. Farmers of Maine it is in your hands to endure or cure. You can if you will, have men in your community who understand the care and condition of sick animals. Your young men, and even you yourselves can be instructed in much which pertains to the theory and cure of diseases in cattle and horses. And it is a business in

which the right man can make money. It can some day become a profitable business to many a farmer's boy. It may be said that this is the selfish or money side of the subject. Grant it; but it is a very necessary aspect of the subject to be considered, for it is no use to urge the claims of any calling unless that calling will supply the means of support.

Brother farmers, I have said that it lies with you to provide a remedy for the evil suggested, and felt in a greater or less degree by all. You will no doubt ask me, "How can we provide a method of cure?" As a means to this end, I believe there should be a professorship of veterinary surgery established, and made available in this State; and it would seem that the most suitable place is in connection with the college of agriculture at Orono. Let a reliable, well educated and practical man be secured, whose duty it shall be both to give lectures and hear recitations upon the theory and practice of veterinary medicine and surgery. Let him teach the normal condition of animals in respect to both anatomy and phisiology, as well as the diseased condition to which animals are subject. As said before, we need a practical man, who has seen diseases among animals, and can impart to others both what he has been taught and what he has seen, as well as one thoroughly educated. It is a most interesting and important study to the farmer, or one intending to be a farmer, to learn of the normal structure and pathological condition of the animals of the farm and stable.

Now let there be a professorship of Veterinary Science established at the college at Orono, and then let every young man who intends to be a farmer go and study under such professor. Let the farmers go for a week or two in the winter seasons, when the farm work is dull. It would not require a long time to become convinced of their ignorance of correct information on the subject, and they would go back ready to discard the bogus cow doctor, and be earnest to demand a trained and educated doctor for sick animals on the farm. If any young man desires to become a veterinary surgeon, the way will thus be opened to him to go and fit himself, at a comparatively trifling expense, for a useful work, and one giving pecuniary profit. There are men in every town who have a taste or an aptitude for such study and work, but hitherto they have quite generally been unable to study and graduate at a Veterinary College, because such an institution is far off and the expense heavy. By providing in our own State

for their education, and thus giving these young men a chance, they will acquire their profession and settle down in Maine; will become your neighbors and friends—men in whose skilled hands you can safely trust the lives of your sick animals—men from whom you may learn how to keep those animals well, and how to make them thrive best.

Let me once more enforce the necessity for young farmers to be instructed upon the structure of animals. Even among horsemen the ignorance is great in respect to the structure of the horse. One man who had owned and handled horses for years, laughed at a friend of mine for his ignorance of the anatomy of the foot of the horse. My friend told him there was but one bone—the pastern bone—extending from the leg joint and widening in the hollow of the hoof. He at once made the assertion, and believed it too, that at that part of the ankle there were a number of small bones. Now, in that part of the leg many horses are lame, and if a man does not know how the bones are placed, or how many there are, how can he intelligently doctor the lameness? Instead of curing may he not aggravate the trouble?

I believe that the farmers of Maine are beginning to realize the importance of such a calling. I am well aware the time has been when this department of the healing art was not sought for by the people at large, as it is to-day. I believe our intelligent farmers feel, both in a sanitary and a financial point of view, the need of such a knowledge. There is a large amount of capital invested in live stock in this State, which needs the better security which such a knowledge would give it. I believe the only way to guard ourselves against the financial losses in this direction, from the invasion of diseases, is to educate the people in the general principles of veterinary science. The spread of contagious diseases throughout the country should therefore receive attention at every hand, and thus be made a leading feature in agricultural education.

Dr. Loring says: "In discussing the questions which come before an assembly of farmers, it is highly important that vague theories should be avoided, and crude speculations should be laid aside, and that the opinions expressed should be based upon the best experience or upon the most intelligent understanding of well established theories. The investigation of unimportant matters, the attempts to reply to unnecessary questions, the desire to fix and establish a traditional notion, have occupied too much time and labor of the agricultural student, and have served to confuse

the practical farmer. Any indication that the time of misdirected energy is passing away, is gratifying and encouraging to all who lay aside mere prejudice and seek to investigate in an intelligent and profitable manner. If our agricultural schools and colleges shall do no more than this, they will have abundantly compensated the community which has invested its money in their foundation."

There is much that might be said on this subject, but I will leave it in this imperfect condition, saying that the prime object of this brief paper is to call forth thought, and if you see fit, discussion, and thus awaken attention to a subject which is second in importance to none that the farmer is called upon to deal with. Let the farmers of Maine see to it that some methods are speedily adopted to supply the lack pointed out, and thus provide for the better protection of our farm stock.

THE BEET SUGAR INDUSTRY.

During the past few years a new interest has been developed throughout our country in the manufacture of beet sugar; and recent attention has been called to it in our State through the message of His Excellency, Governor Connor, and from its having formed the subject of two papers presented at the annual session of the Board, held at Brunswick. One of these papers has been given in previous pages, and the other, from the pen of Prof. H. Carmichael of Bowdoin College, has not, in consequence of pressing College duties, been yet placed at my disposal. I hope it may be received in season for its publication in a subsequent part of this volume. Wishing to give all the information that can be obtained on this subject, I devote a few pages to a re-publication of a series of useful and practical papers originally published in the SCIENTIFIC FARMER, Boston, Mass., by Mr. E. H. Libby, one of its editors. The several chapters well cover the points taken up, and are worthy of careful reading.

I.—IN GENERAL.

Slowly, gradually, an interest is being awakened among thinking farmers and capitalists, to the importance and resources of the beet sugar industry as practiced in Europe. It has already gained a foothold in this country, and, if we read the agricultural weather signs aright, is destined to rank, within a few decades, among our foremost farm industries.

The fact that this country pays annually over *seventy-five million dollars* to other nations for sugar, ought to be sufficient to arrest thought and turn it into this channel. Sugar from the beet root is identical in composition with that from the cane, and can in no way be distinguished from it. Of the direct profits of the industry,

there need not be the slightest doubt, as we shall show in a subsequent paper. But the indirect benefits to be derived from it are even more weighty. The scientific investigations instituted in Europe, into this beet sugar question, are of wonderful interest, since they were the key note to the great advances in agricultural science and practice on the eastern continent. Now the industry stands in the front rank among the agricultural industries of France and Germany, and has gained a strong foothold in England and Ireland. Wherever introduced, it has improved the general agricultural condition, to a marked extent, and is said to have doubled the products of French farms. It enables the farmer to keep much more stock upon the same area, on account of the enormous amount of fodder resulting. The pulp remaining after expressing the juice from the roots, is excellent cattle food in a small bulk; likewise the tops, which may be preserved fresh, in properly constructed pits. The land is continually growing more fertile, for in the sugar sold no fertility is removed from the land, and what little goes off as beef and dairy products, may be easily replaced by means of the profits accruing therefrom. The soil is improved by the deep and thorough tillage practiced, and, by the rotation adopted, other profitable crops are produced.

The earlier efforts in this country in Wisconsin, Illinois and California, were failures, from a lack of capital, and inadequate knowledge of the causes which govern success and failure. Factories at Freeport, Illinois, and several in California, are now meeting with marked success. It is stated that a movement has been begun in Delaware, for the introduction of the business upon an extensive scale. And for several years the question has been agitated in Canada, with a view to its ultimate establishment there. Now and then a pamphlet on the subject appears, and occasionally an agricultural lecturer takes it for his theme. A book on the sugar beet is promised before long, from the pen of an able, Oswego, New York, gentleman. We look with interest upon the Delaware project; for but let success crown the efforts made in this direction in a single instance on the Atlantic coast, and it will be the signal for a score of factories to spring into existence in the Middle and Eastern States. There need be no doubt of the success of this industry, if entered upon intelligently, and with the right men controlling it.

The investigations of Professor Goessmann, at the Massachusetts Argicultural College, in 1870-71, prove conclusively that the

successful cultivation of the sugar beet, in the Northeastern States, is possible, and not attended with very great difficulties. And its cultivation once an assured success, the manufacture of the sugar is but a matter of capital, and the employment of a few skillful men, educated for the business, who may be had almost without number from France or Germany. A series of trials were made in various parts of New England and New York, in connection with the investigations of Professor Goessmann, and under his direction, and the beets were subsequently examined by him, with most satisfactory results. To these investigations we shall make frequent reference hereafter.

Much depends on seed, soil, manures, tillage, locality, and climate, for the successful cultivation of the beet for sugar making. And it is only by trial and experience that the farmers of a certain section can learn whether their conditions are adapted to the business. We believe it would be for the interest of many of our readers to devote a little land, labor, and thought, to this crop the coming season. Then have the crop examined after harvest by competent chemists for the content of sugar in the roots produced. By comparing results next winter in the *Scientific Farmer* a great deal will have been learned about the business; and a decided advance made toward its introduction, as a sugar enterprise. But as an inducement to engage in this culture to a limited extent, as an educational effort, the reader should bear in mind that sugar beets are among the very best of roots for stock food, and the production of rich milk. Such a course will teach whether a particular soil and section is adapted to this branch of farming, and preclude failure. When, years ago, in France, the business was found to promise such large returns, factories started up in many localities, where it was soon discovered that the beets could not be grown profitably, or failure resulted because some condition of success was not previously considered with reference to the case in hand, but especially because of unfavorable climatic and soil conditions.

A few words in regard to the cultivation of the beet for sugar, and we will postpone further remarks until next month, when we will go more into particulars, and treat the subject systematically. The *variety of the seed* greatly influences the amount of sugar in the roots produced, so much have varieties changed through cultivation. The varieties that have given the most satisfactory results in this country, thus far, are the Imperial, and Electoral,

of Saxony, Germany, and may be obtained of the leading seed-houses, but with greater safety from the factories already in operation. The ordinary sorts of sugar beet seed sold by seedsmen for stock food are worthless for the production of sugar. *Nitrogenous manures* should be avoided, on account of their diminishing the percentage of sugar in the juice, and tending to produce an over-abundance of tops. The sugar beet is decidedly a potash plant, hence the German potash salts are a specific manure for this crop. It is recommended to apply 250 lbs. each of sulphate potash (high grade) and superphosphate lime, per acre. Sugar beets do best, in rotation, after a well manured grain crop. A light soil, well drained, is best suited for this crop. Large size should not be sought after, either for sugar or stock food; roots weighing one to two pounds are more solid, nutritious, and contain most sugar. The land should be plowed early and deep, and planted as soon as the soil will admit, before the winter moisture has dried up, to avoid the danger of drought.

II—The Seed and the Soil.

Having premised that locality, climate, seed, culture and manures greatly influence success in this business, and advised our readers in every section to try the growing of sugar beets as an educational effort, as well as a source of immediate pecuniary profit, it remains for us to consider more carefully the various points involved. But so intimate are the relations of pocket and practice in farm economy, perhaps we can start farmers to thinking more interestedly on this subject by the statement that the easily attainable receipts per acre of sugar beets are upwards of $250. Allowing a large estimate, 50 per cent., for expenses, we have a surplus greater even than from a 150 bushel corn crop costing 20 cents per bushel. And the surety of success is scarcely less than with that good old crop in which the *Scientific Farmer* is striving to create a new interest for the benefit of a "profitable agriculture."

Although no book of seed pedigrees has yet appeared—save the seedsman's catalogue—the matter of selection is quite as important in the vegetable as in the animal kingdom; and the results of growth are dependent upon ancestry with equal force. The successful cultivator can almost

> "—— look into the seeds of time,
> And say which will grow and which will not."

"Whatsoever a man soweth that shall he also reap," is especially applicable in this case. The sugar beet is a lineal descendant of the wild beet, *Beta maritima*, of the Mediterranean sea coast, and by change of soil and climate, by selection and cultivation, has got to be a very different plant from its progenitor.

The difference between the sugar beet of to-day, and its cousin the wild beet, is well illustrated by the ash analyses of the roots:

	Sugar beet.	Wild beet.
Potash	48.9	30.1
Soda	7.6	34.2
Lime	8.8	3.1
Magnesia	5.5	3.2
Chlorine	6 5	18 5
Sulphuric acid	2 0	3 8
Phosphoric acid	7.6	3.5
Silicic acid	13.1	3.6

The table shows that though the wild beet may be called a soda plant, the sugar beet is decidedly a potash plant. And in similar proportion does the content of sugar differ in the juice of the two varieties. The sugar beet is very susceptible to change in cultivation, and under improper treatment or neglect soon deteriorates. And the several varieties differ nearly as the localities in which they are grown and the treatment they receive. Professor Goessmann found the sugar in the juice of the various sorts tried in his experiments on the Agricultural College farm to range from 5.035 to 8.004 per cent. in common mangolds, and Vienna red, yellow, and white globe beets, to 15.50 per cent. in the best sugar beet. Lane's Improved Imperial sugar beet, for stock feeding, yielding 6.67 per cent. of sugar in the juice. By careful selection and cultivation, Vilmorin, originator of the sugar beet of that name, succeeded in producing roots that yielded 21 per cent. of sugar, a higher percentage than is contained in the sugar cane. But while the Vilmorin beet has yielded the highest percentage of sugar, it is rather more susceptible to variation. The Imperial and Electorial of Saxony have succeeded best in the hands of cultivators in this country. These results have been attained by selection, close attention to "pedigrees," study of soils, climates, and manures, and careful cultivation.

The soil for sugar beet cultivation should early engage the farmer's attention. The best soil for this purpose is a deep, mellow, sandy loam, with a comparatively light and permeable subsoil, and somewhat rich in thoroughly decomposed organic matter. A clay

soil becomes hard and compact in a dry season, particularly after heavy rains, and seriously retards the growth of the fleshy roots. Wet lands tend to produce coarse, watery beets, with little sugar, and a proneness to early decay. The best sugar beet root is smooth, compact, of rather small size—as size is measured in the root family—but must have room to grow without being stunted. Beets of this sort, containing a large amount of sugar, approach the nearest to perfection when grown in the soil above described.

Proper physical condition is the first requisite for a good beet soil. As for most root crops, deep plowing and thorough pulverization is a desideratum in this case. But when deep plowing is undertaken on a field for the first time, it should be done in fall, to secure the benefit of the action of winter frosts on the fresh subsoil. Old tillage lands in fine condition are better adapted to this culture than new soils; for the latter, during the first few years, usually produce coarse roots of inferior composition, on account of the undecomposed organic matter.

III—Manures.

There is no phase of this subject so full of interest as that of the effect of manures upon the development of the root. For out of its study, in Germany and France, arose the experimental researches which led to much that is known to-day in regard to the effect of manurial substances upon plant growth.

Rapid growth in plants is seldom associated with early maturity. The fruit tree which is remarkable for luxuriant growth is not an early and abundant bearer, because of the lack of maturity in the fruit-bearing twigs. In the so-called root crops, luxuriance and rapidity of growth is not accompanied by an equally rapid development of those features which produce solidity and maturity in the substance of the root, but rather by coarseness of texture, and a watery and saline composition.

While a heavy crop may seem to be desirable, to produce which large roots are necessary, it should be remembered that a large root is always of inferior quality. From analyses of small roots weighing $1\frac{1}{3}$ lbs., and of large roots weighing $5\frac{1}{4}$ lbs., it is shown that ten tons of the small roots contain as much solid matter as 13 tons of the larger roots. The cause of this may be looked for in the fact that the seasons are not long enough for the roots to ripen. How the composition of the sugar beet varies in the

various stages of growth is indicated by the following results obtained by Lotmann:

	July 19.	Aug. 17.	Sept. 1.	Sept. 21.	Oct. 4.	Oct. 12.
Water	86.1	85 2	84.4	84.8	83 9	83.5
Cellulose and Pectin	8.1	7.4	6.7	5 6	5 7	5.9
Sugar	2 5	4.5	6.5	7.1	8.8	9 1
Albuminoids, etc	2.4	1.9	1 4	1 3	.7	.7
Ash	.9	1.0	1.1	1.3	.9	.8

As the percentage of sugar mainly depends on the maturity of the root, the cultivators of the sugar beet plant early and avoid so-called stimulating manures. Nitrogenous manures tend to produce a rapid, luxuriant growth, hence especial care is exercised in their preparation and use in this culture. But as such manures are at the base of the whole system of manuring, and commercial manures only relied on as an aid, it were useless to attempt to argue them away. In order to get the full benefit from yard manure, without any of its bad effects, it should be applied in autumn, and plowed in deep—the beet is a deep feeder. If it is necessary to manure in spring, use only well rotted compost. When stable manure is largely used, sugar beets are usually raised in a rotation after a heavily manured grain crop; thus allowing for the thorough disintegration of the dung. The same remarks apply to the plowing in of green crops for manure. On account of the highly beneficial effect of green manures on the physical condition of the soil, and the fact that the beet feeds largely on the atmosphere, and that proper mechanical condition increases the power of the beet to draw nutriment from the air, such manures have special value; the only precaution necessary being to apply them a sufficiently long time before the beets are planted, to become thoroughly disintegrated. (*Goessmann.*)

An interesting point in regard to size of beets employed in sugar manufacture, is shown by the different systems of taxation in France and Germany. In the latter country the weight of roots is taxed, and the system results in all efforts being directed to the production of small roots and a high percentage of sugar. To this end the systems of manuring are particularly adapted. While in France, the taxation is upon the amount of sugar produced, and here spring manuring is more freely practiced, resulting in a smaller percentage of sugar but a larger yield of roots. The

sugar percentage is 6 in France to 8 in Germany. The same objections to the use of green manures on sugar beet land, apply to prairie soils, and recently cleared woodland, which are full of undecomposed organic matter. The truth of this has a practical illustration in the difficulties attending the first few years of sugar beet cultivation at Freeport, and Chatsworth.

As previously stated, the sugar beet is decidedly a potash plant. But we venture to assume that the failure to perceive beneficial results from the application of potash to English soils may be attributed to the presence already of a sufficient amount of that substance. Comparative analyses indicate this as a natural characteristic of that soil. Its further presence is probably also due to previous, direct application. Enough is enough in any soil. Dr. Goessmann's investigations show that the application of 250 to 300 lbs. of sulphate of potash (kainite) per acre was very beneficial on the college farm at Amherst. It frequently happens in practice, in many sections, especially in beginning this industry, that the exclusive use of commercial manures may be advisable; then it will be found that the potash salts come first in importance. Potash (the sulphate always on roots) tends to produce solidity, early maturity, and to increase the amount of sugar in the root.

The position of the potash in the soil has a marked influence on the product. The beet sends its roots deeply into the sub-soil, and exact investigations demonstrate that the potash must descend to the lower strata of soil before its beneficial effect will be noticed upon this class of roots; which explains the fact that potatoes and sugar beets, though both potash plants, have been raised alternately on the same soil with good results. The potato feeds on the surface soil, the sugar beet largely on the sub-soil.

IV—Results of Experiments.

In the manufacture of sugar from the beet, much depends upon the composition of the juice, aside from its content of sugar, any considerable quantity of foreign matter serving to render the separation of the sugar difficult and expensive. The juice of good sugar beets should not contain more than 18 to 20 parts of foreign matter to 100 parts of sugar. So the cultivator must not only seek a large percentage of sugar, but also adopt those methods of culture which will lessen the cost of manufacture. And in no way can this be done save by proper selection and application of

manures. The investigations of Prof. Goessmann at the Massachusetts Agricultural College have a direct bearing on this point. The following table explains itself:

Kind of Fertilizer.	Per cent. of sugar.	Proportion of foreign matter to 100 parts of sugar.
1. Green stable manure	7.37	45.86
2. Phosphatic blood guano	7 80	41.02
3. Rotten sheep manure	10.97	27.62
4. Stable compost	•11.70	28.20
5. Rotten stable manure	9.50	26.31
6. Unknown	11.00	22.72
7. In rotation, second year after stable manure (*a*)	15.10	19.20
7. In rotation, second year after stable manure (*b*)	9.70	45.26

Those marked *a* weighed from 1½ to 2 lbs. each. Those marked *b* were from the same field, but weighed from 10 to 14 lbs. each.

The above results were obtained by Prof. Goessmann on the College farm (1), and from roots furnished by the New York Agricultural Society (2 to 7), raised on the farms of different members of the society. It will be seen that No. 7 *(a)*, where the conditions are those previously recommended in the case of using nitrogenous manures, is the only one that comes within the limits, as regards the proportion of foreign matter, while also in this case the percentage of sugar is the largest. Undecomposed nitrogenous manures increase the amount of foreign matter in the juice, and seem to hinder the development of sugar; while potash acts the reverse in both cases. We abstract further from Prof. Goessmann's report of the various trials, in explanation of the table:

1. Four acres of a sandy loam were taken on the College farm, which was well manured with common stable manure for a crop of fodder beets, and planted May 23d. Percentage of sugar, 7.37. Roots collected last of September.

2. On a farm at Sing Sing, N. Y.—The soil was loam, two feet deep, resting on clayish hardpan, and had been seeded to grass for many years; 500 lbs. of phosphatic blood guano were applied per acre. Percentage of sugar, 7.8. Some Vilmorin sugar beets from the same farm yielded 9 53 per cent. of sugar. Harvested last of October.

3. On a farm at Washington, Dutchess Co., N. Y.—Soil, a clayish loam, plowed seven inches deep. Rotten sheep manure was applied in trenches, and then covered with the plow, and the

seed sown upon the ridges. Sugar, 10.97 per cent. Harvested 6th of November.

4. On a farm at South Hartford, Washington Co., N. Y.—Soil, a gravelly loam, richly manured with stable compost, and plowed twice previous to planting. Harvested middle of November. Sugar, 11.7 per cent.

5. On a farm at Greenwich, Washington Co., N. Y.—Soil, a sandy loam, underlaid by a fine sand. Seed planted on ridges covering trenches containing a little rotten stable manure. Harvested last of November. Sugar, 9.5 per cent.

7. On a farm at Albion, Orleans Co., N. Y.—Soil, a dark, reddish brown, rich, deep, sandy loam. Clover had been raised on the land previous to a crop of carrots which preceded the sugar beets. Twenty loads of horse manure had been applied the autumn previous to the crop of carrots, which made the sugar beets the second crop after the application of any manure. Harvested November 13. Sugar, 15.1 per cent. in the small specimens *(a)*, and only 9.7 per cent. in the large specimens *(b)*.

Except in the last case mentioned, the roots examined were of a uniform size, from 1 to 2 lbs. each.

In another series of experiments to test the beets from various seed, some raised on the College farm, and the effect of several manures on the development of sugar in the roots, a field 287 feet by 157 feet was taken, and divided into six plots of equal size. The plots ran east and west across the field, with a two feet space between. The manures were applied at the same time to the different plots—about two weeks previous to planting—except No. 6, which, with the rest of the field, had been well manured two years before with stable manure. The following table shows the results:—

Kind of Fertilizer.	Amount of fertilizers per acre.	Percentage of sugar in juice of roots raised from following seeds:			
		Freeport, Illinois.	Sutton's English.	Electoral, College Farm	Vilmorin, College Farm.
Fresh stable manure	14 tons.	11.96	9.71	9.42	7.80
Blood guano, without potash	1200 lbs.	10.99	9.17	10 10	10 20
Blood guano, with potash	1200 lbs.	12.55	10 01	13 24	10 50
Sulphate potash and superphosphate	300 lbs. each*	13 15	10.91	12.16	10 50
Sulphate potash	300 lbs.†	14.52	12.42	14 32	12 78
No manure; second year after stable manure	——	13 90	——	12.78	12.19

* The Kainite contained 15.2 per cent. potash. † This contained 29.3 per cent. potash.

These results plainly indicate the effect of the different fertilizers; that fresh nitrogenous manures are injurious; that when well decomposed in the soil their effect is good; and that potash has a marked influence on the product of sugar. As we shall show hereafter, potash also aids in the separation of the sugar in manufacture. But of course these experiments do not show that where potash is in plentiful supply in the soil, it is necessary to apply more, but simply that its presence is very important. Stable manure always contains considerable potash, and after a year's decomposition the potash in particular is ready for assimilation, and descended probably into the sub-soil, where it is most beneficial.

The beet sugar industry in this country is looking up. In California it has attained great importance. The amount of sugar manufactured at Sacramento alone exceeded 3,000,000 pounds in the season of '75-'76. Twelve thousand tons of beet roots have been worked up at Sacramento, which yielded 13½ per cent. of sugar. There are several other factories in the State, but still there is not enough to supply the home demand. In Maine a lively interest is being awakened, and a company near Portland have sent a man to the Centennial Exhibition, to Freeport, Illinois, and to California, to study up the methods of operation, etc. The Governor, in his last message to the Legislature, deemed it of so much importance as to devote much space to the subject. In Southern Maine the farmers will doubtless readily take hold of the enterprise, having been engaged for several years furnishing immense quantities of sweet corn, peas, berries, tomatoes, etc., to the numerous packing establishments of that section. Rhode Island is stirring in the matter, too, and men who mean business are carefully considering the pros and cons. Repeated reports come from Canada of their intentions. Of the possibilities of Canada in this line we shall have something to say soon. The factory at Freeport, Illinois, is reported in a prosperous condition. And doubtless the Centennial Exhibition will do much toward showing up the possibilities of the industry, as we understand there is or will be a fine showing of the products, which must open the eyes of all interested parties.

V—Prospects for Canada—Climate.

In Professor Goessmann's series of investigations, he tested several samples of beets from Canada, raised for this purpose, with the following results:

	Weight.	Per cent. of Sugar in Juice.
A fodder beet		4.3
A fodder beet		5.8
Electoral	4 to 6 lbs,	9.7
Uncertain variety from Echaullon de Montreal	2 to 2½ lbs,	11.38
Uncertain variety from Riviere du Loup	2 to 3¼ lbs.,	10.2
Uncertain variety from Chambly	2 to 2½ lbs.,	9.02
Uncertain variety from Maskinonge	2 to 3 lbs.,	8.83

The Secretary of the Canadian Department of Agriculture has shown great energy and interest in the investigation of the capabilities of Canada in this direction, which bid fair to be crowned with such success. Canada is not too cold for this industry, the season being long enough for the perfect maturing of the roots. Indeed, it may even be true, that the climate is specially favorable to this end. It is even held that warm countries are rather adverse to its successful prosecution; among other reasons, because of the coarser roots produced, the fermenting of the juice in high temperatures during manufacture, and also, perhaps, that other profitable special crops already have a strong foothold. The results of investigations so far are as favorable to Canada, as to New York. A proper and systematic method of cultivation would doubtless result in a higher and more satisfactory quality of beet and yield of sugar, in both localities.

Introduction of the Enterprise.

The first step has been taken; it has been proved by careful investigation, that the soil and climate, especially of the older sections of the Northern States and Canada, are suitable to the production of beets for sugar making. And in several localities it is already in successful operation; in others it is being agitated with prospects of action. Before steps for actual establishment are taken in any locality, careful experiments should be tried for testing the means for producing roots of the right quality. If from seed of the best varieties, with proper cultivation and manuring, mature roots of medium size and fineness of form, yielding from 8 per cent. and upwards of sugar are produced, then, other requisites being provided, proceed boldly. When capital has been secured, of which from $100,000 to $300,000 are necessary for the manufacturing branch, the matter of location must be prominently considered. Facilities for transportation, and plenti-

ful supplies of water from September till spring, are of prime importance. For the practical operations of the factory, a good foreman should be obtained from some existing establishment, and the services of a good chemist, *having experience in this business*, should at once be called into requisition. The factory sometimes depends on surrounding farmers for a supply of roots; in this case a certain number of acres (500, more or less, according to capacity) should be guaranteed at the outset, and knowledge of the best methods of culture be freely disseminated among the farmers, by discussion, by pamphlets, etc. But perhaps the best way, when practicable, is for the manufacturers to produce their own roots, to a large extent at least. By proper management in rotation of crops, feeding of the refuse to stock, etc., a considerable profit may be realized from this method. Under ordinary circumstances, the system of having the roots furnished by the farmers will be found the easiest to manage. The compensations to the producer of the roots, should always be according to the amount of sugar, and never be regulated by the bulk of roots furnished. For the aim should always be to the production of the best of roots, with the highest per cent. of sugar attainable, which is for the benefit of both cultivator and manufacturer.

One excellent feature of this business, which should commend itself to rural communities, is the fact that the manufacturing season is mainly during the fall and winter months when farm operations are usually at a comparative rest, which admits of the employment of the farm help in the factory, to a certain extent. This plan will tend to retain in the district a set of permanent farm employes, so desirable to secure. What was mentioned at first should be urged again in conclusion,—the general influence of beet-sugar production on the agriculture of the section. With a rotation of grain, grass, and sugar beets, and all the beet pulp for fodder, and other refuse for fertilizing, a high state of culture may be reached. In the sugar, the money crop, no fertility is removed from the soil, its constituents all coming from the atmosphere. Beet pulp in connection with hay, etc., is excellent cattle food. By its utilization, and the feeding of the other crops on the farm, stock-raising enters into the system as a profitable feature; the only manures necessary to purchase being an equivalent of the mineral matters carried off in the carcasses of the animals.

VI—APPENDIX. English Experiments.

As an appendix to the foregoing, I re-publish from the same source as the above, a letter from J. B. Lawes, the veteran experimentor of Rothamstead, Herts, England, which from the source of high authority from which it comes, entitles it to great weight and careful study :

The field upon which the sugar beet has been grown has been under experiment for thirty-three years, and during the whole of this period, except for two or three years, root crops have been grown, and the produce carried away from the land. Also with very few and trifling exceptions the same manures have been applied to the same spaces of land. Without attempting to give a complete explanation of the figures, one or two points of interest may be alluded to.

The plot manured with mineral manures alone gives the lowest produce in the series—five tons, sixteen cwt. of roots. It also gives the highest amount of dry matter, the highest per cent. of sugar, the lowest per cent. of nitrogen and ash of the series. The addition of nitrate of soda to these minerals increases the produce from five tons sixteen cwt. to fifteen tons. The percentage of dry matter and sugar is lower, and the nitrogen and ash is higher than in the last plot. Sulphate of ammonia containing the same amount of nitrogen as the nitrate of soda, gives a less gross produce, higher per cent. of dry matter and sugar, lower per cent. of nitrogen and ash than the nitrate. The 2,000 lbs. of rape cake which also contains the same amount of nitrogen as the nitrate and salts of ammonia, gives a produce resembling more closely that of the salts of ammonia than of the nitrate. The dung, which supplied more than twice the quantity of nitrogen supplied by the nitrate, gives very little more gross produce. In the dung and rape cake large quantities of organic matter is supplied, with the nitrate and salts of ammonia none ; nor has any organic matter been applied to the land during the whole experimental period. We may therefore assume that sugar is a product obtained by the plant from the atmosphere, by the decomposition of carbonic acid.

A similar law appears to be followed by the cereal crops in the production of starch. No more carbon has been given by wheat manured with fourteen tons of farm-yard dung per acre for thirty-three consecutive years, than there was on another plot manured during the same period by minerals and nitrogen.

One of the most important and interesting questions for scientific agriculture to answer, is: In what state of fertility do we leave the land for the growth of plants of a different character after growing one species for a number of years? For instance, the root crop in Great Britain is generally considered to be a restorative crop; that is to say, when land was exhausted by corn [English for grain] growing, a crop of roots is said to restore fertility.

Many reasons might be assigned for this. Roots do not take up silica. Silica is known to form compounds with ammonia, and this or some other compound beneficial to corn and not required by roots, might accumulate in the soil.

As at Rothamstead we have always land under continuous corn crops, it was easy to test this important question by taking corn upon the land under continuous roots. It was therefore decided to do this, and three successive crops of barley were taken. The result showed that not only was there no accumulated fertility, but that the land upon which roots had been removed year by year was less capable of growing barley than the land which was growing barley every year without manure.

Subsequent results and recent analyses of the soil, prove that roots rob the soil of more fertility than any of the ordinary crops of the rotation. This is by no means inconsistent with the commonly accepted idea that roots restore fertility. In the common practice of agriculture, roots are consumed on the farm, and the bulk of the manure elements are returned to the land. In the five years given in the table the manures were applied only the first three years. The last two crops were taken without manure in order to ascertain the quantity of manure remaining in the land.

It will be found on calculating the amount of nitrogen taken up in the five crops of sugar beet bulb grown by tho nitrate of soda, deducting first the produce grown by the minerals alone, that the quantities approximate nearly to the quantity supplied in the nitrate of soda, which would be in the three years about 260 lbs. Assuming that both the cereal and root crops take a large portion of the mineral food, and the nitrogen which they require near the surface of the soil (as is probably the case) the reason why root crops can take up more of the nitrogen supplied as manure, and that they exhaust the soil more completely than the cereals is due to the different period of growth, and in the modes of treatment employed in the cultivation.

The cereal crops when sown in the autumn or spring do not begin actually growing until the middle of April in this country, and they begin to turn yellow and cease to assimilate force in about ninety days. The root crops which are sown about the same time, continue to grow and assimilate force for about twice the period. They are moreover aided by the constant stirring of the soil which they receive throughout this period, fresh matter being constantly oxidated. During this period, too, the rain-fall is hardly sufficient to carry the soluble salts beyond the range of the roots. I think, therefore, these circumstances fully explain why in our experiment, a larger percentage of the supplied nitrogen is recovered in our root than in our cereal crops, and also why a root crop is more exhausting if removed from a soil, and at the same time more restorative if consumed on the land, than a cereal crop can be.

Experiments on Sugar Beet, Barn Field, Rothamstead.

Average produce of 1871, 2, 3, 4, 5. The average produce per acre and the average percentage of sugar are, in all cases, for the five years. The average percentage of dry matter, of mineral matter in the dry matter, of the roots are, in all cases, for the first three years. The percentage of nitrogen relates to the first year only; but the percentage of nitrogen has been determined in the juice in selected cases each year, and these results confirm the indication of the nitrogen in the roots in the first year. The average percentage of dry matter and mineral matter in the dry matter in the leaves are for the first and second years only.

ABSTRACT OF RESULTS. AVERAGE OF FIVE SEASONS—1871, '72, '73, '74, '75.

	Mean of plot, 1; 14 tons per acre; farm-yard manure, first three years, none afterwards. Series 1. Dung only; no cross dressings.	Series 2. Dung as 1; cross dressed with 550 lbs. of nitrate of soda per annum for three yrs. 1871, 2, 3; none afterwards.	Series 3. As 1; cross dressed with 400 lbs. of salts of ammonia for three years; none afterwards.	Series 4. As 1; cross dressed with 2,000 lbs. rape cake, and 400 lbs. of salts of ammonia for three years; none afterwards.	Series 5. As 1; cross dressed with 2,000 lbs. rape cake for three years; none afterwards.
	Cwts. of 112 lbs.	Cwts. of 112 lbs.	Cwts. of 112 lbs.	Cwts. of 112 lbs.	Cwts. of 112 lbs.
Average produce per acre:					
Roots	308	412	397	444	435
Leaves	83	146	143	169	117
Average composition of roots:	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Dry matter	17.49	16.11	16.56	16.23	16.66
Mineral matter (ash) in dry matter	5.00	6.11	5.83	6.55	5.61
Nitrogen in dry matter	0.83	1.24	1 53	1.52	1.24
Sugar in juice	12.70	11.58	11.71	11.35	11.93
Sugar in roots, if 95 per cent. juice	12.07	11.00	11.12	10.78	11.33
Av'ge composition of leaves:					
Dry matter	10.56	10.58	9.01	8.47	9.43
Ash in dry matter	23 25	23 96	24.81	25.39	24.99

MEAN OF PLOTS 4, 5, 6. SUPERPHOSPATE OF LIME WITH OR WITHOUT POTASH, SODA AND MAGNESIA.

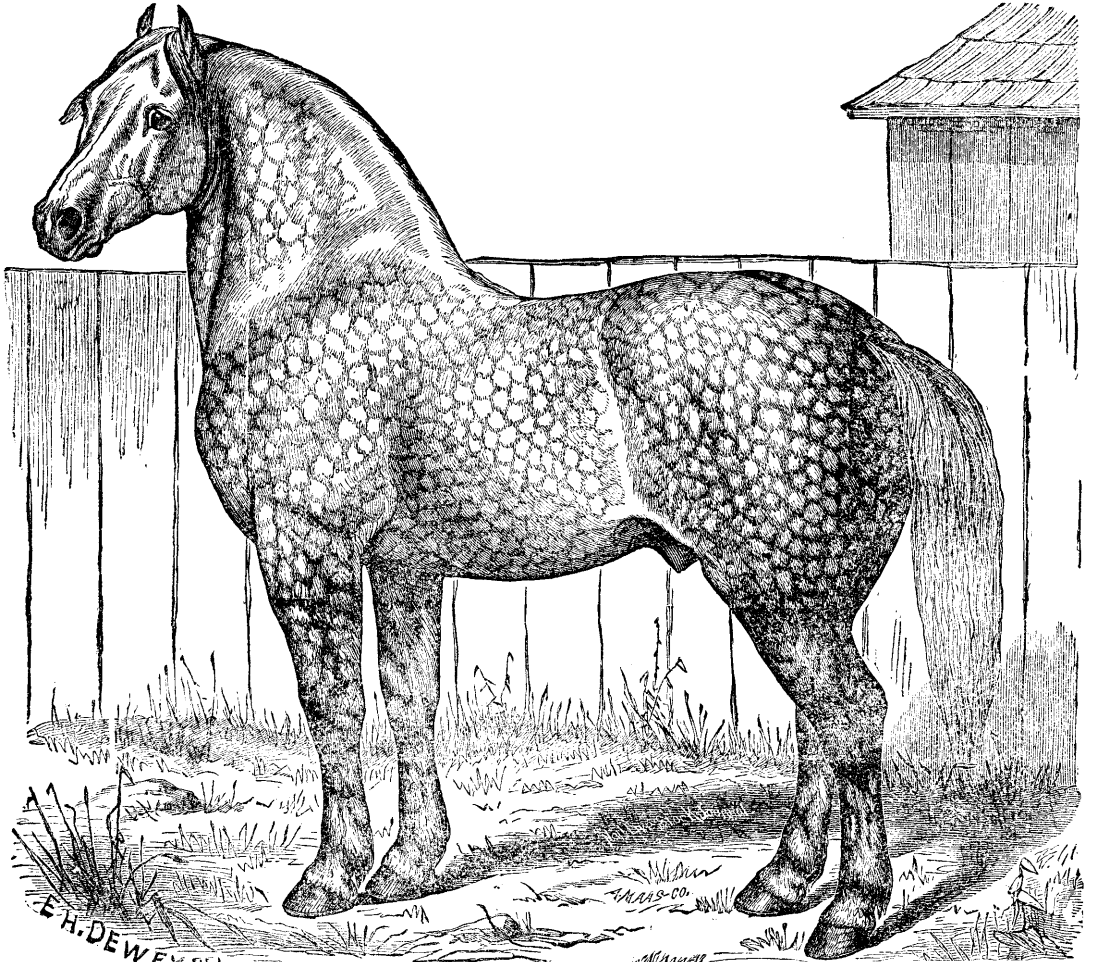
	Without dung or cross dressing.	With nitrate.	With ammonia.	With rape cake and ammonia.	With rape cake.
	Cwts. of 112 lbs.	Cwts. of 112 lbs.	Cwts. of 112 lbs.	Cwts. of 112 lbs.	Cwts. of 112 lbs.
Average produce per acre:					
Roots	116	299	234	278	337
Leaves	26	79	89	68	127
Average composition of roots:	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Dry matter	18.53	15.93	17.43	17.66	15.93
Ash in dry matter	4.30	5.73	4.81	4.50	5.98
Nitrogen in dry matter	0.84	1.20	0.87	0.83	1 52
Sugar in juice	14.06	11.95	13.28	12.98	11.84
Sugar in roots, if 95 cent. juice	13.36	11.35	12.62	12.33	11.28
Av'ge composition of leaves:					
Dry matter	14.51	10.16	10.98	10.70	9.84
Ash in dry matter	23.57	22 34	23.30	22.41	21.51

THE HORSE AT AGRICULTURAL EXHIBITIONS.

Concerning the origin of the horse the Arabs have the following tradition:

"When God wished to create the horse He said to the south wind, 'I wish to form a creature out of thee, be thou condensed,' and the wind was condensed. And God formed a chestnut horse, saying, 'I have called thee horse; I have created thee an Arab, and have given thee a chestnut color. I have bound fortune on the mane which falls over thine eyes; thou shalt be chief among animals; men shall follow thee whithersoever thou goest; good for the pursuit as for the retreat thou shalt fly without wings; riches shall repose in thy loins and wealth shall be made by thy intercession.' Then he marked him with the sign of glory and of happiness, a star shining in the middle of his forehead. After the creation of Adam, God called him by name, and said 'Choose now between the horse and the borak.' Adam replied, 'The more beautiful of the two is the horse.' And God said, 'Excellent, thou hast chosen thy glory and the glory of thy sons; while they exist my blessing shall be with them, because I have not created anything that can be more dear to me than man and the horse.'"

The beautiful imagery in the above extract contains a highly figurative description of the noble qualities of the horse—an animal of greater service and higher use to man than any in the whole range of animated nature; and yet it is not too highly drawn nor too extravagant in statement. The horse is indeed chief among animals. "Without wings, he fairly flies, and wealth and riches grow out of his intercession; fortune rests upon his flowing mane, and men follow him whithersoever he goeth." Endowed equally with strength, beauty and docility, he also possesses wondrous powers of speed and of endurance, has faculties susceptible of a high order of education, and perceptions which catch the spirit of man's intentions. Under the saddle or in the harness, attached to


E.H. DEWEY

the road wagon or the dray, he is the obedient servant of man, doing his bidding cheerfully, often receiving therefor neglect and not unfrequently positive cruelty. His service in all the arts of peace is so important, that no greater public calamity could come to the nation than a plague which would render our horses unfit for work—a brief experience in which, a year or two since, fairly interrupted the business and commerce of metropolitan centres, interfered with the transmittal of the mails, the various departments of the Government service, and even prevented the proper burial of the dead. In war, too, notwithstanding the curious inventions and improvements in our engines of destruction, what could take his place? Well did old Job say of him, "The glory of his nostrils is terrible. He paweth in the valley and rejoiceth in his strength; he goeth on to meet the armed men. He mocketh at fear and is not afrighted; neither turneth he back from the sword. He swalloweth the ground with fierceness and rage. He smelleth the battle afar off, the thunder of the captains and the shouting." In commerce, too, the horse has in the past acted an important part, towing boats ladened with the golden grain of the great wheat producing sections, to the Atlantic seaboard, through important water-ways—which even with our more speedy means of transportation in recent years, still act an important part in the business of the world. Indeed, so infinite are the variations of his uses to man, in all parts of the world, on the farm, on the road, in the workshop—that his capacity has formed the only standard for the correct measurement of steam engines, which, in so many kinds of work have entirely taken his place—the ability to raise 33,000 pounds avoirdupois one foot in height in one minute of time—being everywhere adopted as the actual capacity of one horse, and the standard for estimating the power of the largest engines ever constructed. Moreover, the wide range of country which the horse inhabits, and his adaptibility to conform to various circumstances of situation, is one of the most valuable qualities which he possesses, and goes far towards rendering him the serviceable beast which he is. While other animals which man in various parts of the globe has trained to become his servant, are useful only within limited range—the horse, not only lives with man wherever he can furnish him with a supply of food, but by his peculiar characteristics of speed and strength, renders him a service which is inestimable. The reindeer, the camel, the elephant, are worth nothing out of their small range. The horse exists in

excellent condition from the frozen snows of Iceland to the scorching plains of Africa.

Now without going over the ground covered by a consideration of the antiquity of the horse, and the various types of the animal which have existed or may now be found in the different countries of the globe—it is more to our purpose to come at once to the horses of the present day, and the part they fill in our business, industries and pleasure. But it may be said in passing rapidly to this point, that the different types of the modern horse have been the work of judicious selection and breeding in a given direction for a long series of years. Thus have been produced the hunter, the runner, the cab horse, the trotter, the cart horse, the dray horse, and numerous other fancy varieties, so common in England, and on the continent of Europe. In our own country, where the people have not adopted all the customs and ways of our relatives over the water, fewer types are found, and a classification of our horses would embrace but three, or at most four distinct varieties—the trotter or the American thoroughbred, the horse of all work, the gentleman's driving horse and the heavy horse used exclusively for purposes of draught. But though we have fewer local distinctions in our breeds of horses, and breed less for fancy uses than do the people of the Old World, we have so bred the horse in this country within the past twenty or thirty years, as to command the attention and merit the applause of the best breeders and best judges of horses in the world. What nation of the Old World can show better samples of horseflesh that has been produced in the States of Kentucky, Ohio, Mississippi, Illinois, New York, and many others;—what nation can show finer style and action, better breeding, greater endurance or a faster step than can be shown by the horses of these same States? Our private studs, and our famous trotters, almost surpass the world, and the achievements of Flora Temple, Dexter, Goldsmith Maid, American Girl, Smuggler, Fullerton, Occident, Lula and a host of other famous trotters, have made the people of the Old World fairly stare with wonder; while in the matter of breeding, private citizens in our own country have performed, what in other nations is only carried out under the patronage of Government. This interest in the breeding, training, handling and trotting—if you please—of horses, has been growing and increasing and developing all over our country, during the past dozen or twenty years; and has now in its various interests sub-divisions and

bearings reached enormous proportions. Now I have a sort of theory that while the horse was regarded as of prime use to man, was bred and kept for his real service, and was an actual necessity in the performance of the chief business of the country—his useful qualities were developed and held in high esteem, and he was bred and trained almost solely for these purposes—but when other agencies for the performance of business began to be employed, then men began to keep horses for sport and fancy, to develope qualities outside of those belonging to genuine service, and to put them to the performance of tasks for which they were not previously thought of. For instance: before the days of railroads, when horses were employed on famous stage lines, and for the transportation of merchandise long distances—what magnificent horses we had all over this Eastern country, which was, forty and fifty years ago, all that was of much consequence in the then American nation. How enthusiastically that great writer on the American horse, Frank Forrester, describes the horses which formed the teams on the through line of "flying coaches" between Philadelphia and Portland, from 1825 to 1836—going nine miles an hour, including stoppages—equal to eleven hours on the road —and making the time as punctually as on the best English mail routes,at a time when the English mail service was the wonder of the world—these eleven miles an hour over the American roads of that day being equal to fourteen over the English turnpikes of the corresponding period! Or take, too, the same horses attached to the great teams which transported the supplies of remote places from the great centres of distribution—which carried their monstrous loads up hill and down over dangerous roads, at a fast rate for the time and the kind of business performed. While these were the uses of the horse, the horse was bred especially for them —and the present generation of breeders, in our own State at least, will not soon see such horses as were then used in the business of the country, and which the demands of the country called for. "And these horses," says that great authority just quoted, "were obtained from the northern part of Massachusetts, Vermont, and some portions of New Hampshire—and from those quarters is the origin of the horse of Maine, almost without admixture." To go back now and finish the comparison on which I started in stating my theory of the rise of the American trotter:— When railroads begun to be built, stage coaches were superceded as a mode of travel, and the transportation of heavy merchandise

was no longer carried on by means of "tote teams;" and as this agency began to be employed for these purposes, men began to train their horses to trot and run. The locomotive was a fast team, and men tried to see if their horses could not out-do it:— and it is an interesting fact, which I think has some connection with the theory being put forth, that the building of railroads in this country and the origin of horse racing or trotting, have their date at very nearly the same period, the year 1827 witnessing the building of the first railroad in Massachusetts, and the same year, or possibly a year earlier, the establishment of authorized trotting in New York.

Now, all that has been said (and there is more of it than has perhaps been necessary), is somewhat gratuitous, and may be thrown aside by you as fast as I have read it. It has little connection with, although it may be regarded as a sort of introduction to the real topic which this Board at its last annual meeting assigned to me for treatment, viz: that of "horse racing at fairs, in regard to its influence both financially and morally upon the community." In performing this task, I have nothing to do, as you will see, with the breeding of horses, with the importance and magnitude of the interest which the horse represents, nor with fast or slow horses, except such as are found at our fairs and agricultural exhibitions. And while I was charged with preparing a report upon this subject with direct reference to our own State, I was also directed to open a correspondence with horse men, breeders and Agricultural Societies in other States, to get their views, opinions and experiences upon the subject. So I may be pardoned, if in what is to follow I may allude incidentally to some points of breeding, and to the practices of some societies outside of our own State, where it has seemed to me such things have a close bearing upon the matter in hand.

In Maine, as in all other States, horse trotting has become quite generally, if not somewhat permanently, established as one of the sports of the people, and one of the leading features of fairs and so-called agricultural exhibitions. I say somewhat permanently established—and the statement is borne out by the fact that we now have in this State over fifty tracks or race courses, an average of more than three to each county. While in some instances these tracks have been built by private driving associations, in more they have been built wholly or in part by regularly incorporated agricultural societies, as a legitimate accessory to them, or a

legitimate means of encouraging the interests which they have been established to promote. These tracks have been built upon the principle that the horse is, purely and simply, a legitimate agricultural production; that speed is a legitimate and one of the most valuable qualities which he possesses; that in order to show this quality to the best advantage, and to the least injury to himself, a proper and suitable place is necessary—such a place being a smooth track or course, where in his legitimate trial he may have every chance in his favor. Now this principle is fair, and is in accordance with the best judgment of some of the best men in the country. Further than this: eminent authorities (and if I were to mention some of their names they would carry attention if not belief to the minds of all unprejudiced persons who hear me; names which stand high in the scale of moral worth and scientific acquirements, and which belong to characters above the suspicion of personal ends), who united in the conviction, that with suitable preparation and management, a healthy horse suffers no injury or distress from trotting a moderate distance at the utmost capacity of his speed. Speed, therefore, being a quality of positive value in the horse, the horse being a direct product of the farm, how can trials of speed, properly regulated and conducted, be regarded as other than a legitimate part of agricultural exhibitions? Take the strength of oxen, the wool product of sheep, the milk of dairy animals, and in their several bearings place them in comparison with this prime quality in the horse. The ox is bred for size and strength, and in the trials of his capacity to draw large loads, is, for a short time, frequently put to his utmost powers—and the loads some yokes of oxen are made to draw are simply monstrous. Who objects to this? The dairy cow is specially fashioned for milk production, and has been bred for years with special reference to the development of certain functions in her organization. So, in its particular line have breeders developed and encouraged the promotion of certain desirable qualities in the different breeds of sheep. This has been done in each instance with a view to obtaining the most perfect animal, the best product, and the highest profit. Is not this legitimate? Are not the agencies employed and the ends sought completely in accordance with common sense and high-minded action? Then why deny in the one case the right to judicious breeding and proper development necessary to reach a certain honorable end—and in an exactly parallel case allow that the same course of breeding and training, is just and proper? If

the comparison is not a fair and candid one, let me stand corrected now and here. But, says one, the trials of speed at fairs bring in their train a long array of evils; they lead to drunkenness, to foul speech, to low associates, to betting and gambling, and to numerous vices which curse society, and which it should be the object of all good men to help banish from among us. That these do follow in some instances cannot be doubted, even by the best men and the most ardent lover of the horse—that they follow invariably, and as a matter of course, must be emphatically denied. Is it so hard a matter, as many would try to make us think, to conduct an agricultural fair without in some way countenancing these evils, or winking at their presence? I will endeavor to answer if you will bear with me a few moments.

In this State there are thirty-three local agricultural societies from which returns have been received during the past year. Nineteen of these societies show by their returns that they have awarded premiums for trials of speed; three say emphatically they have not, and the blanks from ten others would indicate either that they did not offer any or that none were awarded. One society which paid a total of $17,760 in premiums, paid $1100 for trials of speed; another, which paid $239 for trials of speed, paid $4 for milch cows; and a third, which paid over $100 for speed, paid $5 for milch cows. Generally, it appears from the returns, that those societies which have awarded no premiums whatever for trials of speed, have awarded the highest premiums for milch cows. These figures are suggestive and appear in quite striking contrasts—but if the whole list could be gone through with in detail, I think it would appear that the statement often made by opponents of trials of speed, that it receives an undue share of the premiums awarded, would not be sustained. It might, however, enforce upon the mind the wisdom of that clause in our statute which gives to the Board of Agriculture the direction of the expenditure of one-half of the sum given by the State to local societies. In Massachusetts—where the State Board exercises no such control—there was awarded by its agricultural societies in 1874, $2,373 in premiums on all classes of live stock, and $12,545 for trotting horses alone. In that State all but six of its thirty-one agricultural societies show an individual indebtedness of from $100 to $36,000—the greater part of them ranging up among the thousands. Of the thirty-three local societies in this State, but fifteen, or less than half, are carrying any liabilities whatever, and in most of these

cases it is very small in amount—so that our comparison with the mother State in this respect is largely in our favor.

To ascertain the just influence, "financially and morally," of trials of speed upon these societies, or upon the communities in which they are located, is not an easy matter, because so contradictory. One or two instances may be cited: The secretary of one society which has abandoned the plan of giving premiums for trotting, says it is working well and the society has no wish to return to the former method. Perhaps it should be mentioned here, however, that in the town where the exhibitions of this society are held, is a Driving Park owned by parties interested in horses, on which trials of speed take place two or three times in a year. Another official manager of one of our county societies says, "Every dollar we get from the horsemen," as he terms them, "costs us two;" and a third says: "It would be impossible for us to run our fairs without trials of speed." These represent the general tone in which the matter is regarded—the sum of them being, if I mistake not: "trials of speed are costly, but the public seem to demand them, and the problem is how to conduct the matter so as to divest them as much as possible of their objectionable features, and render them as far as may be, self-sustaining: or in other words prevent them from becoming a financial burden to the societies."

No question has perhaps been more thoroughly discussed by the agricultural and turf journals during the last few years; or by managers of State and local agricultural societies, than this one of speed at fairs. A heap of writing has been given to it, many arguments have been presented on one side and the other, and a good deal of good natured wrangling by fair managers, has resulted from it:—but I cannot possibly see the difficulties to it which many do. I do not believe it is so hard a matter to control, I believe it may be easily, satisfactorily and fairly handled. To begin with, no fact is plainer than that our people need and must have recreation and amusement:—the community which does not tolerate them in a legitimate way, and the heart which does not rejoice in them to a proper extent, must be a poor, benighted community, and a glum, cheerless heart. Among recreations of a public nature, a well conducted contest of speed, is to most persons a pleasant and attractive spectacle, and I am very safe in saying, experience proves that nothing affords more satisfactory or harmless amusement, provided always, and every-

where, the associations are proper and the whole thing conducted honorably and fairly. Last fall, I saw upon the fair grounds of your society, an exhibition of family horses upon the track, for the somewhat small premium offered by the society for this class of horses, and I am sure those who witnessed the trial will bear with me that the twelve horses, driven by their owners a half mile and repeat, formed a feature in the exhibition which gave as much general satisfaction to the large crowd present as would a more closely contested race by noted trotters. The usual accompaniments of the race-course—where pure racing so to speak, or racing alone, is carried on—quarrelling, profanity, intoxication, gambling and public betting—may, and should always be everywhere forbidden and prevented in connection with fairs of agricultural societies. The morals of the community are of more value than all the 2.30 horses in the country. I abhor and detest from the bottom of my soul all these vices in every form, and have not command of words sufficiently forcible to express my contempt for them. They are mean and low, they lead to other forms of iniquity, and are debasing in all their influences. But I still insist there is no more occasion for immorality in any of these forms, in connection with a trial of the speed of horses, than in connection with an exhibition of the strength of oxen, or the skill of skaters upon an ice rink. Bad men will, nothwithstanding the force of law and the public sentiment against it, manage somehow to ply their nefarious business; they should not and they need not do it upon an exhibition ground or in sight or hearing of any one—and there is or may be law enough to prevent it. If a race is to take place on the ice of this river to-morrow, or on a fair ground any time, what is to prevent a number of men from getting together in a room at a hotel, in a corner saloon or other out of the way place, and selling pools on that race? This they may do on the price of greenbacks, on the result of an election, on the state of the weather, or a hundred similar occurrences—and it is done every day—but would this fact, if known, be likely to stop a man from voting, or prevent him from taking a sum of money that was honestly his due? Probably not. Furthermore, I know, and you all know, scores of gentlemen who may perhaps be termed "horse men," who love a good horse, who don't like to take the dust of a fellow traveller on a public turnpike, and who, perhaps, are proud of a horse that can trot well down in the "thirties"—who never in all their lives had a dollar up on a race, and who detest the

gambling and betting accompaniments with genuine contempt. These gentlemen are not to be classed with the rabble of a crowd. To their energy, and intelligence, and skill in breeding, we owe much of the improvement in this important class of farm stock—and when the State shall strike its great "general average," who shall say they will not be entitled to high rank as good citizens, if not as public benefactors?

But are there not agricultural societies who give no premiums for trials of speed, who allow no trotting upon their grounds? Yes, there are two or three in our own State who hold good exhibitions without trotting—and who are well satisfied with the system—but because they do not allow it is no evidence that it does not flourish in their very midst, and perhaps with greater force and attended by greater evils than would be the case if they allowed and controlled it. Without the State there are two or three honorable examples of societies which have never offered a premium or paid a purse for trotting. In New York, the State Agricultural Society has held thirty-six annual fairs, and has never had a horse trot in connection with one of them. It is to-day the highest type of an agricultural society in existence in this country, and has in its treasury more than $26,000. The Essex county society in Massachusetts, having a history of nearly sixty years, uninterrupted by the sound of a trotter's hoof—save those of its squadron of elegantly mounted Marshals at its aristocratic fairs—has by judicious management, and, as it is termed, "purely legitimate premiums," salted down under its treasury pad the snug little sum of $30,000. This last named society is one of the most useful in the Commonwealth, and embraces upon its roll of members some of the most distinguished names in the State. I am under obligations to its officers for kindly attentions, and shall not soon forget the sight of its magnificent dinner, at which six hundred persons sat down to elegantly decked tables, after which grand speeches were spoken by some of the most eloquent men in the "Old Commonwealth." But after all, my impression was that its exhibition ranked low as compared with many in our own State, (aside from its one grand feature of a well conducted plowing match); and I came away from Danvers at the close of two happy days saying to myself: "The managers of Old Essex are gentlemen, they go in for a good time, they pay their own bills, and with $30,000 in their pockets they can have horse trotting or not, just as they

please." These societies are cited by all opposed to trotting at fairs, as showing the success attained without resorting to horse races to draw a crowd;—but I am persuaded their success is due to other causes quite as much as to the absence of trials of speed. Nor must it be forgotten that in the State of New York, there are more than two hundred and fifty driving associations and race courses, with all their questionable accompaniments; and that in connection with the exhibition of this single society in Massachusetts, I saw more drunkenness and fighting than I ever saw in Maine at all the fairs I have ever attended in all my life. It is not true that the trials of speed of horses embodies all the evils in connection with our system of agricultural exhibitions; there are others from which we in Maine are happily free; and in comparison with which the well conducted race at a county fair can but be regarded a legitimate pastime.

Now, recognizing the need for pure amusements for the people and the value of speed as an element worthy of encouragement—whether is it better, for our agricultural societies to banish trials of speed from their exhibitions, leaving it to driving associations and jockey clubs with all the iniquitous systems with which they clothe it; or take it into their own hands, keep it under their own control, offer reasonable premiums for its encouragement, allow no betting or gambling in connection with it, and, recognizing it as legitimate, by their good management keep it so? In what community is society better and purer:—that in which an agricultural society allows and controls trials of speed—as does yours in this place [Topsham]—or that where such a society gives it over completely to gambling horse men who maintain their private club and race course, and with it all the evils upon which it feeds? And while these societies boast of paying no premiums for trotting, and draws its garments about it for fear of impure contact, is it not true that illegal racing, gambling, betting, and drunkenness are at their flood tide in their very midst? Of course we as a Board of control, have nothing whatever to do with societies not receiving the aid of the State—but as we all have at heart the good of all its agencies for the improvement of our agriculture—I can hardly refrain from saying that at the last State fair, no feature was so disgraceful in connection with its entire management, as the countenance which it gave to open and public betting, before all spectators, upon the races for which it offered premiums—and to express the hearty contempt I have for such a

course—notwithstanding that among its managers are your friends and my friends. What decent man at Presumpscot Park in 1875, did not receive a shudder of disgust at the noisy bawling of the pool-seller, within sight and sound of young men and boys, mothers and daughters, gentlemen and ladies! I appeal to the executive officers of this great society, which is capable of uniting the people of the State upon its annual fairs, to pronounce the sentence of banishment beyond the limits of its control, upon the pool-box and all its belongings. If this be not done, would a prediction that its coming days will be crowded with evil and disaster—be not in order?

I would not be unmindful of the fact, however,—to speak for a moment of a point in breeding—that speed in horses has assumed a fictitious value, and has by many been greatly over-estimated. It is true that it is a quality both useful and attractive—a horse, however, possessing speed alone has little to recommend him to general use. But to a horse possessed of other good qualities, speed gives additional value. The trouble has been with us here in Maine, and to a great extent all over the country, that without the requisite class of mares from which to breed, and without the requisite skill in breeding—men have been infatuated over the success of some one who has raised a fast colt, and they have all been trying to do the same thing. I don't know what there is to breeding fast horses that renders it so contagiously attractive—other than the excitement and intoxication which men feel over a life of bustle and push in any department of business, as compared with one slow and moderate—but I do know it to be an evil to a community to be filled up with a lot of fast horse men; and I think if any class can be spared from Maine it is those young men, who with a fast colt, a second-hand sulky, an oroide watch, an empty cigar case, and a wallet empty of honestly earned money, spend most of their time lounging at corner saloons and stable offices, talking of nothing better than races and pools, and doing nothing better than playing "poker." Without wishing to afflict any part of our country with the presence of these useless young gentlemen, my advice to them would be the advice we see printed on the great railroad posters, "Go West young man, go West." But, as I just remarked, the one great mistake of horse breeders among us has been, that with material unfitted to make a trotter, they have been continually trying to make trotters—and have failed. The standard trotter is now a 2.30 horse, and 2.30

horses are not common. There are in Maine, to-day, but three such horses; and in all we have bred in all the past their number is but thirty-nine—three of which have trotted in better than twenty, viz: Hopeful, 2.17¼; Lady Maud, 2.18¼, and Camors, 2.19¾. Now if a man sets out to raise a 2 30 horse—taking the ratio of the past as a standard of his success—he has only to raise 2,383 ordinary colts before he will make a strike and get one that can compass his mile in two minutes and a half—but I am inclined to think he will become tired and discouraged before he has bred half this number. Even in the United States, with its 7,145,370 horses, but 567 have a record of 2.30—a proportion of one to 12,425 of the whole number. In view of such figures, would it not be infinitely better to confine our efforts at breeding a class of well proportioned, stylish, good moving, kind, serviceable horses, of good weight, good for the road and for the farm, with good speed, if you please—rather than to waste so much energy in the endeavor to raise a two-thirty horse, out of material that will hardly produce a three minute step?

It seems to me, in summing up the matter which I have gone over somewhat hastily and imperfectly, that no one can fail to acknowledge speed as a quality of legitimate value; but while legitimate and useful, it is not the only quality to be recognized and encouraged. Fairness demands that we accord to speed and its display at our exhibitions, the same opportunities we afford to the exhibition of the animal's other qualities, and offer the same premiums for speed according to its value, that we do to roadsters, draft, saddle, and breeding horses. Let no enormous premiums be offered to any quality in a horse, to which a fictitious importance attaches. If in testing the quality of speed it is thought best to have a public trial of different horses, let every incorporated society conduct such trials in accordance with square and manly rules; allowing no gambling, no betting, no ungentlemanly language or conduct. Then elevate to equal importance with the noble qualities possessed by the horse, all the other departments of our exhibitions—especially all our live stock interests—and I am sure one great cause of embarrassment and dissatisfaction will be done away. On this ground I believe our societies may firmly and squarely stand, because I believe it good, honest ground; and the position a good, honest position.

PAPERS AND DISCUSSIONS,

AT THE SEMI-ANNUAL MEETING AT

FRYEBURG, October 31st and November 1st, 2d, 1876.

CRANBERRY CULTURE.

By C. L. Washburn, Pembroke.

Knowledge, labor and skill, judiciously and persistently applied, will ensure the accomplishment of any undertaking within the capacity of man to achieve. The once quite prevalent opinion that successful farming depends upon advantageous location, depth and fertility of virgin soil, favorable weather and money capital, has long since given way to the more radical and sensible view, that success depends upon the fibre of the man. Misapprehensions with regard to the requisite conditions, cannot alter their nature, nor their bearing upon the case. Like the laws of the Medes and Persians, they change not. Common sense, education and "push" are the farmer's proper credentials, and having these, he may go forward, taking due advantage of circumstances, but placing no dependence whatever upon "luck." Indeed, persistency of application is the crowning need of the hour, and the want of it has shipwrecked more enterprises upon the farm than all other causes combined. The possession of this trait is as indispensable in conducting the operations of the farm as in managing an International Exhibition, or removing the obstructions at Hellgate. The present is also emphatically the day of close competition and small profits; hence the still greater need of a determined will in order to succeed. Time was when a live New England farmer could start a new branch of farming industry and follow it by himself, year after year, without fear of molestation, but in these days of Yankee shrewdness and keen observation, he who steps out of the beaten track to begin a new and paying branch of the business, is soon aware that some lynx-eyed neighbor, on the alert for anything that promises better returns, is on

his trail, and the monopoly, but briefly enjoyed, ere long gives way to sharp competition, and the new enterprise becomes in its turn like all the rest, the most that can be said of it being, "small gains, but sure." According to the farmer's code, monopolies of this kind are not consistent with the spirit of the maxim, "Fair play."

It has been supposed by many that there is money in cranberries, that the cranberry meadow is the paradise of fruit-growers, the *ne plus ultra* of the capacity of Mother earth to enrich and bless the yeomanry of the land. But the truth is, cranberries, as a cultivated crop, will not grow until we learn the method of culture, and then *work* to make them grow. As regards the site, methods, success, &c., various opinions have been expressed. Mr. E. W. Crane, who is considered a competent judge, says: "The best locations for the cranberry are peat or muck bottoms, with adjoining banks of pure sand for covering, before the plants are set, and so situated that they can be flowed in winter and spring, and drained at all other seasons of the year." Mr. Phinney of Barnstable, Mass., writes: "Successful culture means that the crops, including present value of meadows, have more than repaid the original cost, interest and incidental expenses of cultivation, gathering and sending to market."

But to come nearer home. Conspicuous among the cranberry growers in this section of the State, is Mr. Benjamin Shattuck of Red Beach, who may be regarded as the foremost of the pioneers in this business in Eastern Maine. Located in a region naturally rough and forbidding, surrounded in part by small mountains of the superb red granite which is destined to make the locality famous, he and his two sons, Benj. and Geo. C., availing themselves of the marshes and lakes which partially occupy their territory, have achieved success in the culture of the cranberry. Some twenty-five or thirty years ago the elder Mr. Shattuck noticed near the edge of a bush swamp, three acres in extent, a few small patches of cranberry vines, bearing fruit. Conceiving at once the idea of enlarging the area and product of the vines, he soon after began to remove the bushes, pulling them up by the roots; using the hands, and a team when occasion required. The plants, but few in number, were then set at wide and varying distances, often more than a rod apart each way. They spread rapidly, soon covering the whole ground, and producing, after the plants had become well established, fifty to two hundred bushels per acre from year to year.

By the use of a dam at the lower part of the meadow, it is flowed in the spring to prevent the "fly" from depositing its eggs, the worms from which injure or destroy the fruit. This purpose is fully accomplished by a complete submersion of the plants for ten days just previous to the 1st of June. Flowing from November to March is sometimes resorted to for the purpose of preventing winter-killing, of which in severe seasons there is some danger. The damage by frost to the crop of 1875 was so serious that the Messrs. Shattuck determined, if possible, to devise some adequate means of protection against this drawback. They accordingly invented and constructed a covering, consisting of strips of wood four feet long, five or six inches wide and three-eighths of an inch thick, nailed crosswise to thicker strips, three in number, twelve feet long, the whole forming, when completed, a covering piece about the size and shape of a large single barn door. A sufficient number of pieces in this portable shape were taken to the meadow just before the season of frost, and placed so as to extend lengthwise in a direction north and south, and covering the vines entirely. In the morning the south end was raised four feet above the meadow, supported by two props. This admits the rays of the sun, favoring the growth and ripening of the fruit. Whenever frost is apprehended, the boards are let down at night-fall, by two persons, the process occupying 40 minutes or a little more. The cost of this covering is about $200 per acre. Near this meadow is a lake, embracing an area of 27 acres, which was partially drained many years ago to furnish water to a mill, farther down the valley. Upon the drained border of this pond, a few cranberries were afterwards found, and their cultivation forthwith commenced. The drain, four feet deep and forty rods long, was dug by Mr. S. himself, the labor requiring all the spare time of two summers for its completion. The portion of the lake's bed left bare by draining, comprises some six or seven acres of sandy, rocky soil, perfectly adapted, as has been proved, to the growth of the cranberry. In this their natural and congenial home, the plants were set, and here they have thrived, and borne fruit abundantly year after year. Flowing is easily accomplished by closing the gateway of the drain. The proximity of the water affords complete immunity from frost, the warm air above the surface of the lake being diffused over the border occupied by the vines; a phenomenon which the commonly received notions of the laws of the accumulation and radia-

tion of heat, will sufficiently explain. Referring to this important desideratum, natural protection from frost, Mr. S. says, that were he to begin again, he would go 200 miles to find a lake, were none available within that distance. The kinds of berries grown here are designated 'bell shaped' and 'cherry shaped,' and are identical with those raised at New Jersey and Cape Cod.

The pickers begin about the 20th of September, and gather from 1 to 2½ bushels each, per day. Sometimes 50 or 60 persons, men, women and children, are employed. The ground allotted to each person is indicated by lines of twine stretched along the surface for several rods, and 8 to 10 feet apart. Compensation, 50 cents per bushel. At the Cape they receive but 25 cents. A fair yield is 200 bushels per acre. The crop this year is light, owing to an unprecedented drouth.

The Messrs. Shattuck attempt no abstruse philosophical reasoning, concerning the principles of plant growth and nutrition. They state squarely, as the result of their long practice and experience, covering a period of nearly 30 years, that the cranberry grows to perfection on lake shore soil, whether it be composed of sand, gravel or clay, or a combination of the three; that it thrives in peat or muck, in a word, that it grows wherever grass will grow, it being necessary only to keep down the bushes, and attend to flowing at the proper time. Further, it is not claimed on their part that cranberries can only be grown by strict conformity to their own methods of culture; they only state just what they have done. It is not the object of this essay to suggest how far the results obtained by these men should go to modify or correct the methods practised elsewhere, or to disprove the statements of other writers, some of them no doubt practical men, who assert that cranberries will not grow in what geologists call the "drift formation," that is, loam and clay; but it is certainly gratifying to know that the culture of this fruit need not be limited to the narrower range of soils in which, generally speaking, it has hitherto been grown, and so far as the idea is new, it will operate to encourage the grower, and induce a larger number to engage in the business. Finally, the results here noted abundantly prove that Maine embraces all the requirements for the successful culture of the cranberry, so far as the means and facilities furnished by nature therefor are concerned. Discouragements will of course arise, mistakes, blight, frost and sometimes unsatisfactory crops, but these are only circumstances, that eventually

give way before the magic power of a resolute will. Then let the worthless marshes and bogs that blot and disfigure our farms, be cleared up and transformed into meadows of cranberry vines, yielding in due time their ripe, ruddy fruit, beautiful, wholesome, and pleasant withal to the taste.

Thus can we improve our farms and our health, elevate our manhood, replenish the family exchequer, benefit our fellow-men, and vindicate our claim to the high social and moral distinction that rightfully belongs to every honest, intelligent tiller of the soil. Thus may we hasten and justify the long-deferred, but surely forthcoming and unanimous verdict, that, in substantial worth, and dignity of character, the educated, progressive farmer, free from debt, stands the peer of any man on the broad face of the earth.

Discussion of the Above Subject.

President Shaw. In the town of Franklin, Mass., some ten or twelve miles from where I was born, there is a cranberry bog, which the owner prepared some thirty-five or forty years ago. There is a small stream of water that flows through it, and he put in dams occasionally so he could flow the whole of it. A thermometer is kept there, and when there is felt to be danger of frost, the man who has charge of the bog goes out at night and examines the thermometer, and if it is down to 40° he lets on the water. It can be drawn off as readily as let on. In that way they control the elements. In the vicinity where I formerly resided, quite a business is done in raising cranberries on the lower lands or bogs. They have no means to flood them, and they seem to come into vines naturally. They occasionally cart on sand or gravel, and spread it two or three inches thick; it seems to be what the vines need. They do it in the winter, on sleds if there is snow, if not, on carts.

Question. Is it absolutely necessary to remove the surface grass before setting the plants?

Pres. Shaw. I do not, from my observation, consider that it is absolutely necessary, but if you get the grass and weeds out of the way the vines have nothing to overcome. If not, it takes a series of years for them to become master of the situation and produce crops; but they will do it finally.

Mr. Hight. I have about an acre of land that is covered with muck to a depth varying from six inches to a foot, and then you

come to sand. It is not convenient to flow it. Would it be any use to set vines in such a place as that?

PRESIDENT SHAW. They do it successfully in many places. All you have to contend against is frost, but I think you would be successful in a majority of years. The soil they grow on naturally in Massachusetts, is a peaty soil. I think cranberry vines will not kill grass entirely, but they will overpower it so as to predominate. I think the quickest and easiest way to get a crop would be to take the grass off before setting. If I were going to set out vines without taking off the turf, I should haul on sand or gravel before setting. If I could plow I should do so, as it would be easier to plow than to take the turf off. In our town they set the vines about a foot apart.

QUESTION. Don't they sometimes chop vines up before setting them?

PRESIDENT SHAW. Yes; one of my neighbors told me that two or three years ago last summer he mowed over some vines, and would sometimes cut them. After dinner he raked the piece, and while raking when he saw a vine he would make a hole and stick it down, and he found that they invariably grew.

SECRETARY BOARDMAN. It may or may not be known to members of the Board, that Mr. Chase of Buckfield is one of the largest growers of cranberries in the State, that he has devoted years of time to it, and is very successful. I would like to hear from Mr. Reynolds, an account of his operations.

Mr. REYNOLDS of Canton, Member from Oxford county. Mr. Chase has three pieces of cranberries; one in Peru, one in Buckfield, and one near Bryant's Pond Station on the Grand Trunk. He has raised six and seven hundred bushels in a year. He always cleared the turf off, and always planted where he could flow. A brother of his has begun to raise them. He got seventeen bushels this year. Several persons in Peru have begun to raise them. A man by the name of Richards has just cleared off two acres, and got them ready for the vines. Mr. Chase says it is not much use to try to raise them where you cannot flow. Sometimes they have trouble by getting the vines frozen in the ice, and then a freshet coming and lifting the ice so that it tears them out.

QUESTION. Does he find it necessary after removing the turf to cover the piece with sand?

Mr. REYNOLDS. He does. It makes it a good deal cleaner picking. The muck is nasty in wet weather, and the berries are picked

by women chiefly. He does not use the cranberry rake much, it injures the vines. They could take them off faster with the rake. If it is wet, they have a piece of plank or of cloth to sit on, and in that way keep dry.

Mr. LYMAN H. WINSLOW of Nobleboro', Member from Lincoln county. I am not an extensive cranberry raiser. I have raised two or three barrels this year. I have a low meadow, which is flowed in the winter time, and pretty late in the spring. A few years ago I came upon a cranberry patch by the side of the pond shore, and I took up some vines and tramped them into the meadow with my foot. In a few years I found I had quite a little patch of cranberries in the grass. A few years ago I took some of the turf off and set some vines out, and they grew a year or two, and then died. There isn't a root left now, while those set in the grass are all there. They will kill out the grass, and you will have no trouble if you only keep the bushes down. There are considerable many raised in my vicinity, and none of us can flow them. I never lost any but once. We sometimes pick them when green for fear of the frost. I think the flavor is not quite as good when picked green.

QUESTION. If a man has a small patch, and raises cranberries for his own use, instead of picking them green, wouldn't it be policy to cover them?

Mr. WINSLOW. I should think it would be very good policy; and let me say that there are very few farmers but have some little place on the farm where they can raise cranberries enough for their own use. I get more profit in proportion from my cranberries than from any other crop I raise. My ground is soft. I can run a pole down 10 or 15 feet. Now I believe this matter of cranberry culture is one of great importance to the State. How many acres there are in every section of it that seem good for nothing but to hold the State together, and yet these same lands might be brought into cranberry fields and made to pay. Let me ask this question? If we could take our best fields, and by putting on a liberal dressing of stable manure could raise cranberries on them, who is there that would not raise enough so that he might have this delicious fruit on his table? There are some who won't try to raise them because they can't flow in the spring and in the fall, and so fear that they may sometimes lose a crop from the worm or the frost. But are we sure of a crop of corn? Don't the midge and the rust sometimes destroy our wheat? Can we

prevent the potato rot? There is risk in everything somewhere. Then why give up the idea of raising cranberries on the lands that cannot be flowed because one year in five, or one year in ten we may fail of a crop? I would advise every farmer to raise enough for his own use, and if he can have a few barrels to sell so much the better.

Mr. STARRETT of Warren. There are cranberries raised in my town. Quite an amount are taken from vines which grow naturally on the meadows and salt marshes. The crop has been very large this year. One man has sold over one hundred bushels from his meadow. They are cultivated to some extent on reclaimed swamp lands. When the turf is taken off the soil is sandy. Mr. Comery, the largest cultivator, began some fifteen years ago with a piece perhaps fifty feet square, planting them in the sod. That was the method generally practiced in the early days of cranberry culture, but it has been abandoned because it is a waste of vines, and because with the vines you transplant the grasses that you wish to keep out. From this piece he has picked forty-five bushels. He has gradually enlarged his area until he has now nearly an acre under cultivation, on the greater part of which, however, the vines are scattering and have but just commenced to bear. His entire crop this year is about seventy-five bushels. Eastwood, in his work on the cranberry, says it is essential that the cultivator shall be able to draw off the water, as stagnant water in summer is injurious to the vines, and I have seen an instance where a small portion of a cranberry patch could not be drained, and on that portion the vines were killed. The berries are generally raked from the vines on the marshes and meadows. The rakes do not take them off entirely clean, and it is desirable to have raked cranberries hand picked before putting them in market; by the use of the rake the crop can be secured quicker, and so there is less danger from frost. The cultivated cranberries are picked by hand, as the rake tears up the vines. Mr. Comery told me that he picked this fall three bushels in a day. He thinks his older vines will in a few years become so firmly rooted that they can be raked. He also thinks that the plants would root more quickly if sand were hauled on, as the sand would cover the runners and cause them to take root.

Mr. MALLETT of Topsham, Member from Sagadahoc County. There are some places in my town where cranberries grow spontaneously, and some few cultivated fields. There is a large

tract of meadow land which runs through the town and extends up into the town of Bowdoin, and scattered over it are acres where they grow naturally, and I dare say there has been hundreds of bushels picked from that meadow this year. This has been a great cranberry year with us, and must be taken as the exception, and not as the rule. Hon. Charles J. Gilman of Brunswick has gathered from a piece of cultivated land on the Androscoggin, 380 bushels. He has between one and two acres. They cost him nothing but the trouble of picking. I have a good chance and calculate to set out plants some time when I have time, and probably if I ever do it I shall have to take time. I have some thirty acres of muck land, where you can run a pole out of sight, no matter how long it is; and I have thought of trying that. While I am speaking, I will relate what a Massachusetts grower said to me about the preparation of the land for the reception of the vines. He told me to take the turf off and haul upon the muck sand or fine gravel to the depth of two or three inches, and the poorer the sand, the less soil with it, the better. Their manner of setting is to cut the vines in a hay cutter and strew them on the bed evenly and trample them into the sand. It is done very rapidly. He says there is no trouble but they will grow, if you just take a little trouble to get the grass out at the start, and once grown they are masters of the situation, unless some bushes should spring up. I believe the cranberry to be a very profitable crop, when once it has got so that it produces.

Mr. BODWELL of Acton, Member from York County. I am not a cranberry grower, but I live in a vicinity where cranberries are grown. One of my neighbors, who lives about three-fourths of a mile from me, had a piece of land similar to some that has been spoken of here, where, except same bushes on a part of it, nothing grew worth cutting. Some twenty years ago he discovered on the west side of this piece of land a cranberry bed, and after a while he picked cranberries enough from among the grass to supply his family. That bed still continues, and has extended until it covers about a quarter of an acre. In the centre of the piece there is a wet hole, where the water stands during the spring and fall to the depth of two or three feet. About ten years ago he commenced to cultivate cranberries on the east side. He plowed about half an acre, took the sod off and piled it up. Below this was a white soil, rather hard, and on that he put his cranberries—cut the vines up and sowed them over the ground,

and I think he said hauled on some sand. Two years ago I was on that piece of ground and he remarked to me that he had picked forty bushels of cranberries, the most of them on that part of the piece where the cranberries originated, which never was cultivated. I saw him about a fortnight ago, and he told me he had picked sixty bushels and was still picking. I don't know on which part the yield was greatest. These cranberries were what they call the Bell variety, and nicer ones I never saw. He told me that he labored under a disadvantage in not being able to flow his vines at will. If he could do so he could destroy the worm which is the enemy of the cranberry. He flows as much of his ground as he can in the fall, after taking off his berries, but he cannot flow all of it.

Mr. Gile of Alfred, about twelve miles from my place, is a large cranberry grower. He has twelve acres under cultivation; I think on some portions of it he took off the sod, others he did not. His land is so situated that he can flow it any season. He has been troubled with this worm, but he has learned the season when it is destructive, and by flooding at that season he destroys it. His present method of gathering his cranberries is to rake them off, and leaving them on the ground, to flow the meadow. The cranberries rise to the surface, and run by a flume into a house which he has built to receive them, and he has constructed a machine of his own invention, which separates, as they come down, the berries from all dirt, and the large berries from the small. It cost 20 cents per bushel to gather them in this way, and it formerly cost $1.25. He raised about 120 barrels this year.

With regard to winter freezing, I have no doubt that if the water freezes low enough to get hold of the cranberry roots, and the ice is lifted by a freshet it would destroy the vines, but I don't think the frost itself will destroy them. When I was a boy, I knew a marsh where cranberries grew spontaneously, and I have gone many a time in the winter and cut out cranberries with an axe, and they were as nice ones as I ever saw in my life.

President Shaw. The remarks of Mr. Bodwell remind me of what I was told some time since by a cranberry cultivator, that in taking off the turf he had taken too much soil, and the vines were going to be a failure because there was not soil enough left.

Hon. G. B. Barrows of Fryeburg. It seems to me that this is a very interesting subject, and if the Board shall succeed in calling the attention of the farmers of the State to the possibilities in

cranberry culture, it will be one of the most important services it has rendered to our people. I believe that no acre of our grass fields can be made to produce as much value, in grain crop, or hay crop, or any other crop, as can be produced without any manure from an acre of these otherwise worthless lands in cranberries. Now, the Board may get together and talk about apple culture, and no new ideas be presented, no new suggestions be made. I know it is well that these suggestions be repeated, but here the attention of the people is called to new resources, and that is vastly more important. One of our assessors tells me that there are four or five thousand acres of waste land in this town; and here another man is telling us that these are the very lands for cranberries; and right here by Lovewell's Pond, where the battle was fought, we find the cranberry vine coming up. Our situation is a favorable one for cranberry culture. We are nearer Europe than any other State. The export of cranberries to Europe is just beginning; the people there are just learning that there is such a fruit, and they consider it a luxury. Now, why should we not cultivate them?

I have no practical knowledge of cranberry culture, but I am satisfied that two things have been brought out here to-day—that water is the best friend, and the worst enemy of the cranberry. You should have a place that you can flood in the spring, to prevent the spring frosts from killing the blossom, for you want to guard against spring frosts as well as against the insect and the fall frosts. In New Jersey, they have had trouble with what is called the scald, and the health of their vines was a matter of so much interest to them that they sent to Washington to the Department of Agriculture, and the microscopist connected with the Department was sent to examine the deceased vines and report the result of his investigations; and his report was, that the trouble was caused by lack of drainage. So you see, that while you need water to secure a crop, you don't want it when it will do damage. But if you can let on the water when you need it and let it off at your pleasure, you can grow the berries without trouble, and by adopting the plan that has been referred to, all you have to do to gather the fruit is to rake the ground and pick up your berries. Now we get this point from the paper that was read: That, while you need water, you may get the same advantage by planting on the borders of a lake, where you can have the benefit of evaporation, that in other situations you get by flowage and drainage.

It seems to me that we need direction ; but I think we have splendid opportunities for entering upon this business, and if every gentleman who has a chance would experiment—not dash out, but try a square rod by removing the top soil, another by plowing, and another by hauling on sand, in that way we should run no risk, and I am satisfied that in the end our efforts would result in success.

SECRETARY BOARDMAN. I want to endorse the views presented by Mr. Barrows, though I do not know as I can say a single word to give them greater weight. There are as we know, thousands upon thousands of acres all over the State, of such land as has been described. In many localities cranberries grow upon them naturally, but there are many more where they may be cultivated with profit, and it does seem to me, as Mr. Barrows says, that the subject is one of the most important that can be brought to our attention.

There are some things I think, that this discussion has brought out. While I do not doubt that my friend Winslow in his locality, can grow a small patch of cranberries without trouble and every few years get a nice return from it; I also believe that to succeed in cranberry culture *as a business*, it is necessary to remove the turf, and bring sand to put on your soil. The sand not only furnishes a food that the vines need, but it keeps down the grass. Again, I think it is best to set the roots. Of course you can cut the vines and trample them into the earth, but there must be a true policy, and I believe that policy is to set the roots and set them properly, and that you will find it the better and safer way if you propose to cultivate for profit. If you only want to raise a few berries for your own table you need not take so much trouble, and some years you will get a crop—others you will not. Again, I believe that water is indispensable, and that the best growers so say. I believe it is necessary not only for the protection of the vines in blossom from the frost and the fly, but for the better ripening of the berry in the fall before the early frost. It has been remarked that you can get along without it, but to make it a business, I believe that flowing is indispensably necessary. I think that about a week from the last of May to the first of June is the time of flowing, and if you flow constantly for ten days at that time, you prevent the frost from destroying and the fly from injuring the blossom, and of course you get a better berry by allowing them to remain on the vines till the fruit is perfected, and I think

it has been demonstrated that this can only be done where by flooding you can guard against the risk from freezing.

Mr. BARROWS. At the meeting in Calais it was reported that some parties had successfully cultivated cranberries, but that on some part of their patch they had suffered from frost. Was it from spring or fall frost?

Col. WALKER of Fryeburg. It appears to me I am shut out, because I cannot control the water. Saco river will rise and fall, and I cannot help it, and at a time when we can't dip a pail of water we can't flow a cranberry bed. Would the gentleman advise me to undertake to raise cranberries when I can use the water only when it will come?

PRESIDENT SHAW. I would say, that in Massachusetts, where I am aquainted, cranberry beds are almost invariably on land which they can flow in the spring and fall and not by artificial means.

The subject was here laid upon the table, and was taken up in the evening, after the discussion on sheep husbandry, when Mr. WASSON, who was not present in the afternoon, made the following remarks:

I know that turkey and cranberry make a favorite dish, but how cranberry and mutton may go together I don't know. I am not engaged extensively in cranberry culture, though I have cultivated them for some ten or twelve years, and I live in a vicinity where they have been cultivated for a number of years with the highest success. I was agreeably surprised to find so large a territory so well adapted to the culture of the cranberry as I find in your vicinity, and back many miles along the railroad. It would seem to me that you are more favorably situated for growing cranberries than for growing sheep.

But it is not every marsh, or muck-bed, or bog, over which the water may or may not be thrown, that can be successfully cultivated to cranberries. There are about as many failures as successes, and the reason is, that parties set out vines without knowing the conditions of success or failure. The principal element in the soil that produces cranberries must be sand, and undoubtedly you have some of it in your soil. The rocks should be quartz rock. If you have quartz sand or silex in your land, with or without muck, or with or without water, if proper care is taken in planting out the vines at the start, success is sure to follow.

There is no enterprise in which any of the good people of Maine are engaged in which the margin of profit is so large as in the growth of the cranberry. Let me give an instance. A neighbor of mine had in 1856, and has had for a number of years, a mortgage on his farm that had accumulated interest until it had got beyond his control and he had ceased to try to lift it. Lying right back of his buildings, in a soil made up almost entirely of quartz rock, and on the top of a hill where he could not flow it, was a piece of marshy land that measured just one-half acre. In the fall of 1856 or '57, he set that out to cranberries. The next year, the season of '58 I think, he sold from that a trifle less than $90 worth of cranberries, and since 1859, for 16 years he has never sold less than 150 bushels in a year and from that to 300 bushels from that piece of land. He has long since redeemed his mortgage and fixed up round his buildings. He has gathered this year, I think, between $600 and $700 worth of cranberries, and how near he is to exhausting his soil I don't know.

In our section of the State, we have no difficulty in growing the cranberry in mowing fields. The only trouble is, they are in the way of the mowing machine. More than 1000 bushels are yearly grown in mowing fields, where there is no flowage at all. We cannot grow them as well because we cannot flow them in June, and that is the time that the fly lays the egg which produces the worm, and if we could flow them we could protect ourselves from the only enemy we have. I do not care for the frost, for I can protect myself from that by selecting the right variety. Here is the second mistake. Many want the vine that produces the largest fruit, and that is just the kind we don't want in Maine. I am now speaking of the Cherry cranberry, that is nearly round, showing two colors, red and pink. The Bugle cranberry, which is egg-shaped, is pretty safe from attacks of frost that destroy the Cherry. Another mistake, in my opinion, is, that in planting, people don't set one-tenth the number of vines they ought to, and if there are roots or seeds in the soil there is too much for the vines to contend with. The process in my section is this: If the land can be plowed we plow it, using a heavy team, and then harrow it; then furrow two feet apart and set out the vines. If I were to plant on your soil I wouldn't set vines, but I would cut them in a hay cutter and sow them. Every piece will produce a stock. In my section we have too many weeds to contend with, and it takes too long to get them started. One of our cultivators

told me that he had a piece that he could flow, but he wouldn't spend money for a dam, for he thought it wouldn't pay for the cost.

Now I come to the question—Does it pay? There is no preparation of the soil after the first year; no application of fertilizers; no weeding to be done. There is nothing to be done except to thin the vines once in six or eight years. They hand-pick in my section, this year, for 28 cents per bushel. They hire women, girls and boys; the boys make the best pickers. Last year I got a little avaricious, and will tell you what I made by it. When I harvested my cranberries they wouldn't pay but $2.50 per bushel and I wanted $3.50. I kept them till the latter part of February and sold for $3.50, but to my surprise when we measured them I found they had shrunk so that I had lost more on my measurement than I had gained on my price.

THE POSSIBLE CAPACITY OF MILCH COWS.

By Horace Bodwell, Acton.

The cow is of ancient origin, the female of the ox kind, and very noted for her usefulness, especially for her qualities in the production of milk for the support of the human family, and after these have failed, for her meat, tallow and hide. Persons proud, potent and wealthy, in the days of the prophets, were likened unto the kine of Bashan, to denote their stupidity, luxury and wantonness.

The seven fat kine which Pharaoh saw in his dream represented seven years of great plenty, and the seven lean kine as many of famine. Nations are likened to heifers, Egypt to a fair one and the Chaldeans to a fat one; and in like manner I might carry you along to the days of our Savior when on the earth, when the father said "bring hither the fatted calf, and kill it and be merry."

The first cows were brought into this country by Columbus, at the time he made his second voyage, in 1493. In 1610, Sir Ralph Lane brought cows from the West India Islands to Virginia, and in 1611 Sir Thomas Gates brought to the same place one hundred cows. In 1624, the ship Charity or Ann brought to Plymouth Colony three heifers and a bull. In 1626, twelve cows were sent to Cape Ann, and in 1629 thirty more were sent to the same place.

The best dairy farms in Rhode Island, in 1750, consisted of one hundred cows, producing 13,000 pounds of cheese yearly, besides a large quantity of butter, and it is asserted by good authority that seventy-three cows on one farm produced 10,000 pounds of butter in five months.

The cow has no superior to her as a producer of milk, both to quality and quantity, and its adaptation to individual wants, for there are but a few persons who do not use milk in some form or other and relish it as a food.

If we take into consideration the profits of the cow to the owner as a part of her possible capacity, we must have regard to

what age she ceases to be profitable, as many dairymen believe, especially in England and Scotland, that the younger the cow the richer the milk, that is, from three to six years old, taking into account both quantity and quality of the milk; while there are others who believe that from six to ten years old the cow yields the largest flow of milk, retaining its quality, and at that time, if judiciously fed, she will have ceased her flow of milk and ready for the butcher at a small expense. My experience and observation in the matter coincides with the latter, in good milkers, as a rule, although I have known the former most true, not doubting the older cow consumes the most food. Neither would I consider it advisable after she attains the age of ten years, as a rule, to retain her longer for her milk,—First, because her milk is failing both in quantity and quality; and second, she is becoming of less value every year; and lastly, which is an item too often overlooked in good cows and a point I doubt not I shall be sustained in by every good and observing feeder, that the older cow requires much more food than the younger one.

The dairyman, however, has his favorites in his herd, not only for her quality and flow of milk, but as a stock breeder, for you are aware that the cow best known for the greatest flow and quality of milk, is not always the best for the rearing of stock, although of the same breed; and much depends upon the capacity of the cow when turned out to pasture to shift for herself on the grazing lands. If the pasture has not been overstocked, the flow of milk will run very even for ten or twelve weeks, and whenever you begin to perceive a falling off in the flow of milk, then feed with some nutritious substance to make good that which the pasture fails to give; a change in the pasture as often as ten or twelve days tends very much to keep up the quality and flow of the milk, and this gives the grazing lands time to grow the grass, leaving it clean and sweet, and thereby creating a change as often as the herd is shifted, and a point worthy of notice, not only as regards the quantity, but as much so in the quality of the milk.

The first and important thing to be considered, when the farmer is about to stock his farm with cows, is the breed, both for dairy and stock. For dairy purposes the Ayrshire cow deserves a place in the first rank for her large yield and quality of milk; and perhaps, as many dairymen say, who have had long experience on this point, gives a larger return of milk on the whole for the feed

consumed than any other breed, and this is the very point on which the profits depend.

The Jersey cow, if not taking the first rank, most assuredly deserves a rank in the first class for the richness of her milk; so much so, that I find many of the farmers in our part of the State are keeping one or more of the breed to improve the quality of their butter.

The Shorthorn is quite a favorite with many of our farmers, perhaps not so much on account of the great flow and quality of their milk, as for their stock. For mixed, arable and dairy farming, as in our section of the State, where young stock is reared, they are not second to any breed for their yield of milk and capacity for large stock.

Very much depends upon the management of dairy cows; so much so, that it has now become a very important point with the dairyman, to see that his cows have both warm barns and regularity in their feed, as upon this, much depends the quantity and quality of their milk.

That a mixed system of dairying and tillage farming has long been practiced throughout this and other New England States, beneficial to those who have had proper care for their dairy cows, there can be no doubt. The dairy process of converting milk into butter and cheese is no new invention, but a very ancient discovery, and in common use in patriarchal and pastoral times. As with Abraham entertaining his guests with milk and butter while on their way to visit the cities on the plain, frequent mention of butter and cheese is made in scripture.

Among the New England and many other States, as with the European agriculturists, the root crops are grown and fed not only to the cow, but to the other stock upon the farm, as a nutritious food, and that they will yield more nutritious feed to the acre for stock than any other crop, be it for flesh or milk, has been to my mind proved beyond a doubt, both in this and the old countries. From the Agricultural Reports, we notice numerous instances, both in this country and Europe, where 1000 bushels of carrots and the same of parsnips have been raised on one acre, and as high as 1200 bushels of beets and the same of turnips to the acre. With proper care for our cows, we can usually obtain all the milk from the cow at the age of ten years as at the age of twelve years. And here let me say, by proper care is meant everything essential,

not only for the yield of milk, but for their comfort at all seasons of the year, in the heat and cold as well as in stormy weather—for you are aware that the changes in our climate are frequent and often very sudden, both in summer and winter. See that our stables have proper ventilation as well as warmth; dry floors at all seasons of the year, with bedding during the cold weather; kind and gentle treatment at all times; regular feed with a good supply of water and salt, and the same person milking the same cows as much as possible; and when turned from the barn to the pasture to shift for herself on the green grass, see that there is no lack of feed and good water, if there is, supply them at the stables with the amount required, in meal, shorts and such other nutritious substances as may come to hand; and during the fall months, when the feed is short and dry, feed with sweet corn fodder and roots, and if more is needed, add meal and shorts.

With this treatment to your cows, and I speak whereof I know, you may expect an average of ten quarts of milk per day for twenty-six weeks, making four hundred and fifty-five gallons; and for the next thirteen weeks, five quarts per day, one hundred and thirteen gallons, making, in the aggregate, five hundred and sixty-eight gallons in nine months, leaving three months, one-fourth of the year, for her calf. Allowing two and one-half gallons of milk to make one pound of butter, we have in the aggregate two hundred and twenty-seven pounds of butter, and the butter at thirty cents per pound you have sixty-eight dollars and ten cents; and with the calf at four weeks old at six dollars you have in the aggregate seventy-four dollars and ten cents; at twenty-five cents per pound, with the calf, sixty-two dollars and ninety-five cents; or the milk at three cents per quart, and the calf, you have seventy-four dollars and sixteen cents—this last leaving a better margin than when manufactured into butter at thirty cents per pound.

It is about a fair estimate to call the yearly feed of the cow at fifty dollars, twenty-two dollars for hay and the same for grain and roots, and six dollars for pasturing—leaving a margin of about twenty dollars, allowing her droppings and skimmed milk to pay for her care.

And here let me say, that a cow with this treatment from the time of her dropping her first calf, at three years old, will at the age of ten years, nearly, if not quite, cease her flow of milk, and

with a small amount of grain for from four to eight weeks, be in the best of order for beef.

I notice some dairymen rate their yearly milk from their herd of cows as high as six hundred, six hundred and fifty and six hundred and eighty gallons per cow, when fed in the manner I have mentioned, making in the aggregate the sum of $81.60 per cow, allowing $60 for feed and labor; showing a net profit of $21.60 per cow yearly. Also, one dairyman in Illinois, from one hundred cows, averaged eight hundred and sixty gallons of milk and three hundred and fourteen pounds of butter per cow the past year. The butter was sold at 38 cents per pound, showing a yield of $119.32 per cow, $11,932.00 for the one hundred cows. These cows were fed freely on meal. Mr. G. S. Miller of Peterborough, N. Y., reports the milk from three Holstein cows, being about of equal weight, twelve hundred pounds for three years; their ages, four, five and six years, respectively, in 1870, commencing April, 1870, and ending April, 1873. The six years old cow, in 365 days, produced 12,681 pounds of milk, daily average 34 pounds; second year, 365 days, 11,528 pounds, daily average 31 pounds; third year, 257 days, 648 pounds, and a daily average of 25 pounds. The five years old cow, the first year, 293 days, produced 9,379 pounds of milk, daily average 32 pounds; second year, 258 days, 10,691 pounds, daily average 41 pounds; third year, 365 days, 11,766 pounds, daily average 32 pounds. The four years old cow, the first year, 327 days, produced 6,980 pounds of milk, daily average 21 pounds; second year, 245 days, 7,893 pounds, daily average 32 pounds; third year, 365 days, 8,588 pounds; daily average 23 pounds.

By the foregoing statement you readily perceive, that the first named cow, from 6 to 9 years old, was in milk during the three years 987 days, and in 108 days short of three years produced 30,689 pounds of milk; the second cow, from 5 to 8 years old, in milk 916 days, and in 179 days short of three years produced 32,836 pounds of milk, and the third cow, from 4 to 7 years old, in milk 937 days, and in 158 days short of three years produced 23,461 pounds of milk. From this statement, we have in 987 days, from the 6 to 9 years old cow, 30,689 pounds of milk; from the 5 to 8 years old cow, 32,836 pounds of milk in 916 days, and from the 4 to 7 years old cow, 23,461 pounds of milk in 937 days. The first cow, from 6 to 9 years old, gave a daily average of $30\frac{3}{4}$

pounds; the 5 to 8 years old, a daily average of 34¾ pounds; the 4 to 7 years old cow, a daily average of 25 pounds—making a daily average of the 5 to 8 years old cow over the 6 to 9 years old cow, 4 pounds, and over the 4 to 7 years old cow, 9¾ pounds. These cows were fed on hay the first winter after they were dried off, and during the two following winters they were fed on hay, giving each cow two quarts of grain daily, and when in milk six quarts of grain daily during the spring, and four quarts daily in the autumn and in the early part of the winter. The grain was composed of corn, meal, oats, barley and shorts, and fed to them dry, and they had the run of a common pasture during the summer months, with corn fodder after the first of September.

A correspondent from Litchfield county, Conn., in a report to the Commissioner of Agriculture, in 1853, says the average quantity of cheese per cow is 300 pounds; of butter, from 200 to 250 pounds yearly. Another correspondent, from Castle county, Md., says their dairies consist of from fifteen to seventy-five cows each, and that one gentleman keeps two dairies of fifty cows each, which produce 15,000 pounds of butter yearly; that the stipulated price is 25 cts. per pound, and that the net income from the two dairies is $3,600 yearly.

That the farmer is giving more attention to his dairy and realizing larger profits than in the past, there can be no doubt—thus realizing the truth of the Saxon proverb, "The softer the food the more milk," and I will also add, the richer the quality. Many of the yields above given are much in excess of a majority of the cows that compose most of the dairies of our State. Now, if some of our cows can produce such an amount of milk, can we not improve our dairy stock by judicious breeding and feeding, and an average be obtained which will match these figures?

A correspondent of the *New England Farmer* of Sept. 30, 1876, who has of late been collecting some of the largest reported yields of dairy cows which had come under his notice—which shows what is possible for the cow to do—reports as follows:

In the *American Agriculturist* of Nov. 1874, is an account of the Ayrshire cow, Lady Kilbrine, owned by Sturdivant Brothers, Framingham, Mass. She gave, in one year, 7,429 pounds of milk, equal to 3,455 quarts. Her weight is 850 pounds. Also of the Ayrshire cow, Georgia, owned by same persons. Her weight is 890 pounds. She has given 7,127 pounds in one year, or 3,315 quarts of milk. The *American Agriculturist*, January, 1874, re-

ports a native cow, owned by F. M. Bassett, Independence, N. Y., which gave 57 pounds, or 26½ quarts of milk per day, and made 14½ pounds of butter per week. September, 1874, the same journal reports a three years old Jersey heifer, Mulberry, 2d, owned by Mr. McKee, which made 13¼ pounds of butter in one week, on grass alone. In November, 1875, it reports a Jersey cow, Myrtle, 2d, owned by Thomas Fitch, New London, Conn., which has made 15¾ pounds of butter in one week. In Flint's Abstract of County Agricultural Reports for 1867, Jersey cow May Day, owned by I. S. Munroe, Lexington, Mass., is reported as averaging, in June and July, 43 pounds of milk per day, which made 15 pounds of butter per week. Two Devon cows, reported by Z. E. Jameson, in the *Vermont Watchman and State Journal*, one of them, Helena 16th, made 15 pounds of butter in a week. Gem, owned by Gov. Hyde of Connecticut, has made 15¾ pounds of butter a week, and 2¾ pounds in one day. A correspondent of the *Ohio Farmer* reports a grade Devon cow, which gave 60 pounds of milk per day. The *Indiana Farmer* reports Thomas Hansell, Guilford, as having a cow that averaged 60 pounds of milk per day in June. This same cow and a heifer from her, made 15 pounds of butter each in a week. Mr. Scott of Shaftsbury, Vt., is reported as having a cow whose milk yielded 504 pounds of butter in a year. A. A. Moore, East Berkshire, Vt., reports in the *Vermont Farmer* a three-fourths Durham and one-fourth Ayrshire cow, that gave 60 pounds of milk per day and made 16 pounds of butter per week. The *American Agriculturist*, January, 1876, gives an account of the Jersey cow Maggie Mitchell, owned by M. T. Tilden, New Lebanon, N. Y. Her weight is 1020 pounds; she gave 7,500 pounds of milk in a year, and has given 38 pounds per day, and has made at the rate of 18¾ pounds of butter per week. Mr. Talcott of Rome, N. Y., reports a yield of 15 pounds of butter per week from some of his Shorthorns.

The celebrated Oaks cow was owned in Danvers, Mass. She made 19¼ pounds of butter in one week, and averaged more than 16 pounds a week for months. A Bates Shorthorn, Oxford Lass, owned by J. Talcott, Rome, N. Y., is reported as giving 50 pounds per day; Bates' Shorthorn Violetta as giving 60 pounds per day. A correspondent of the *Ohio Farmer* reports the Shorthorn cow Flora as giving 10,452 pounds of milk in one year; and the Shorthorn cow Rosa as giving 11,705 pounds of milk in 1863. Also another Shorthorn is reported as giving 58 pounds of

milk per day for ten days, and making butter at the rate of 14¾ pounds per week. During the season of 1874, she gave 12,875 pounds of milk and 513 pounds of butter. A cow is reported as kept by the county jailor at Servis, England, which gave in one year 10,578 pounds of milk, which made 540 pounds of butter.

In Flint's Abstract for 1874 is the statement of the seven-eighths Jersey and one-eighth Ayrshire cow Sybil, owned by Henry Saltonstall, Peabody, Mass. Her largest yield was 60 pounds of milk per day, or 28 quarts. She weighed 950 pounds. She gave in one year 13,065 pounds of milk. In Flint's Abstract, 1862, is a statement of the Ayrshire cow Jean Armour, imported by Mr. Peters, Southboro', Mass. She weighed 967 pounds, and gave for ten days in June an average of 52 pounds per day. Her largest yield was 58 pounds in a day, and 14½ pounds of butter per week. By statement of J. R. Kendall, Middlesex county, Mass., of two Ayrshire cows, Minnie 2d gave 51½ pounds per day for a week; Clover, 54¾ pounds per day for a week. By statement of S. Crosby, Lowell, Mass., his grade cow gave an average of 58 pounds of milk per day for thirty-one days in July, 1868.

By statement of M. C. Graves, Springfield, Mass., as given in Flint's Abstract, 1872, of nine cows entered for premium, three of them gave the second week after calving, respectively, 56, 54 and 53 pounds each per day. The *American Agriculturist*, November, 1873, page 407, gives an account of the imported Ayrshire cow Beacon Belle, owned by Wm. Crozier, Northport, L. I. She gave in Scotland 36 quarts beer measure daily, equal to 43 quarts of our milk measure, or 92½ pounds per day. This is a large story, but it was proved before a justice in Scotland. Still larger is the statement in the *Agriculturist*, March, 1874, of the Ayrshire cow Old Creamer, owned by S. D. Hungerford, Jefierson county, New York. She weighs 1080 pounds, and has given 96 pounds, or 45 quarts per day, and an average of 94 pounds per day for the whole month of June. This is *believed* to be the champion cow of the world. Who will raise a cow that will beat her?

The census of 1840 shows the whole dairy products of this country to amount to only $33,787,003, while that of 1870 shows the butter product of this country was 460,000,000 pounds. This was produced from 8,935,000 milch cows, an average yield of a little over 50 pounds to the cow. This butter at thirty cents per pound amounts to $138,000,000. The increase of milch cows from 1850 to 1860 was 2,000,000, and from 1860 to 1870, during

the war, was much less. From all accounts since the close of the war, it appears that the farmers have been busily engaged in restoring their dairy herds, and the improvement in the dairy business has so much advanced that the Commissioner of Agriculture for the year 1873 reported that the whole number of milch cows in the United States was 10,705,300. Maine had 153,500; New Hampshire, 92,700; Vermont, 195,700; Massachusetts, 136,300; Rhode Island, 20,400; Connecticut, 106,800; New York, 1,410,600; New Jersey, 147,900; Pennsylvania, 812,600; Delaware, 24,900; Maryland, 96,900; Virginia, 234,000; North Carolina, 199,000; South Carolina, 157,800; Georgia, 157,400; Florida, 6,900; Alabama, 173,400; Mississippi, 180,100; Louisiana, 90,700; Texas, 526,500; Arkansas, 151,800; Tennessee, 247,700; West Virginia, 124,300; Kentucky, 229,400; Ohio, 778,500; Michigan, 350,600; Indiana, 448,400; Illinois, 725,100; Wisconsin, 442,700; Minnesota, 196,900; Iowa, 569,500; Missouri, 421,400; Kansas, 331,100; Nebraska, 49,900; California, 310,500; Oregon, 73,500; and the Territories, 258,700. So that now, in 1876, three years later, it may be safe to estimate the milch cows at 11,000,000. These figures, allowing the average of 100 pounds of butter to the cow, at 30 cents per pound, amounts to $330,000,000 and 1,100,000,000 pounds of butter produced annually in this country. Now leaving out 15,000,000 pounds for our annual exportation, we have left 1,085,000,000 lbs. for our annual consumption, or about 25 pounds per capita. This estimate is made after leaving out one-third part of the new milk produced from the yield of the cow for family use throughout the towns, villages and cities of the whole country, thereby making in the aggregate $495,000,000. At the meeting of the National Butter and Egg Association, held at Davenport, Iowa, during the past winter, it appears from the report that the people in this country annually consume for table and culinary use 1,400,000,000 pounds of butter. During the year 1870 we exported 60,113,090 pounds of cheese, valued at $8,646,491; in 1871, 69,907,167 pounds, valued at $8,027,754; in 1872, 65,459,462 pounds, valued at $8,421,114; in 1873, 91,358,077 pounds, valued at $11,911,541. Our export of butter during the same period was: In 1870, 2,072,751 pounds, valued at $570,432; in 1871, 8,568,012 pounds, valued at $1,606,239; in 1872, 5,044,227 pounds, valued at $1,041,032; in 1873, 4,074,657 pounds, valued at $947,968.

The dairy products of the County of York, for the year ending

June 1, 1871, were 1,122,636 pounds of butter, 30,495 pounds of cheese, and 147,342 gallons of milk. The butter at 30 cents per pound, would amount to $336,790.80; the cheese, at 12 cents per pound, $3,659.40; and the milk, at 12 cents per gallon, $17,681.04. Making the total amount $358,131.24, besides the milk used by the owners of the cows.

G. A. Willard of Springvale, Sanford, Maine, has a Jersey cow seven years old, from which he made 296 pounds of butter the past year, reserving during the time 178 quarts of milk. The butter, at 30 cents per pound, amounted to $88.80, and milk at four cents per quart $7.12, or a total of $95.92.

Professor Willard estimates the annual yield of milk per head at 450 gallons, and valued at ten cents per gallon. At these figures, the milch cows of this country, in 1873, produced 2,567,365,000 gallons of milk, worth $481,738,500; and at the same ratio it would be safe at this date, 1876, to estimate it at $500,000,000.

The time is not far distant when, with the practice and improvements our farmers are now making, we may expect our butter export to be increased 200,000,000 pounds, and thereby add to the annual income of the country $60,000,000.

Discussion of the Above Subject.

Prof. M. C. Fernald. The paper has brought to my mind a thought which has been expressed before, and that is that the farmer neglects a vital point in failing to consider what is to be his margin of profit. A certain amount must be expended to keep a cow, and a certain quantity of milk will pay for that keeping, and the farmer's profit must come in the produce beyond that point. From the statements made in the paper, as nearly as I can average in my mind the cases presented, the average yield would be about eight quarts of milk and the average cost of keeping he brings at about six quarts. That is a margin of profit of two quarts per day. Now, suppose the flow of milk could be increased by judicious care of the cow till she will give two quarts more—then the profit is doubled. A little while ago I made some inquiries in regard to a cotton mill which had just been started, and was told that the manufacture was 2000 yards per day, and that recently there had been an advance of one-half cent per yard. Now that is a small advance, but it means an increased profit of

$300 per month—a very comfortable margin. It seems to me that the profit in keeping cows is to be secured by looking to these little things, and so increasing the profit. It is only when the yield is above a certain amount that there is any profit at all. I doubt not that there are thousands of cows in the State that don't pay their keeping. The expense of keeping a cow poorly, is pretty nearly as large as the expense of keeping one well, and the profit is a good deal less. Another point is, warmth of building. I think I can bring facts to show that by having a building properly warmed at least 10 per cent. in the cost of keeping is saved, and I am inclined to think the saving would be as high as 16 per cent. Now, if a margin can be saved in both ways we have a considerable chance for an increased profit.

PRESIDENT ALLEN. I received the day before I came here some statistical tables from the Department of Agriculture, which presented very clearly the comparative products of the different States, not by figurés but by lines. I had just an opportunity to glance at them, and I looked to see the place which Maine held in the yield of milk. I found it not at the head where I wanted to, but below the middle. I am quite sure that why we don't produce more is because we don't have the right breed of cows, or don't take sufficiently good care of the cows we have. I am quite sure that if we did what we could do, taking the State as a whole, it would give us a high instead of a low place in that column.

Mr. FARRINGTON of Orono. I am very sure that many of our farmers are keeping cows and getting returns from them too much at random, and the question recurs to the individual farmer—How shall I be sure as to the amount of profit my cows are paying me—how inform myself whether my cows are being kept at a profit or a loss? I have made some experiments in that direction with a view of ascertaining what are the returns from our cows, and I will state how they have been conducted. We provide ourselves first with a piece of paper on which each cow's name is written one above another. Close by that is a spring scale, on which as we milk each cow we set the pail and put the weight of the milk against the cow's name. At the end of the week that paper is put by, and the results entered on a book. By that process, at the end of the year we know when each cow commenced to give milk; how much she gave at each milking; at what point the flow of milk began to fall off; how much it fell off, and at what time she ceased to give milk. By means of a per cent. tube,

at each season of the year we test the milk of the different cows. I had supposed that that afforded an accurate test of the amount of butter that would be obtained, until not long ago I noticed a paper in which the position was taken that the percentage of cream is not a test of the butter qualities of a cow. I have with a good deal of interest tested the milk of our cows in this particular. I saved for a week the milk of our best Jersey cow which showed 24 per cent. of cream, and of a grade Jersey which showed but 15½ per cent. of cream, and churned them separately, and I found that the proportion of butter to the quantity of cream shown was very much the larger with the grade. By thus saving the milk or cream from each cow and churning at the end of a given time, the dairyman can learn the butter quality of each cow. By keeping these three things, the daily yield of milk, the percentage of cream at different seasons, and the butter yield, we can tell accurately what are our receipts and what the comparative receipts from each cow. That is a thing that every farmer could do with small expense and very little care, and at the end of the year he would know whether his cows were profitable or not. It seems to me this would be a most desirable thing for our farmers to know.

SHEEP HUSBANDRY.

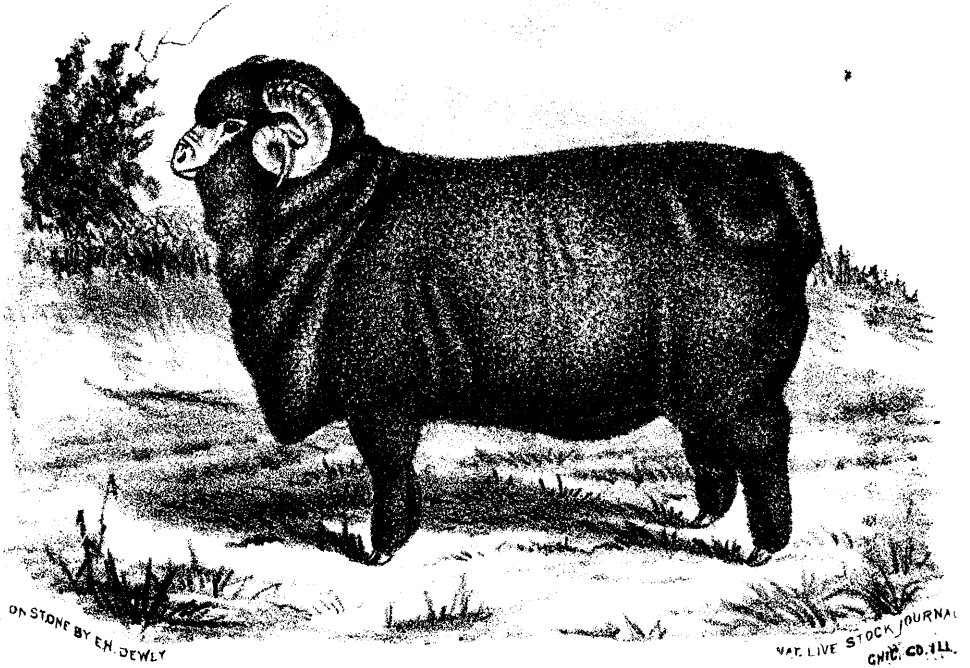
By George Flint, North Anson.

"It is justly admitted that of all domestic animals reared and fed for profit in Great Britain, sheep are of the greatest consequence, both individually and in a national point of view, and afford a better return than can be obtained either from the rearing or feeding of cattle. Sheep Husbandry deserves to be esteemed in all its different branches, and claims the priority of consideration among agriculturists."—*English Journal.*

In view of the superior advantages in markets and marketing facilities opening up on either hand in our State, we realize the necessity of a different system of farming from that practiced in years gone by when the soil was fertile, the country new, and transportation less easy. It is not optional, but a necessity forced upon us to adopt methods and means that will improve the soil and at the same time return a profit to the owner. In this the older States of the Union must look to England and Germany for their models.

By sheep husbandry and dairying, with a judicious system of farming connected therewith, must the average farmer of Maine solve the problem connected with profit and loss in farming. No animal possesses so great value in proportion to its average cost, or gives so quick returns for capital invested as the sheep. Finding food in nearly every plant that grows upon our hill-sides, mountains or plains, they become available stock for nearly every acre within our State. By experiments, it has been proved they will eat one hundred and forty-five varieties of plants that cattle refuse; keeping down and entirely destroying weeds and bushes that would in a few years drive cattle from their range.

Either the coarser varieties of mutton producers, or the fine-wooled Merino breeds should be selected, according to the object aimed at and number intended to be kept. If wool alone, or wool and mutton combined is the object, the Merino and their grades are admitted to be superior; more especially if large numbers are to run together upon the same farm. For constitutional vigor and



GOOD TYPE OF A MERINO RAM,

GENESEE, SELECTED FROM THE FLOCK OF HON. E. TOWNSEND,

PAVILION CENTRE, N.Y.

capacity to thrive when herded together in large flocks, no other breed can compete with them. Generally speaking, the South Down and Cotswold sheep do not thrive in flocks exceeding fifty, and I think the farmer should not attempt to keep the coarse-wooled varieties unless he has the means of giving to them good care and constant attention. As they come to maturity earlier and die younger than the fine-wool breeds, neglect tells quicker on the flock. Whatever the variety, one thing is certain, as in every occupation or profession, he who gives to it the best care and most judicious attention will reap the best results.

The size and price of the animal offers opportunities for investment of small capital, to be increased as means will allow. In this it is the poor man's friend as well as the rich man's source of profit—always paying their bills as they go, and they never die in debt to their owner. Whatever class of sheep can be most readily obtained will do to commence with, but the better at the start, of course the sooner a good flock will be obtained; yet they can be greatly improved in a few years by using judgment in selecting breeding animals.

The great want is not a particular class of sheep, but greater care in feeding, both summer and winter, to bring them to perfection and to realize all that is of profit. No animal should be allowed to run down and die of old age, and none sold, as a rule, except those in the best possible condition for the butcher, for herein lies the success to which all efforts must tend. It is impossible to improve a farm by selling *lean stock*.

Sheep are good feeders and readily digest and appropriate to flesh and fat any kind of grain or roots. The qualities of grain for stock, all understand; but the value of the turnip and beet for feeding is not understood by farmers generally. Especially are they valuable for fall and early winter feed, to be fed while the flock is in the pasture, or in connection with grain during the early winter; for it is only during fall and immediately after, that they can be fed to profit. Grain is lost if fed the latter half of the winter; and if the sheep have been allowed to run down and become lean, the digestive organs are weakened with the body and both fail alike, as is shown by the scours that follow any attempt to increase the feed to any great extent. A good sheep should pay its cost and keeping in wool, with a margin even at that, leaving the body for the butcher as profit.

I subjoin a few statements obtained of some of the best flocks of Somerset county. By more inquiry I might have obtained a higher average: Of fifteen flocks I find the following average, of washed wool where wool is mentionod: average number in flock, 147; average weight of fleece, 6 16-100 lbs; average increase per 100, 28; average cost of wintering, (estimated,) $1.58; average cost of pasturing, (estimated,) 43c. These flocks included all ages and sexes, of Spanish Merino and high grades. In some flocks of the coarser-wooled varieties not figured in the above, I find a larger rate of increase and less weight of fleece, making the average sales about equal.

The great gain from sheep must be attained by close attention to the farm, and by restoring to the soil everything taken from it. Grain and roots should be raised with which to fatten, and in many places the sheep can be yarded and fed on the ground intended for crops the following year with excellent results. This is especially recommended by the English farmers as preparatory to a crop of wheat. It has been noticed in the old countries that the increase in the product of wheat has kept step with the increase of sheep.

Only when we cease importing corn, flour and pork, and depend upon our own resources for the staple products, will the farmers of Maine cease complaining of *hard times*. If the food consumed by inferior cattle and useless horses was fed to sheep, how different would be the result in the two-fold blessing of wool and mutton; and of greater independence to the farmer!

Discussion of the Above Subject.

Mr. Lee of Foxcroft. There is one point in sheep husbandry I wish to mention, and that is the washing and shearing of sheep. Formerly I washed and sheared the first of June, but I have changed my method and now shear in the last of April before my sheep leave the barn. Then they become acclimated before they are turned to pasture, and do not suffer at all from the removal of the fleece. With us they make a quarter discount in the price when the wool is unwashed, and I am satisfied that making that deduction my wool brings me more money. Last spring I sold the next day after shearing for 27 cents. The farmers of Piscataquis county are generally adopting this method, and I hope it will be adopted by the farmers of the State. It is an outrage on sheep

to throw them into a cold brook to wash them. In some respects they are not unlike human beings; some are nervous, and in the aggregate thousands of them are lost in consequence of throwing into a cold brook every year.

Mr. FLINT. The gentleman evidently made a profit on dirt. If he is going to deal in wool he should sell the genuine article. His position is different from that of most of the farmers of the State; he is near a woolen manufactory. The trade of the bulk of our State is with Boston, and we must put our wool in the condition in which Boston buyers require it. I shear the first and second weeks in June, usually finishing about the 16th.

Mr. BARKER of Houlton. I have adopted Mr. Lee's plan of shearing early for a number of years, but for different reasons. One is, that if there are ticks on the sheep they get rid of them before they drop their lambs, and the lambs will not be troubled with ticks. I think it is better for the sheep, as I have a warm place and the wool starts before they go to grass, and they do not suffer from the cold. I cannot say, as Mr. Lee did, that I think I made anything on the wool. I certainly think there would not be a quarter discount, but I was compelled to make it.

Mr. WASSON. In my section of the State the shearing is done early in April and often as early as March, and those who have sheared early never would go back to the old method. I think, however, to lay this down as a general rule is unfair to the people and it certainly is to the sheep. If sheep are in a locality where they are exposed to cold winds in March or April, they ought not to be sheared so early, because cold storms are death to them.

The subject of sheep husbandry is one which has been much discussed by the Board, and much has been written about it, but one upon which it is necessary to give line upon line and precept upon precept. The great mistake that the farmers fall into is, that when wool is high they all rush into sheep husbandry, and when there is a depression, and wool isn't worth more than half what it was, those who bought at a high price are anxious to sell and get out of it. Now the time to buy sheep and build up a flock is when they are low, and the farmer who has a flock of sheep when wool is worth but about 17 cents, if he will hold on to them, increase his number and keep his wool for an advance in price, it will pay him better than anything else in which he can invest his money. Take the years 1864 and 1867. In 1864 there were more and in 1867 less sheep in the State than at any period since

1840, and the sheep purchased by hundreds and thousands at prices varying from $5 to $15 per head were with their increase sold at about $2 50 per head; and men were as eager to sell as they had been to buy. Yet in three years afterwards sheep had again increased in value. This policy we have been pursuing for thirty years. We have nothing like the number of sheep we had in 1840, and our growth of wheat has fallen off in about the same proportion; there is something reciprocal between the two. I close by saying that this is something our farmers cannot think too closely upon. I believe if they will put money into sheep, stick to the business, and manage it with the same prudence that they would any other, in twenty years from this time the agricultural wealth of the State will be doubled.

Mr. FARRINGTON of Orono. I have been astonished at the practice of the farmers, to which our friend has referred, to change with the changing times from one method of husbandry to another. If, for instance, for a few weeks butter brings a good price how many will enlarge their stock of cows, and if it sells a few cents short they will sell the cows and buy sheep at a high price. These changes inevitably come, and those farmers who follow them are always seeking for what they never find. I wish our farmers would heed the caution given by Mr. Wasson, and when they have once adopted the system of sheep husbandry they would follow it through evil report and good report—through high prices and low prices, and I believe as the years go on they would find in it a constant source of profit and prosperity.

GEN. JOHN MARSHALL BROWN of Portland, member from Cumberland county. I rise for the purpose of asking the question, why it is that as a matter of fact our people are not fond of mutton as an article of food? For the past year I have been trying an experiment of my own with a flock of 60 sheep, and I am told by the butchers that our people do not eat mutton. Of course some of it is eaten, but as a rule our people eat beef and pork, and mutton is sent out of the State. In other countries it is considered a delicacy. I consider it so myself, and I do not see why it is not more highly appreciated by our people.

Mr. FLINT. It is a hard subject to throw light upon, but it is a fact that the descendants of the Pilgrim Fathers are opposed to eating mutton. The only reason I have ever heard given for it is that we have not raised choice, first-class mutton sheep. I do not know whether that is it or not. I think the time will come, and

is coming now, when mutton will be esteemed as an article of food throughout the whole country, as it is now in California and some parts of the West. I think mutton is most eaten with us in February, March and April, the months when people seem to require a light diet, but I believe our people would find it throughout the year more wholesome than beef. I believe the scientists who have examined the subject, state that it is more easily digested and that it is more easily assimilated by the system than beef.

Mr. WATERHOUSE of Fryeburg. I have kept 100 sheep, but now have but 60. I think the greatest lack in keeping sheep in this vicinity, is that the farmers do not feed them well enough. They do not keep their pastures in a sufficiently good condition. A good many people think that a sheep will live where nothing else will, but I am satisfied that it is a mistake, and that if we want to make a profit we must not only winter them well but must summer them well. My sheep have averaged eight pounds of unwashed wool. I have been in the habit of shearing about the first of June, but as the gentleman says, I don't know but it would be better to shear earlier. A poor sheep well kept will shear more than a good one poorly kept. I have been able to sell my lambs for $5, when I have noticed that some were glad to get $3. I kept them better, but I got enough better price to more than pay the difference in the cost of keeping.

NOTES UPON THE CULTURE AND MANIPULATION OF THE SUGAR BEET.

BY ALFRED B. AUBERT, B. S.,
Professor of Chemistry, Maine State College, Orono.

Previous to giving any rules for the selection and manipulation of the beet seed to be used for sugar manufacturing purposes, it may not be amiss to give a short description of the shape, structure and varieties of the sugar beet.

The sugar beet is of an elongated pear shape, generally free from forked roots, but sending out from opposite sides spirally disposed rootlets. The shape is not invariable; it is greatly affected by the nature of the soil as well as the source of the seed. If the soil be not well broken up and the root finds obstacles in its growth, it will develop with forked roots. M. M. Péligot and Leplay consider forked roots generally richer in sugar than the straight beet; but it seems more profitable to obtain the straight root as there is less liability of the root breaking when being washed, previous to use in sugar manufacturing.

Small beets are richer generally than large ones. Beets weighing from 1 to 2 pounds are better adapted for sugar manufacturing than those weighing 3 and 4 pounds. Mr. Hortsky of Hortskyeld, (Bohemia,) grows beets which are never to exceed one pound in weight, as stated in his contracts with sugar manufacturers.

The varieties at present cultivated are: The Vilmorin beet, which is very rich in sugar, but does not keep as well as other varieties. The Quendlinburg, of slender shape and pinkish skin, is considered earlier than other varieties. The White pear-shaped Silesian, known as the green ribbed beet. The Siberian or white ribbed beet, larger than the Silesian but poorer in sugar. The Electoral and Imperial are also recognized as good sugar beets.

STRUCTURE. If a section of a beet be made perpendicular to the axis, it will be found to consist of alternately opaque and translucent layers of vegetable tissue. The richest sugar beets contain the most opaque layers. From Bretschneider's investigations it appears that a relation exists between the number of leaves and the number of zones. There also exists a relation between the percentage of sugar, the number of leaves and the number of zones, as shown by the following table :*

	Per cent. of Sugar.	No. of Leaves.	No. of Zones.
Vilmorin Beets.	15.7	42	48
	14.8	39	36
	13.8	31	32

The percentage of sugar varies in different parts of the same beet, being greater near the bottom of the root than at the top.

CHOICE OF THE SEED. It becomes of vital importance to the beet grower to obtain seed from a good source. These can be at present obtained in sufficient quantities from France or Germany ; but as our own agriculturists may wish to produce their own seed, some rules which have been laid down by long practice may be of value. In the choice of seed-beets, reject all specimens which grow out of the ground. Select clean growing roots of from $1\frac{1}{2}$ pounds to $2\frac{1}{2}$ pounds weight. These must be kept between layers of sand or in dry pits during the winter. The beets should be of a well proved variety, grown upon a soil which is neither too moist or clayey, nor too rich in vegetable mould. The densest roots are generally chosen for seed-beets, and formerly their specific gravity was determined by immersion of the roots in solutions of salt of known density ; this gives fallacious results, as beets contain a small volume of gas in their cells. It is therefore best to determine the specific gravity of the juice as Vilmorin directs, and which according to him should not be less than 1.05—those beets whose juice has a specific gravity of 1.06 and over being of superior quality. M. Violette recommends the determination of the sugar in the juice by the use of titrated solutions.

Small seeds generally give smaller but richer beets than large seeds—as is shown by the following result obtained from Simon Legrand seeds.†

* Champion & Pellet. De la Betterave, etc.; p. 58. † De la Betterave; p. 28.

They were planted rather late in the season.

100 large seeds weighed..... ...3 2 grammes.
100 small seed weighed.....0.425 grammes.
(1 gramme = 15.43 grains.)

	Dates.	Average Weight of 4 Roots.	Sugar in 100 Grammes.
Large Seeds.	Aug. 11,	66 grammes.	
	Aug. 20,	75 do.	11.4 grammes.
	Aug. 31,	125 do.	
	Sept. 16,	375 do.	11.8 grammes.
Small Seeds.	Aug. 11,	30 grammes.	
	Aug. 30,	50 do.	12.0 grammes.
	Aug. 31,	75 do.	
	Sept. 16,	233 do.	12.5 grammes.

A more extended series of experiments upon this subject would seem useful.

Walkhoff says it is best to take the large seeds because they give more robust roots.

It is a noticeable fact that small seeds generally contain a somewhat greater percentage of nitrogen than do large ones, as shown by the following table:

Vilmorin Seeds.	Weight of 100 Seeds.	Per cent. of Water.	Nitrogen.	Ash.
Large,	4.130 grammes.	10.9	2.66	5.4
Small,	0.546 do.	11.0	3.07	5.3

The difference is not as great in the other varieties of beet seed as in the Vilmorin, averaging about .34 per cent. more of nitrogen in the small than in the large. The richest beets are produced from those seeds which contain most nitrogen and least ash.

It has been recommended to soak the seeds in water some hours, and to use them some time after they had been removed from the water. The following experiment will give an idea of the utility of such a treatment:*

	Roots pulled up	Average Weight of Roots.	Per ct. of Sugar.
Unsoaked Seed.	Aug. 31,	400 grammes.	16.4
	Sept. 16,	460 do.	13.4
	Sept. 29,	580 do.	17.0
Soaked Seed.	Aug. 31,	——	16.9
	Sept. 16,	500 grammes.	14.9
	Sept. 29,	580 do.	17.2

The blanks in the soaked seed patch were few, while there were many in the patch in which the unsoaked seed had been sowed.

Some of the soaked seed showed signs of germination after having been sown from six to seven days, although the soil was of

* De la Betterave; p. 33.

bad quality and had not been properly prepared. The beets produced by the unsoaked seed had many forked roots, owing to the fact that they were less advanced in growth than the soaked seeds, when the hot and dry weather rendered the soil hard and compact.

Water slightly acidified with nitric acid has been recommended for soaking seeds. Boettger discovered that the germination of seed is generally hastened by soaking for a few minutes in a weak solution of either potash, soda, or ammonia. Many other substances have been used.

Vilmorin thinks that beet seeds should retain their vitality for five years. M. M. Champion and Pellet had seeds which would not germinate after nine years of keeping.

Soil. The best soil for sugar beet cultivation is a deep sandy loam, which may be somewhat calcareous; it should not however be clayey, as it becomes so compact in dry weather as to materially interfere with the growth of the root; in wet weather it leads to the production of a large watery beet of low sugar percentage. The subsoil should be freely permeable, or the land carefully underdrained. The land should be deeply plowed in the fall—the deeper the better—a foot to eighteen inches being none too deep. The manure is now also applied, plowed deep into the soil and thoroughly mixed with it. The soil should be carefully broken up and loosened before seeding.

The manure should be slow acting. It is advisable sometimes to plow again after the first frosts. The seeds are planted by hand or by a sower; from 12 to 18 pounds are used per acre. These seeds should be sowed as near together as possible; when sowed by hand, they may be dropped "fourteen inches apart, or, if sowed by machine, they are dropped eight inches apart in rows twenty inches apart, which allows one horse with implement to pass between."*

The influence of the space between the roots may be gathered from the following experiments of Champion and Pellet.

Influence of space upon the weight of roots:

Source of Seed.	Space between Rows.	Weight of Root.
Vilmorin Seed.	20 centimetres.	354 grammes.
do.	30 do.	460 do.
do.	60 do.	1200 do.

(1 centimetre = 0.3937 inch.)

* Prof. Goessman's Report on the production of beet sugar as an Agricultural Experiment in Massachusetts; p. 58.

Influence of space upon the richness of sugar:

Seed.	Space.	Sugar in 100 parts of Beet.
Vilmorin Seed. 1st Experiment.	20 centimetres.	14.2 parts.
	30 do.	13.4 do.
Vilmorin Seed. 2d Experiment.	30 do.	14.7 do.
	60 do.	13.6 do.

M. Leroy, on his farm, (Ferme Neuve, près Noyon,) has obtained the following results—the distance between the rows being forty-five centimetres, the space between the roots varying:*

Space between Beets.	Yield per Hectare.
50	64.100 kilogrammes.
40	68.800 do.
30	72,200 do.
25	72,600 do.

(1 hectare = 2.47 acres — 1 kilogramme = 2.2 lbs.)

The seeds generally give rise to more than one root; in this case, the strongest should be preserved and the smaller roots pulled out. It is well to keep some beets ready for transplanting as there may be blanks in the beet field, which can thus be easily made up; transplanting retards the plants however. In case the blanks be very numerous, seeding may be resorted to if the length of season permit.

As may be seen from the table on page 167, those beets having the greatest number of leaves are the richest in sugar, owing to the greater facility they possess for assimilating atmospheric food and forming sugar. While the beets are young, the soil around them should be loosened carefully, and this treatment continued until the leaves are fully developed. The maturing of the root is indicated by the change of the green color of the leaves to a more yellowish green; the roots are harvested when the outer leaves become yellow and dry. The percentage of sugar varies greatly at different times of growth of the beet, being greatest at the time of maturity.

Influence of Rain at the time of Ripening. If, at the time of ripening, the beet be exposed to rainy weather the result is a watery beet, which contains less sugar than it would had it developed in ordinary weather. The proportion between the saline constituents and the sugar is generally increased.

* Journal des Fabricants de Sucre. No. 37. 4 Mars, 1875.

The following table gives give the effects very concisely:

* Beets pulled up Aug. 31st.			Same kind of beets pulled up Sept. 16th, after some days of rain.		
Per cent of Sugar in Juice.	Saline Quotient.	Average.	Per cent. of Sugar in Juice.	Saline Quotient.	Average.
16.8	3.8	4.8	14.4	4.7	5.2
16.2	4.0		13.1	5.3	
14.7	6.1		12.7	5.4	
14.7	5.3		12 0	5.3	

When beets are closely planted, the action of rains manifests itself principally in the development of leaves; if the roots are widely separated, they enlarge greatly under the influence of rains while the percentage of sugar diminishes.

Some of the beet growers used to strip the roots of some of their leaves while they were growing, but this practice has no sanction in experience, for it has been proved that the percentage of sugar is greatly diminished by the stripping of leaves.

Walkhoff gives analyses of beets which had been cultivated without stripping the leaves; they contained 13.72 per cent. of sugar, while beets of the same kind, cultivated in the same way, but which had the leaves stripped twice, only gave 8.34 per cent. of sugar. This practice, though detrimental to the beet for the manufacture of sugar, is sometimes resorted to for beets used for feeding purposes.

With a soil of good quality and strict attention to the details of culture, there is no reason why an acre should not yield at least 24,000 pounds of sugar beets, and even more than that.

In France, M. Simon Legrand estimates that, by properly manuring and planting the beets closely enough, one can obtain, per hectare, as much as 60,000 kilogrammes of beets, containing from twelve to seventeen per cent. of sugar.

Quantity of Mineral Substances taken from the soil by Beets. Prof. Goessmann states in his report (p. 74) that "a fair average crop of sugar beets abstracts per acre:

By Roots and Leaves.

Phosphoric acid	35 lbs.
Potassa	164 lbs.
Lime and magnesia	62.5 lbs.
Silica	15.9 lbs.

* De la Betterave; p. 65.

By Roots Alone.

Phosphoric acid	25 lbs.
Potassa	126 lbs.
Lime and magnesia	32 lbs.
Silica	6.5 lbs.

Returned by Leaves.

Phosphoric acid	10 lbs.
Potassa	38 lbs.
Lime and magnesia	31.5 lbs.
Silica	9.4 lbs."

The following tables from Champion and Pellet, give a good idea of the quantity of mineral substances abstracted from the soil by beet crops of different richness in sugar.

QUANTITY OF SALTS TAKEN UP BY A BEET CROP OF 50,000 KILOGRAMMES OF ROOTS TO THE HECTARE.

	Beets averaging 10 per cent. of sugar—*i. e.*, 5000 kilogrammes of sugar to the crop per hectare.			Beets averaging 15 per cent. of sugar—*i e.*, 7500 kilogrammes of sugar to the crop per hectare.		
	Leaves. 13000 k.	Roots. 50000 k.	Total crop per hectare	Leaves. 25000 k.	Roots. 50000 k	Total crop per hectare.
	k	k	k	k	k	k
Potash	145.0	146.5	291.5	270.00	129.00	390.00
	k	k	k	k	k	k
Soda	45.0	25.5	70.5	73.75	22,50	111 25
	k	k	k	k	k	k
Lime	50.0	21.0	70.0	97.50	18.75	116.26
	k	k	k	k	k	k
Magnesia	37.5	19.0	56.5	78.75	16.50	95.25
	k	k	k	k	k	k
Chlorine	42.5	28.5	71.0	90.00	25.55	115.55
	k	k	k	k	k	k
Sulphuric acid	20.0	11.0	31.0	45.00	9.75	54.70
	k	k	k	k	k	k
Silica	5.0	17.0	22.0	11.25	15.00	26 25
	k	k	k	k	k	k
Phosphoric acid	30.0	29.5	59.5	63.75	26.25	90 00
	k	k	k	k	k	k
Other mineral constituents.	25 0	8.0	33.0	33.75	6.75	40.50
	k	k	k	k	k	k
Total mineral constituents.	400.	306.	706	783.75	270.00	1053.75
	k	k	k	k	k	k
Am't of nitrogen taken up.	41.9	125.	167.9	75.	200.	275.00

From the above tables it is evident of what immense manurial value the beet leaves may be if no other use is found for them. Also the press-cake, that is, the organic and mineral part of the beet left after the juice has been extracted, is of great manurial

value, if it cannot be used as fodder first. It is also seen from the tables that the greater the percentage of sugar, the greater is the weight of leaves, and the greater the quantity of mineral matters abstracted from the soil. The following table gives the proportions which have been noticed to exist between the percentage of sugar and the weight of the leaves :*

Per cent. of Sugar in Roots.	Weight of Leaves in 100 parts by weight of Beets.
15.4	58
15.2	63
14.1	52
14.7	62
13.1	31
13.8	26
13.5	36
13.4	25
11.8	26

The following table shows the comparison between the Vilmorin sugar beet and others.

Kind of Beet.	Leaves for 100 parts of Roots.	Per ct. of Sugar in Beets.
Vilmorin Improved,	56	14.5
Simon Legrand,	33	13.3
Ordinary sugar beet of manf'rs,	20	11.8

Special culture also has an influence upon the bearing of leaves as well as the richness in sugar, as is shown by the following example in which the same seeds were used :

	Roots	Leaves.	Per ct. Sugar.
Ordinary sugar beet of manufacturers, (special culture,)	100 kilos.	52 kilos.	13.3
do. (ordinary culture,)	100 kilos.	28 kilos.	11.8

After carefully comparing the amount of matter taken up by a beet crop, it becomes evident that judicious manuring or restoring the lost substances to the soil is of prime importance. This is generally done by the use of special manures, in connection with farmyard manure. Rotation of crops becomes a very useful adjunct in the cultivation of the beet, aiding, as it does, in fully bringing out the mineral resources of the soil, and avoiding any exhaustion thereof.

In Prof. Goessmann's report we find that "Well manured annual leaf crops for green feeding are considered the best crops to precede the beet; next in order follow well manured summer or winter grain crops; less recommended are perennial grasses and other fodder crops; directly objectionable are, if not specially

* De la Betterave; p. 43.

manured, potatoes and root crops in general, of which mangel is the worst. The sugar beet, on the other hand, is a good crop to precede almost any other farm plant. The succession of crops, adapted to the interest of sugar beet industry, has reference to two important objects, namely, an adequate supply of food to each crop and the production of the largest possible amount of animal manure. A fair crop of beet roots is of course more exhausting to the soil, as far as phosphoric acid, and particularly potassa, is concerned, than most of our farm plants; a judicious system of rotation divides that effect over several years, and thus enables the farmer to draw more efficiently on the natural resources of the soil, and so avoid a direct outlay of money. The following succession of crops is considered very satisfactory, viz.: green fodder, wheat, sugar beets, and, finally, a summer grain crop; or barley, sugar beets, barley, green fodder, wheat, sugar beets; and these are economical as far as manure is concerned. Two thousand three hundred pounds of hay, or its full equivalent in fodder value, are considered sufficient to replace the constituents which a fair beet sugar crop abstracts per acre, in excess of what refuse material, resulting from such crop in the course of beet sugar manufacture, will compensate for."

Rotation of crops not only has a very great advantage in preventing the rapid exhaustion of the soil, but it also keeps in check the development of the vegetable and animal parasites of the beet plant, which, under other conditions, would increase very rapidly and soon endanger the crops. A good rotation seems essential to the economical cultivation of the sugar beet, reducing, as it does, the expense which would have to be incurred for special manures, in case beets alone were cultivated, and also greatly removing the danger of ravages by parasites of the beet.

Farmyard manure is very generally used as a manure for beet crops; it is well, however, that the beets should be a second crop, as, by that time, the manure will have disseminated through the soil, and will be thoroughly disintegrated. The manure should be applied in the fall, if possible.

In the cultivation of the sugar beet special manures are often of great value, when used in moderation mixed with well decomposed compost. Manures, containing large quantities of nitrogen, are not at all advisable for the sugar beet, as they give rise to excessive leaf development, and increase the quantity of albuminoids in the roots, while, owing to excessive and rapid growth,

large quantities of saline constituents are absorbed from the soil. Potash and phosphoric acid are the special manures most needed by the sugar beet, and, when judiciously applied, well repay the extra expense attendant upon their use. Peruvian guano, Chili saltpetre, Stassfurt salts mixed with phosphate of lime in some form, give satisfactory results. Green manuring is highly recommended.

M. E. C., in the *Journal des Fabricants de Sucre*. No. 20, 1875, gives the following results of analyses of comparative trials in the culture of French and German sugar beets.

The method of culture adopted in these experiments was the following:

1. Space between the rows, 48 centimetres.

2. Space between the roots in the rows, 23 centimetres.

3. The seed was mixed with three times its weight of the following pulverulent fertilizer:

Superphosphate of lime.....	600	kilogrammes.
Nitrate of potash.....	100	do.
Nitrate of soda.....	100	do.
Plaster (to facilitate mixture)....	200	do.

4. From fourteen to seventeen kilogrammes of seed were used to the hectare—sowed by machine.

5. The quantity of artificial fertilizer varied from 500 to 800 kilogrammes per hectare, according to the nature of the soil. The fertilizer was thrown broadcast two weeks before seeding, and mixed with the soil.

Beets pulled up September 8th, 1874. Analyzed the 9th.

Name of Seed.	Source of Seed.	Aver. weight of Beets analyzed.	Patch sown in 1873, to	Kind of Manure for the 1874 crop.	Brix degrees	Polarization Test.	
						Sugar.	Not Sugar.
GERMAN BEETS.		Grammes.					
Vilmorin improved.....	Archersleben	470	Oats	Stable manure.....	18.29	16 02	2.27
Electoral	do.	470	Beets	Artificial manure.....	17 65	14.23	3 42
do	do.	540	do.	Farmyard manure.....	17.28	14.29	2.99
Imperial	do.	630	Oats	do. do.	17.46	14.18	3.28
White silesian	Bebitz	690	Fallow land	Farmyard manure and compost..	16 94	14 18	2.76
do.	do.	430	Beets	Artificial fertilizer	17.33	14.13	3.22
FRENCH BEETS.							
White with pink collar.	Departement du Nord	520	Wheat.....	Farmyard manure.....	18.27	15.49	2.68
do. do.	do. do.	540	do.	do. do.	17.59	14.81	2.78
do. do.	do. do.	950	Beets.....	Scum from defecating process...	17.15	14.50	2.75
do. do.	do. do.	640	do	do do.	15.90	12.27	3.63
do. do.	do. do.	385	Oats.....	Farmyard manure.....	17.45	15 15	2 30
do. do.	do. do.	615	do.	Compost	17.25	14.18	3.07
de. do.	do. do.	560	Beets.....	Scum from defecating process ..	17.86	14.83	3 03
do. do.	do. do.	1.k205	do.	Artificial fertilizer	14.84	12.00	2.85
do. do.	do. do.	410	Fallow land ...	Farmyard manure.....	17.10	14.07	3.03
do. do.	do. do.	690	Beets.....	Artificial fertilizer	17 20	14.75	2.45
do. do.	do. do.	550	do.	do. do.	16.80	13.91	2 89
do. do.	do. do.	690	do.	do. do.	16.70	13.55	3.15
do. do.	do. do.	760	do.	do. do	16.85	13.48	3.37
Average.....	GERMAN.....	544	- -	- - -	17.47	14.50	2.97
Average.....	FRENCH	630	- -	- - -	16.97	14.07	2.90

In Russia, beets have been raised upon good soil without any use of fertilizers. This has produced a very rich but small beet, and the yield has also been rather meagre: 12,000 to 20,000 kilogrammes per hectare. As a general thing, by judicious manuring a so much larger quantity of roots is produced, that the slight reduction in saccharine richness of the beet is much more than compensated by the increased yield. If our attention be paid to the closeness of the roots in well manured lands, beets as small and rich are produced as those grown on unmanured land, but separated by larger spaces.

Sufficient care is not generally bestowed upon the subject of spacing the beet, and that is one reason why the sugar percentage falls so low sometimes, when land has been rather richly manured. The influence of fertilizers on the quantity of beets produced and their richness in sugar, may be gathered from the following experiments of M. Pagnoul:

Years.	Manured with	Weight of Roots per hectare.	Sugar in 100 parts of Beets.	Total yield of Sugar per hectare.
1871–2.	Farmyard manure,	64173 kilos.	7.10	4556 k.
	Complete fertilizer,	70172	11.20	7926
	do. do.	64567	11.40	7370
	Nothing,	51520	13.90	7161
1873.	Nothing,	30358	13.03	4051
	Complete fertilizer,	40525	12.03	4984
	Nitrate of soda,	43164	13.02	6761
	Farmyard manure,	57876	12.02	7061

The roots were closely planted.

Manuring to excess must of course be avoided; it is, however, a great auxiliary when carried on judiciously; the nature and condition of the soil being taken into consideration as well as the closeness of the roots.

It is the purpose of the writer to present other reports upon this important subject, but he hopes to have shown already that many valuable experiments might be made in this State upon the best methods of cultivation of the sugar beet, including all details, such as choice of seed, spacing of plants, application of manures, etc.

Report on the Sugar Beets grown on the Farm of Maine State College.

The plat upon which these beets were grown is a moist sandy loam. The following is the history of the patch as given by Mr. J. R. Farrington, Farm Superintendent:

"The plat of land on which the sugar beets were grown was broken from grass and planted to potatoes in the spring of 1872. The three succeeding years it was sown to onions. To enrich the land for each onion crop, a heavy dressing of manure from the cow stable was plowed under in the fall, and the following spring nitrogenous fertilizers, such as poudrette, hen and sheep manure, were spread in liberal quantities and worked into the surface soil. Ashes and superphosphates were also used in small quantity. The crops raised were not sufficiently abundant to exhaust the land, it rather increased in fertility.

In the autumn of 1875 manure from the cow stable was again plowed under. In the spring of 1876 a good dressing of like manure was spread and harrowed in. No other fertilizer was applied to the beets. The ground was sufficiently worked with cultivator and hoe to keep it in good tilth and free from weeds."

The beets were pulled up about the second week in October. Three or four light frosts had occurred previous to their harvesting, but had not been deep enough to affect the beets. The beets were of good shape and size, being generally clean and free from roughness. Most of them grew well under ground, the Vilmorin being especially well covered. It seems probable that richer beets might have been produced had the land been less charged with nitrogenous substances. The leaves of the beets were rather more luxuriant than is common in good sugar beets.

Analysis of Sugar Beets grown on the College Farm.

Name of Variety.	Seed obtained from,	Average weight of roots used for analysis.	Specific gravity of juice	Per cent. of sugar in juice.
Improved French white sugar beet..	J. J. H Gregory.....	585 grammes	1.070	12.68
Improved Vilmorin do.	Dept. of Agriculture..	450 do.	1.068	11 41
Carter's improved nursery do.	do. do.	589 do.	1.062	10.67
Silesian sugar beet	Illinois	519 do.	1.063	10.64
Imperial do.	Dept. of Agrieulture..	613 do.	1.059	9 44
Silesian do.	do. do.	575 do.	1.057	8.17
FODDER BEET.				
Lane's improved sugar beet.....	Kendall & Whitney..	–	1.050	8.07

The determinations of sugar percentages were made by myself with Fehling's solution. It is but just to add, that I owe many thanks to Mr. A. M. Farrington, a graduate of the course of agriculture of this college, for his kindness in preparing the juice of the beets for analysis. Had it not been for his valuable aid, I doubt whether I could have found time to do all the work.

WOOL INDUSTRY IN OUR NATIONAL ECONOMY.

Believing that our State possesses superior advantages for the production of wool and mutton; that a well settled system of sheep husbandry, uniformly and persistently followed, would conduce to our agricultural prosperity; that our farmers generally should give more attention to the growing of mutton and the production of wool, and that this end will be promoted by a careful reading of the same—I give herewith a most admirable article on the part of the Wool Industry in our National Economy, contributed to the Bulletin of the National Association of Wool Manufacturers by Hon. JOHN L. HAYES of Boston, Mass., Secretary to the Association and editor of its valuable quarterly journal above named. The points taken up cover the whole matter thoroughly, are most intelligently treated, and the discussion of the subject is not only interesting, but so valuable and complete as to form an important contribution to the subject: and I take pleasure in transferring it to my report:—

Great truths never become trite by repetition. The mountains have stood unchanged in every outline of their gigantic features since the primeval cataclysms which uplifted them from the abyss; yet in winter and summer, spring and autumn, in storm and calm, in sunrise and sunset, how varying are they in aspect,—eldest of created forms, yet for ever new! One sermon, pronounced eighteen centuries ago, embodies all that the ministers of the church have preached for succeeding ages. Yet the truths of Christianity will be always as new as the dawn of each day with the same recurring sun. In the political campaign just ended, the tens of thousands of speakers on either side have been effec-

tive only by repeating the few rallying principles of their respective parties, and eager audiences have never wearied of hearing again and again that which they most earnestly believed. The old lesson of line upon line and precept upon precept, the old illustration of the perpetual water-drop upon the stone, must always be borne in mind by those who become weary in impressing upon others their convictions. If we have been presumptuous in the illustrations of the work we have taken in hand, it is because of our conviction that the truths which lie at the foundation of a wise political economy are among the great truths which demand perpetual enforcement. In the considerations above suggested, we find an excuse for discussing a topic which is neither original nor novel, but which involves the whole mission of this journal; viz., *the Part of the Wool Industry in our National Economy.*

Introductory Definitions. Economy means a well-ordered arrangement, and a national economy a well ordered arrangement of the material interests of a nation. We shall assume that the readers to whom we address ourselves, who are rather, in this case, the general public than specialists in the wool industry, will admit what is the universal instinct of intelligent nations,—that a wise national economy demands that a nation should fix upon its own territory all those branches of industrial activity which suit its soil, climate, and commercial position, or, in other words, whose acquisition is authorized by the nature of things; that the end of a nation, like that of an individual, is its own perfection; and that, as a means to that perfection, it should aim to develop the resources of its soil and the activities of its people until they become in all necessary things independent and self-sufficient. The accomplishment of these objects is the true national economy. By the wool industry, we understand every thing which relates to the production and manipulation of wool. We discard the distinction between wool growers and wool manufacturers as unsound, both performing an equally important part in converting the products of the soil into fabrics. The grower converts the raw material, grass and grain, into fibre. The wool scourer gives that fibre clean to the spinner; *he* furnishes the raw material, yarn, to the weaver; and the finished fabric of the latter is raw material for still other manufactures, as of cloth for the tailor, or felt for the paper-maker. The distinction, sometimes made between the

producer and consumer of raw material, is therefore fallacious. The producer in every stage of the wool industry is both a producer and consumer of raw material; and the occupant of every stage has an equal claim with any other upon the national consideration.

The relations of the occupants of the first stage in the wool industry—that of wool production and its incidents, mutton production and sheep breeding—to the national economy naturally come first under consideration. Although in this branch of our subject we are peculiarly oppressed by the consciousness of an inability to add so little to what we have elsewhere said, familiar facts may be more strongly impressed by a new statement.

Sheep Culture not Sectional. We are first struck by the fact that wool production, with its incidents, unlike the production of any other raw textile material, can be advantageously pursued in some of its forms in every State,—certainly within our own territory. Cotton can be grown only in the South; silk only in California and Kansas; but wool-growing is suited to every soil and climate except those of the tropics or extreme north. It would be difficult to find an industry more cosmopolitan, or to which national encouragement can be afforded with less risk of arousing sectional jealousies.

Cheapening of Animal Food. Chief above all the relations of the wool industry to the national economy are the benefits which it confers upon the State in the supply or cheapening of animal food. European economists manifest grave apprehensions on account of the increasing cost of animal food in the older nations. The *savans* of the Society of Acclimation in France have for years labored to conquer the prejudices against horse flesh, and have finally succeeded in establishing its regular sale in the markets of Paris. They even regard the seige of Paris in some measure compensated by the fact that its necessities reconciled the Parisian masses to the use of the flesh of dogs, cats, and rats for food.

Says the French Secretary of Finance, in reply to the allegation that duties on wool will increase the cost of clothing: "No matter: they will encourage the growth of sheep, and diminish the cost of food. *Alimentation is more important than vestiture.*"

Sheep, from the facility and rapidity with which they are matured, the rapidity of their increase, and their treble use for food, raiment, and manure, are the most available means of supplying a

deficiency of animal food. Nature and the art of the breeder have made the sheep the most perfect machine in existence for converting grass and grain into flesh. France is turning her merino sheep into flesh producing animals of equal weight with the South Downs, and maturing as early, yet retaining all the attributes of the merino fleece. Germany, less wise, but with the same object of increasing the supply of animal food, is abandoning her splendid merinos for the English mutton races. The superiority of the sheep as a meat-producing animal has been conclusively demonstrated by experiment. It has been proved that seventy-five pounds of food (be it hay, corn or turnips) will make as many pounds of mutton as one hundred pounds of the same will of beef, and that when ready for the butcher, the "fifth," or waste quarter,—the offal parts of the sheep,—will be three per cent. less than that of an ox or cow; so that, by this showing, the weight of food required to produce seven hundred and thirty pounds of beef would make one thousand pounds of mutton. When we consider the positive saving in the use of mutton over all other meat, its superior nutritiousness, and the facility with which it is digested, added to the fact that of all animals the sheep is easiest fed, we need not wonder that England, with its dense population and manufacturing cities, has been compelled to cultivate sheep up to the absolute capacity of her high-priced lands, and to attain the enormous number of 34,532,000, yielding an annual produce of over £30,000,000.

In England the indispensable necessities of its people are sufficient to stimulate the production of sheep. In this country the increase of sheep has been aided by the protective duties on wool. Thus we are able to draw a supply of mutton from thirty-five millions of sheep. The supply of pure mutton sheep—those of English blood declining for a time by the free admission of Canada combing-wools under the Reciprocity Treaty—was revived by the protective duties on combing-wools, under the tariff of 1867, and is now having a rapidly increased extension. The quality of mutton in all our markets has improved. It is daily increasing in popular demand. Where hundreds of sheep were sold in the Brighton market twenty years ago, there are now sold thousands. In the markets of New York, where sheep, a few years since, were slaughtered solely for their pelts and tallows, more time is required of the butchers to supply the demand for mutton than for all other meats; and the returns of these markets show mutton to

be worth from two to five cents more than beef. The consumption of beef for our armies during the war seriously diminished the supply of cattle, which required years to repair. The sheep husbandry, so capable of rapid increase, stimulated by the extraordinary activity of the wool manufacture during the war, filled the void in the beef production, and kept the prices of animal food within reasonable limits; for the abundance of mutton kept down the prices not only of that commodity, but of all animal food. The benefits of this diminished cost of sustenance to every individual of our population has never been properly estimated. The cost of animal food to our population is certainly ten times that of wool clothing, which is but four dollars per head. Assuming that the whole duty on cloth is a tax on the consumer, and that the sheep husbandry, and consequent supply of mutton, are stimulated by protection, we may safely conclude that the whole duty on the cloth is reimbursed to the consumer by the diminished price of food resulting from the protection of wool. No legislation can wisely disregard this relation of the wool industry to the national economy.

Sheep Husbandry Improves the Land. Next in importance are the relations of sheep husbandry to an improved system of agriculture. These considerations apply much less to the simply pastoral husbandry, like that of California and Texas, than to sheep culture pursued as a branch of a mixed husbandry. Sheep are the only animals which do not exhaust the land upon which they feed, but permanently improve it. Horned cattle, especially cows in milk, by continued grazing, ultimately exhaust the pastures of their phosphates. In England, the pastures of the county of Chester, famous as a cheese district, are only kept up by the constant use of bone-dust. Sheep, on the other hand, through the peculiar nutritiousness of their manure, and the facility with which it is distributed, are found to be the most economical and certain means of constantly renewing the productiveness of the land. Mr. Mechi, the most famous of the living scientific farmers of England, estimates that fifteen hundred sheep folded on an acre of land for twenty-four days, or one hundred sheep for fifteen days, would manure the land sufficiently to carry it through four years' rotation. In the counties of Dorsetshire and Sussex, where the Down ewes are fed in summer on the hill grass, during the day, and at night are folded on the arable without food, the value

of the manure is set down at one-fourth the value of the sheep. By the combination of sheep husbandry with wheat culture, lands in England which, in the time of Elizabeth, produced, on an average, six and a half bushels of wheat per acre, produce now over 30 bushels. For these reasons, the recent practical writers in the Journal of the Royal Agricultural Society of England pronounce that, while there is no profit in growing sheep in England simply for their mutton and wool, sheep husbandry is still an indispensable necessity as the sole means of keeping up the land. Fortunately, we are able to find recent illustrations at home of the point above asserted.

Facts in America. The eminent agriculturist, Mr. George Geddes of Onondaga county, N. Y., in an article written at our request, and published in the *New York Weekly Tribune* of September, 1876, has given the results of the sheep culture in mixed husbandry attained by the late William Chamberlain, of Dutchess county, N. Y.

In 1840, Mr. Chamberlain purchased a farm in Red Hook, N. Y., of three hundred and eighty acres, which had been used so long to raise hay for sale that it was worn out. The hay-crop of 1841 was seventeen loads; forty acres of rye gave ten bushels to the acre; twenty-five acres of corn averaged twenty bushels to the acre; the remainder of the farm was pasture, and proved equal to the raising of one span of horses, two pairs of oxen, and one cow. The land was so exhausted that it would not raise red clover. The so-called commercial manures were tried with but little advantage; and then Mr. Chamberlain resolved to test the Spanish proverb,—"The hoof of the sheep is golden." By using sheep as manufacturers of grain, hay, corn-stalk straw, swamp mush, leaves, and weeds into manure, he had, in 1844, not only restored this worn-out farm to its original fertility, but made it so productive that its crops would be satisfactory even in Ohio.

The account of the crops in 1864 showed six hundred tons of hay; forty acres of Indian corn, estimated to yield fifty bushels to the acre; wheat, for which the land is not well adapted, but the best crop with which to sow timothy and clover seed, thirty acres, averaging fifteen bushels; thirty acres of oats, eight acres of roots, and the pasturage of three hundred sheep, with the teams, cows, &c., necessary to carry on the farm and to supply the families on it with milk and butter.

Mr. Chamberlain's plan, when he first commenced making manure by using sheep, was to spread it thinly, so as to go over all the surface he could, and have enough to make clover grow; and he said that when he had brought his land to where it would produce red clover, thenceforth improvement was easy and rapid. The sheep not only gave the first impulse, but were all the time depended upon as the chief manuring power.

Mr. Geddes adds his own experience in raising sheep for many years in connection with grain. He says, "With about one sheep to the acre of cultivated land, pasture and meadow, we raise more bushels of grain on the average than we did when we had no sheep to manufacture our coarse forage into manure, and to enrich our pastures to prepare them for grain crops. While producing more crops on less acres, and at less cost than we did before we kept sheep, and, at the same time, constantly improving our land, we have the wool and mutton from our sheep in addition." These facts are conclusive as to the superior profitableness of sheep in mixed husbandry, and especially as an adjunct to wheat farming. We may add that these considerations have recently attracted serious attention in some older States. The Maine State Board of Agriculture have discussed the subject with great earnestness; and, in their last report, have published elaborate articles showing that an extension of sheep or mutton growing is of the first necessity to the agriculture of that State.

Promotes the Highest Arts of Agriculture. Sheep husbandry in its higher branches is eminently promotive of the individual culture of those who pursue it, and is thus conducive to the intellectual advancement of the nation. It is well recognized that the simple culture of a single crop, whether of corn or cotton, is the lowest form of agriculture; but, when combined with the culture of animals, farming assumes a higher phase. The culture of sheep, especially connected with wheat-growing, has distinct advantages over other forms of stock-raising. One advantage, though not directly bearing upon the immediate point in question, is that the ewe gives two dividends each year,—her fleeces and her lambs. The males give larger fleeces, and go to market earlier. The beef-producing animals give no dividends, and the grower must go on adding his expenses till the end of their lives, when in one gross sum he must find his compensation if he can. To this may be added that, in mutton production, the capital invested may be turned over two or three times

during the same period that the same capital is employed in beef raising. This, however, is beside our subject. We have heard a striking advantage of wheat and sheep growing over dairy farming commented upon by practical farmers. In dairy farming there is an unvarying routine of providing food for stock, selling the dairy products, and shovelling manure. There is no let up, no vacation to the farmer. In wheat and sheep farming combined, there are two short periods of excessive activity,—the harvesting and lambing seasons; in the intervals, long periods for other pursuits or intellectual culture. Hence this has been called the aristocracy of farming.

The breeding of animals is now recognized as among the greatest of the creative arts. Professor Agassiz says enthusiastically of the stock breeders of the present day: "The practical realization of a theoretical acquisition has led them to make science the foundation of their business. From very empirical workmen they have raised themselves to be a class of thinking workers, who, as regards mental range, will very soon surpass every other industrial class, and before long will give society a totally new impress."

No class of stock-growers have done so much to merit this high praise as the breeders of sheep. This species being so plastic in its character that the breeder, according to Lord Somerville's celebrated saying, "may chalk out upon a wall a form perfect in itself and then give it existence," presents the most signal illustrations of the modern doctrine of evolution. The breeder has become a veritable creator. The products of his art have the permanency of primeval species. There are convincing reasons for believing that the precious merino was converted by the art of man from the coarsest of the primeval sheep, the hair being dropped, and the underlying down, found still in the rudest of the ovine races, having been developed into fine wool. All the most valuable long-woolled races of England, so distinct in their characters, have been developed by human agency. The merino of Spain has been converted on the one hand to the electoral race of Germany, and the sheep Naz of France; producing fleeces of the utmost fineness, but weighing not more than a pound and a half, and with a length of fibre of less than an inch; and, on the other, to the Rambouillet sheep, producing fleeces of thirty pounds weight, with a length of five inches. New and unexpected qualities appear from time to time through accident,

which the breeder turns to advantage, such as the silky Mauchamp wool, rivalling the cashmere, or even modifications of the skeleton form of the animal, as in the Ancon or *otter* sheep of Rhode Island, with limbs so formed that it cannot jump fences. A new attribute attained by the breeder's foresight, or his judicious application of happy accidents, may be of priceless value. Thence the immense money value of the best stock sheep,—a value enhanced by the rapidity with which the regenerating influence of the male propagates itself. The influence of one buck in three or four years may raise the wool product of a flock of a thousand sheep from five to ten pounds for each individual. There are cases which justify this statement. Thus, even in the time of the Emperor Tiberius, Spanish rams were sold for a talent,—about a thousand dollars of our money. The ram letting of two animals by Bakewell, the producer of the new Leicester sheep, produced in one season twelve hundred guineas. Our Mr Hammond sold his bucks for five thousand dollars each; and even in Australia, where perfection in sheep-breeding might be supposed to be everywhere prevalent, a ram at a sheep auction in Melbourne, during the present year, "after the keenest competition was knocked down at three hundred and fifty-five guineas."

In the history of agriculture no names stand so prominent as great benefactors as those of Robert Bakewell, the creator of the new Leicester; John Ellman and Jonas Mills, the improvers of the South Downs; Von Thaer and the Duke of Lecknowsky, in Germany the improvers of the merinoes; Daubenton, the associate of Buffon, the founder of the French merino; Mr. McArthur, the creator of the Australian sheep husbandry; Edwin Hammond, of Vermont, mainly the originator of the American merino. The nobility of sheep-breeding is recognized in all the advanced nations. The Empress Eugene took the flock of Rambouillet under her special protection. The Queen of England takes pride in the choice flocks which adorn her parks. The English nobleman values the prizes for his perfected South Downs or Lincolns above all the honors of the turf. And, at a dinner of the landed gentry, the topic of sheep and turnips takes precedence of all other table-talk. Such recognitions lift the creative work of the sheep-breeder to the rank of the highest of the arts of agriculture, and make its acquisition not only a source of national emolument, but an object of national pride.

A Means of Settling New Territories. Pastoral sheep husbandry is of the first importance to the nation as the most effective means of settling and improving the vast unoccupied lands of the new or vacant States of the West and South. Of all the products of agriculture, wool is most capable of transportation; or, in other words, the greatest value can be placed in the smallest bulk, in a form liable to receive the least injury in the friction of transportation. When the freight of wheat from Chicago to the seaboard costs eighty per cent. of its value, of pork thirty per cent. and of beef twenty-one per cent., that of wool is but four per cent.; wool, therefore, may be grown with profit in the districts of the remotest interior favorable to its production.

Sheep in Russia. No industrial movement of the present century is more marked than the development of the pastoral sheep husbandry, upon a vast scale, in new countries, distant from the markets where the products are sold. The manufacturing centres of Europe derive their chief supply from distant and newly occupied regions. The wool production of England remains stationary; that of Germany, Austria and France is declining. Russia alone, among the European nations, with her vast unoccupied lands, is extending her sheep husbandry as the readiest means of occupying her distant possessions. The numbers of her sheep in the Russian empire reach the enormous figure of 65,387,000. Single proprietors have not less than 400,000 animals. While Great Britain has 133 sheep to each hundred inhabitants, France 97 and Prussia 93, the whole Russian empire has 81, and certain provinces, as those of Central Asia, have 565 sheep for each hundred inhabitants. The culture of sheep receives the most watchful care from this eminently paternal government. This was well illustrated at the International Exposition. The choicest exhibit was made by an Archduchess. The imperial commissioner, himself a privy councillor, would not trust the explanation of the wool exhibits for awards to a subordinate, declaring, as he pointed out the characteristics of each exhibit with striking minuteness of information, that "this industry was peculiarly under the care of his government"

Argentine Republic. Although the Argentine Republic did not seriously undertake the culture of merinos until 1826, she numbers now 51,500,260 sheep, producing 216,000,000 pounds of wool.

Estancia after *estancia*, district after district, has passed into the hands of the sheep farmer. The value of sheep has increased ten fold within twenty years, and of land in the same ratio. The shepherds, from the poorest classes of English and Irish immigrants, have become wealthy proprietors, and the republic, through her sheep mainly, has become the most prosperous of the states of South America.

Australia. But Australia presents the most striking example of the influences of sheep husbandry upon civilization. In 1803, Captain McArthur brought a few merinos, from the choice flock of George III, to New South Wales. In 1810, the export of wool was 167 pounds. In 1875, the export of wool from New South Wales was 216,000 bales, of the value in the London market of between five and a half and six million pounds sterling. The number of sheep in the seven colonies of Australia, in 1874, was 61,684,127. The exhibits of wool from Australia, at the Exposition at Philadelphia, were the finest ever before made. Hardly less conspicuous than the wool exhibits were the evidences of wealth and progress in all the arts, the variety of products of the mine and the soil, and the illustrations of social and educational improvement, which made the exhibit from these distant colonies among the most attractive in the exhibition. The chief instrument of this civilization was the sheep. In the words of one of her commissioners, "Although Australia may freely boast of the unequalled richness and variety of her mineral productions, of the large returns and great fortunes amassed from her gold fields, yet nothing approaches the wool industry in importance." The close of this century will doubtless see these separate and dependent colonies incorporated into an independent republic, and the extraordinary fact will be shown of an empire founded by the humble sheep!

Relations to Settlement in the United States. It is only within the last ten years that the system of pastoral wool husbandry, as an independent industry,—after the methods of Australia, the Argentine Republic, and Russia,—has been undertaken in this country. The attempts in Texas were arrested by the war of the rebellion. The tariff of 1867, by excluding the over-production of the Southern Hemisphere, firmly established the pastoral sheep husbandry upon the Pacific coast. This year, from the returns which we have, California will produce fifty-one million pounds of wool; while, in 1860, the whole country produced, according to the

census returns, but sixty thousand pounds. The pioneer wool-grower in California, Colonel Hollister, having led a company of emigrants to that State in 1852, saw, at the head of San Francisco Bay, a band of some two thousand Mexican sheep herded by two dogs, with no man in view. "If dogs can do this," said the colonel to himself, "what may not men do with sheep in a country like this, where grazing is perpetual, where no shelter is required, and where the natural increase is one hundred per cent. annually?" Starting, in 1853, with eight hundred sheep, secured for himself from three thousand brought into California from Ohio in 1852, he formed a partnership with the Messrs. Diblee Brothers, who had been successful wool-growers in Los Angelos county. In 1863, the partners bought the great Lompoc rancho for sixty thousand dollars, and stocked it with ten thousand sheep. In 1874, the landed property was worth a million and a half of dollars,—all the result of sixty thousand dollars originally invested, and ten thousand sheep well handled. The product of four hundred pure merino ewes purchased in 1862 was, in 1875, fourteen thousand one hundred and nine-three pure merino ewes, descended from the parent band, in addition to the males reared. In 1874, the sales of wool and sheep amounted to one hundred and twenty-four thousand two hundred and forty-nine dollars. With all these splendid results, in the words of his biographer, Colonel Otis, "Colonel Hollister himself looks upon sheep husbandry, not as an *exclusive* interest, to be prosecuted indefinitely on the extensive scale which now characterizes the pursuit, but rather as a pioneer industry for a new country, useful to bridge over the gap between a sparse and a dense population, and which ought to be gradually retired before the advance of settlement and the advent of the plough."

These words indicate precisely the part which the pastoral sheep husbandry plays in the settlement of a country. The sheep grower moves to new lands after opening those first occupied, to permanent agriculture. Sheep husbandry will advance from the foot-hills of California to the *parks* of the Rocky Mountains; and regions as wide as Australia or the Pampas of South America, supplied with aromatic grasses, preserving their nutritiousness during winter, lie open for pasturage between the Missouri and the Pacific. To give but one illustration: The Valley of the Republican is two hundred and fifty miles long and one hundred miles wide; containing two thousand five hundred square miles,

or sixteen millions of acres. "There is not a rod of these sixteen million square acres," says Dr. Latham, "that is not the finest of grazing, and which is not covered with a luxuriant growth of blue buffalo and gramma grasses." He continues: "New York, Pennsylvania, Ohio, Michigan, and California are the five largest stock and wool growing States, aggregating sixteen million sheep. The sixteen million acres in one valley would graze all the sheep of these States, and still leave millions of acres of grasses untouched." Texas and other Southern States have millions of acres nearer at hand, with advantages of winter grazing equal to those of Australia. We have before us the careful estimates of the most experienced flock-masters in this country, proving that sheep husbandry can be profitably conducted in Texas on the same gigantic scale as in Australia and Southern Russia. Who will deny, in view of these facts, that the wool industry performs the high part which we claim for it in our national economy?

Relations of Domestic Wool to Domestic Manufacture. The domestic production of wool is highly promotive of the perfection and abundance of the wool manufactures of a nation. As a rule, the characteristic wool manufactures of the leading nations have been determined by the abundance and peculiarities of their own raw material. Turkey, having no clothing wool, makes but few and exports no cloths; but she sends her beautiful Smyrna carpets and rugs to all the wealthy markets of the world, for the simple reason that she has in abundance the admirable carpet wool produced by the barbarous or fat-tailed sheep inherited from the remotest ages. It may be said that the United States excels in the manufacture of carpets, although producing no carpet wools. This exception to the general rule is due to the fact that American ingenuity, developed in other branches of the textile industry, first successfully achieves the manufacture of carpets by the power loom.

England, the creator of the long combing-wool sheep, and by far the first country in the world in their production, was the inventor of the countless dress fabrics for common consumption made from this fibre. It is first through these fabrics, the products of the peculiar fibre of her own sheep, that England ranks as the first wool manufacturing nation in the world, and, secondly, that she has practically the command and the first choice of the products of her colonies, the fine wools of Australia

and the Cape of Good Hope, although continental manufacturers apparently have free admission to the London markets of the Cape and Australian wools. The substantial advantages which the English have in the command and first choice of these wools in their own market, is well recognized by other European manufacturers.

Germany, through the genius of her breeders and the advantages of a dry climate and not too fertile soil, having produced the electoral fine-woolled sheep, immediately availed herself of this domestic possession to give a new character to woollen cloths. The light and fine German broadcloths became the rivals of the more substantial and less pliable West of England cloths, which formerly had undisturbed sway, and still dispute supremacy with them at the International Expositions.

France furnishes a still more remarkable illustration of the influence of a domestic wool production. It is well known that the most luxurious woollen dress goods for fashionable consumption, such as all-merinos, cashmeres, serges, matelasses, baskets, challis, besides countless novelties appearing each recurring season, are of French fabrication. France established her prestige in this fabrication through her possession of the merino combing wools, which she in fact created. The directors of the national sheepfolds of France, after obtaining merinos from Spain, instead of pursuing the German methods of breeding, aimed to increase the size of the frame and the weight of the fleece of the animal. With this increased size and weight, there was developed a corresponding length of fibre, and a merino combing wool was for the first time created. The French manufacturers were the first to avail themselves of this new property of wool, which their own territory supplied. National pride stimulated them to create original fabrics from the new material furnished from domestic sources. They invented all the fabrics above described, and more recently worsted coatings; in a word, all the woollen stuffs of the nineteenth century, which distinguish themselves in their physiognomy from the tissues of the preceding centuries. To France must be accorded the honor of impressing the most characteristic features, both of sheep husbandry and wool manufacture of the present age. This was the result of the combined possession of sheep husbandry and wool manufacture by a nation having a genius for the arts, and at the same time always fully appreciating the relations of the wool industry to a national economy.

In further illustration of this branch of our subject, we may compare two other European nations: one possessing great disadvantages in a deficiency of experience, but with abundant flocks; the other having the highest advantages of experience and traditionary skill in manufacture, but without sheep,—Russia and the Netherlands.

The first cloth factory in Russia was founded by Peter the Great, solely to provide cloth for his troops, in 1698, when Netherlands was at the height of its manufacturing prosperity. In spite of the encouragement of the government, the cloth manufacture made scarcely any progress during the last century; not improbably because Russia had then no merino wools. In 1820, prohibitory duties were placed on black and green cloths, and very high duties on other cloths. We infer also, though we have no exact data on this point, that the merino sheep husbandry began at this period to receive expansion. From this period the wool manufacture made rapid strides. In 1871, the factories in the empire numbered 1,339; the workmen, 121,070; and the value of the production reached the sum of 77,017,600 roubles. To this is to be added a much more extended woollen industry,—the home fabrication of cloth by the peasants. "The industry of wool," say the Russian statisticians, "suffices largely for the necessities of our vast consumption, and allows us even to export a part of our products to Asia." The excellence and variety of the Russian wool products were fully demonstrated at our International Exposition. We need not add that the raw material of these products is furnished to Russia by her sixty-five million sheep, twelve million of which are merinos. These facts show that it is by developing all her internal resources and making her industries independent of all foreign supplies that this vast self-contained empire dares to place herself, as she is at this moment doing, in defiance of all the great powers of Europe.

Netherlands in the sixteenth century was the chief seat of the wool manufacture of the world. Then she absorbed the wool product of Spain and England. Without flocks, her wool industry has lost its importance, and in the poor displays at the exhibitions of Paris and Philadelphia there were but few traces of its former splendors. Switzerland, distinguished as she is in the silk manufacture, has no sheep and no woollen industry. Belgium, which has no sheep, but a very considerable wool industry, might seem to contradict our position. But with some few notable exceptions

the Belgian cloth industry is characterized by its cheapness, and the use of the weakest and cheapest of foreign wools, which are sure to betray themselves in the fabrics.

The wool manufacture of the United States is conspicuously dependent upon our domestic wool production. It was hardly established until the introduction and rapidly increased culture of the Spanish merino in the decade of 1810 and 1820. It was modified by the introduction of the Saxon sheep in 124–26, and still again by subsequent changes in the general character of American wools. The two branches of the wool industry have always stepped together, though unconsciously, quickened or retarded by the same general influences. As the flocks spread in the new States, the mills were planted in their midst,—not clustered in a few centres as in Europe, but broadly scattered, like sheep feeding in a wide pasture. In the State of Ohio, the first of the wool producing States, there are in present operation 261 sets of woollen machinery distributed among 187 mills, and these mills distributed among 157 counties of the State. Some of the other Western States, all of which are eminently wool-growing States, have establishments and sets of machinery as follows:

STATES.	Establishments.	No of sets of cards reported.	Establishments, capacity not given.
California	10	59	2
Illinois	99	192	13
Indiana	157	215	33
Iowa	98	118	20
Michigan	55	55	20
Missouri	57	69	19
Oregon	9	22	1
Wisconsin	67	72	21

All these mills use, exclusively, American wool, and almost universally the wool produced in their immediate neighborhood. It would be safe to say, that not one of these mills would have been established but for the contiguous flocks, and that, if forced to seek imported wool, each one would stop.

The gain to the manufacturer and wool-grower from the contiguity of the flocks to the mill, and the mills to the consumer, is

immense. There are savings of transportation, facilities for selection and purchasing, and conveniencies, both to the manufacturer and wool-grower, in the direct exchange of cloth for wool. We have before us the individual returns of each one of the mills above enumerated. The mills are most of them small, from one to two sets in capacity. The remarks attached to so many of the returns, such as "sell our own goods at the mill," "goods made for home consumption," etc., show how they directly supply the necessities of their immediate neighborhoods, and what a saving is effected in transportation and dispensing with the middlemen. While the judges in the group of woollens at the Centennial were making their examination of exhibits for awards, their attention was directed to cloths, principally fancy cassimeres, exhibited by a mill of Oregon, of twelve sets, and therefore of very considerable magnitude. The styles, designs and fabrication were excellent, as well as the quality of the wool. The significant fact about these goods was the inconceivably low prices at which they were marked, making them the cheapest, for their quality, of any in the Exposition. The explanation of this phenomenon was that the cost of wool to the Oregon manufacturer produced from flocks grown immediately around his mill was about half that paid by the Eastern manufacturer. There was a saving of middlemen's profits and the transportation across the continent. The official award made by the judges expressly recognizes these facts.

The consumption of domestic wool is not confined to the Western manufacturer. All our manufacturers prefer American wools, at the same price, to foreign wools even nearly resembling them in quality. In view of the widely and erroneously asserted statement of the importance of extending our importation of foreign wools, we cannot too often repeat the results of the census statistics of 1870, relative to wool consumption in our woollen mills proper,—those producing cloths, blankets, flannels, &c.

Domestic wool used	154,767,095
Foreign	17,311,824
Cotton	17,571,929
Shoddy	19,392,062
Total material	209,022,910 lbs.

Thus the foreign wool consumed in our cloth mills is only ten per cent. of the whole wool used, and is of less importance than the cotton and shoddy which enter into their production. These figures are sufficient to show that the very foundation of our cloth manufacture is the domestic production of wool.

There is still one other consideration which must not be overlooked. A nation can import only what it has means to pay for. Any check of domestic production diminishes the power of importation The wisest of all our political economists, Stephen Colwell, has shown that a nation consumes abundantly, only when it produces abundantly. When Pennsylvania is able to produce in a year five hundred thousand tons of iron, through the activities and quickening influences of this industry, and the rapidity of the societary circulation of which the whole State partakes, she is able to consume all these five hundred thousand tons. She pays for them through her own domestic production and exchanges stimulated by this great vivifying industry. Let the production of iron fall off, Pennsylvania will not import the deficiency. She will cease to consume. Railroads will cease extension, old tracks will not be repaired, the machine-shops will be stopped; with the arrest of production, the power of consumption comes to an end. This is as true in wool industry as in iron production.

Unfortunately our wool-growers did not do justice to themselves by the exhibits of raw fleeces at the International Exposition; but the foreign experts in the wool industry at Philadelphia saw with unconcealed surprise the evidences of our domestic wealth as displayed in our fabrics. They saw, with astonishment, blankets made from American wool in the new States of California and Minnesota, as well as old Massachusetts, which seemed fit only for royal couches; flannels, on the one hand, of snowy whiteness and of the softness of cashmeres, and others dyed with every hue of the rainbow, and in all varieties, so cheap and abundant as absolutely to shut out all foreign competition; shawls, pleasing in design and substantial in texture, and yet so reasonable in price that the humblest work-woman could afford the comely covering; yarns of every shade which the infinite applications of the knitter's art could demand, recalling Morris's lines,—

> "The many colored bundles newly dyed
> Blood red, and heavenly blue, and grassy green;
> Yea, and more colors than man yet has seen
> In flowery meadows midmost of the May;"

fancy cassimeres rivalling the best products of Elbeuf looms; and worsted coatings which had their only rivals in the master-pieces of Sedan. They heard manufacturers declare that for all these fabrics they preferred American wool, because it is "stronger, softer, and works more kindly." We believe, in fine, that the

conviction forced reluctantly upon our foreign visitors as to the power of America to supply its own markets, was due no less to the evidences of our command of raw material than to the proofs of our ingenuity and skill in fabrication.

Before dismissing this branch of our subject, we ought to answer the question which will naturally occur to many,—What reason is there for the alleged superiority of American wools? The answer is not difficult. All experts in wool fibre recognize that there are well-marked characteristic qualities in the wools of different nations, even when produced from the same races. The American wools, to which we have referred, are those of the merino race, which are our principal product. Their superiority is due in the first place to a physical cause,—our characteristically dry climate. Prof. Sanson, an eminent French authority, has shown that a dry climate is indispensable for the health or successful culture of merino sheep, and that even the will of Napoleon failed to make the merino sheep successful in the moist or oceanic climates. The second and most important cause is a moral one. In all other parts of the world, the flocks of merino sheep are tended by hireling shepherds. In this country, as a rule, the farmer is his own shepherd, and the flocks are usually so small that they can receive the closest supervision. Not without an eye to thrift, but in part influenced by a morality which is of Puritan heritage, the American farmer would sooner starve himself than his animals. Regular and abundant feeding makes healthy sheep, and strong and uniform fibre; that is, without the weak spots caused by an occasional deficiency of food. Thus the high quality of American wools is due mainly to the moral habits of our farming population.

Part of the Wool Manufacture. We have thus far considered only the relations of the agricultural branch of the wool industry to our national economy. We have yet to consider the wool industry as a branch of the mechanical, chemical, and industrial arts, or, in other words, the relations of the *manufacture* of wool to the State. The common sentiment of the civilized nations of the present day that, next to the preservation of liberty and justice, the highest duty and crowning glory of a nation is the acquisition of the industrial arts, is pronounced by the international expositions of the last half century. It will be affirmed with enthusiasm by the eight million visitors to the Centennial, who have returned delighted, instructed, and inspired, as it were,

with a new sense, an ambition for the precedence of our nation in the industrial arts. Among these arts, those of the textile industry take the first rank. They contribute most to the comfort of the people, and to one of the strongest passions of man,—the love of personal adornment; for, if there is one thought which predominates in a city population, it is that of the selection and preparation of clothing. In the great cities, it is the trade in textiles which throngs the thoroughfares, makes the streets gay with colored tissues, builds palatial warehouses, creates the highest rents, and secures the largest fortunes to the great distributors. The textile industry, above all others, displays the command of man over the forces of nature. Mr. Garsed, of Philadelphia, who manufactures in every day of ten hours thirty-three thousand *miles* of cotton thread, with the expenditure of force derived from seven tons of coal, has shown by careful calculation that, if it were possible for such quality of thread to be made by hand, it would require the labor of *seventy thousand* women to accomplish this work in the same time. The command of the improved textile manufacture increases the power of the factory operative over the hand-workman more than a thousand-fold. And this is the chief source of the supremacy of the manufacturing nations. The profit on the manufacture of cotton in Great Britain during the last fifty years has exceeded five thousand million dollars. Says Mr. Porter: "It is to the spinning-jenny and the steam-engine that we must look as having been the true moving powers of our fleets and armies, and the chief support also of a long-continued agricultural prosperity."

To come nearer home, the textile industry is the chief means of diversifying the occupations in the older States, of removing surplus population from worn-out lands, and of equalizing, by the aid of machinery, the weak muscles of more than half of our working population—the women—with those of men. It is shown by the first volume of the census returns of the State of Massachusetts, just published, that this State, having the most dense population of any State in the Union, and ranking seventh in actual numbers, in 1875 employed in the textile manufactures 85,287 persons, and, if we add those engaged in the allied clothing manufacture, 28,935,—a total of 114,222; while the numbers employed in agriculture, the care of animals, and the fisheries is but 81,156. The whole number employed in all manufactures and other mechanical industries was 316,450. The products of manu-

factures and fisheries in 1875 was $596,415,866; while those of agriculture and mining were but $43,461,599. The prosperity of the city of Boston is due to the fact that it is the centre of distribution of the raw material and finished products of those manufactures. One of her own satirists first ironically called this city the *Hub*,—a phrase sometimes amusingly applied by strangers as an expression of her own conceit. But Boston, almost without metaphor, might be called the hub—of a vast factory wheel.

But our theme is the relations of but one branch of the textile industry; and the general facts first referred to have been introduced only to give force to the first proposition which we make in respect to wool manufacture.

Pioneer of other Industries. The manufacture of wool is the precursor of a general manufacture. The household fabrication of wool having been in former times, in temperate climates, the most extensively pursued of the household arts, the first advances from the rudest instruments to the more complicated machines were made in this industry,—such as the change from the distaff to the spinning-wheel; from the card to the heated iron comb of Bishop Blaise; from the fulling tub to the fulling machine moved by water,—the first substitution of the mechanical forces of nature for human muscles in the textile industry. In England, a protection of four centuries to the woollen industry had made her a nation of spinners and weavers, of artisans subsidary to them. Commerce and capital had become familiar with the profits of a manufacturing industry; and the cotton industries were the natural offshoots of the wool manufacture, and needed hardly more than a hundred years to reach its present vast proportions. The Edict of Nantes, at the close of the sixteenth century, which restored to France the Protestants, who had acquired in the Low Countries the arts of spinning, weaving, and dyeing woollens, first planted the wool manufacture in France, out of which her varied textile industry has grown.

In this country, the woolen mill is shown to be everywhere the pioneer of a diversified manufacture. As we have said elsewhere: "Settlements are made in the beginning upon our watercourses. Water power is first applied to the saw-mill; then comes the grist-mill; then follows the woollen mill. In old times, it was the fulling-mill with its carding-machine. The fulling-mill was, and the woollen mill now is, to a matured industry, what the emigrant's

wagon is to the great interior,—the pioneer of manufacturing enterprise, as that is of permanent settlement. The cotton, the machinery, the iron, the silk, the paper manufactures follow, and build up our Lowells, Patersons, and Manchesters. This is no fancy sketch. We remember the time when the Salmon Falls River, between Maine and New Hampshire, watering a district which was occupied by one of the earliest and important settlements in New England, dating back to 1632, had no other manufacturing establishment than a saw-mill, a grist-mill, and a fulling-mill. The latter disappeared, and was succeeded, in 1828, by a well-appointed woollen factory. Afterwards came other woollen factories and cotton mills; and the Salmon Falls River moves now one hundred and thirty-two thousand cotton spindles and fourteen sets of woollen machinery." This is but a type of the march of manufactures everywhere in the country. They propagate themselves by contagion; or, like the banyan tree, their branches descend and become trees. The communities where they are planted become imbued with industrial instinct and knowledge. Hence, practical men say that the best place to plant a new mill is by the very side of those which have been long established. Manufactures not only propagate themselves, but engender other industries, as cultivation, with new plants and flowers, attracts and multiplies the birds and insects. The erection of a woollen mill of two or three sets, in a new State, which seems to us a trifling affair, is an epoch, the dawn of manufactures, which all experience tells us will expand into a widely diversified industry, and its attendant results of wealth and culture.

Demands high Intelligence. One reason for the influence of the woollen manufactures is the high character of intelligence and skill required for its successful pursuit. In this respect it undoubtedly stands at the very head of the textile industries. Great, undoubtedly, as was the genius displayed by those who introduced the cotton manufacture in its present form into this country, there is much less required in continuing its fabrication. The whole product of a mill often consists of but a single fabric. As Mr. Bachelder, the most eminent cotton manufacturer living in this or any other country, says: "Thousands of looms are employed making drillings, of precisely the same description, with the same number of threads both in the warp and filling, of the same average weight, with yarn of the same fineness, and without the least

variation in any particular, as were first invented and made by me in 1827."

In the wool manufacture, especially since the general disuse of broadcloth, the requirements of fashion demand new fabrics or new designs every season. A large fancy cassimere mill will produce not less than two hundred distinct designs each season, making four hundred in the year. In some mills there are made not less than fifty distinct classes of fabrics, to say nothing of styles. New fabrics perpetually call for new machines. The producer in this industry can have no rest: he must be constantly learning. No degree of skill in the selection of other fabrics is comparable with that which must be exercised in buying and applying wool. Its preparation is more difficult, and the finish of its products is more complicated. Add to this that the dyeing of the wool fabrics requires what is a distinct art by itself in Europe, and in some branches, such as the indigo fermented vat, is the most difficult work in practical chemistry, and we see a sufficient reason why the wool manufacture takes the first place in the textile arts. Some branches of the wool manufacture, like that of carpets, require the most profound knowledge of the principles of decorative art; others, like that of printing stuffs, are based upon a knowledge of the chemical arts. Indeed, it may be said that no industrial work brings so fully into play the results of scientific research and the practical applications of art as the vast establishments in this country which make and print the mixed dress goods of cotton and wool. Thus it will be seen that the acquisition of a perfect wool industry is in itself the possession of the most important arts.

THE MANUFACTURE ESSENTIAL TO A SUCCESSFUL SHEEP HUSBANDRY. We have shown that without domestic wool we should not have mills. On the other hand, without mills we should not have sheep. We have exported so little wool that it has been said that the value of imported playing-cards exceeds the value of all the wool sent abroad from this country. Under the prevailing system of growing sheep in small flocks, it would be clearly impossible for the American farmer to compete in the markets of the world with the possessor of a hundred thousand sheep. We shall never export wool until a system of pastoral sheep husbandry, without artificial feeding in winter, is developed on a scale as broad as in Australia or Buenos Ayres. And the only means to that end is a

market for our wools at home. For many years to come, the sole dependence of the American wool-grower must be the consumption of our home mills. Even with an equality of natural facilities, the prices of labor, the high interest on capital, local taxation, and the general expenses growing out of the higher demands of American civilization, will not permit our wool-growers to compete with the producers of wool in the southern hemisphere. No one can doubt for a moment that our mills sustain sheep-growing in this country for *wool* alone. But it may be said that mutton sheep would be grown for their flesh and lambs; while the wool might be exported, as in Canada, which has no home market for its combing wools. In reply to this, we note the fact that, because she must export her combing wools, Canada is rapidly diminishing the production of her mutton sheep, filling their place with merino sheep, to supply her newly-established cloth-mills; while contiguous American States—Michigan, Ohio, and New York—are even more rapidly increasing their combing wools and mutton sheep, for which they have a home market in the worsted mills and the populations which the mills gather around them. Thus, recurring to the earlier propositions advanced in this paper, our woollen manufacture directly benefits the nation in supplying annual food, improving general husbandry, and settling new territory.

Clothes our People. Our own woollen manufacture cheaply and abundantly clothes our people. Our last proposition has established that our wool manufacture contributes materially to the first necessities of a people, by supplying animal food and increasing the productiveness of lands, thus cheapening bread. The benefits it confers in supplying the second necessity, clothing, are beyond calculation. Much as cotton and linen contribute to cleanliness and comfort, and silk to adornment, wool, in our rigorous climate, is the only absolute necessity. It formed the sole clothing of our million soldiers in the great war. Falstaff said: "There's but a shirt and a half in all my company." With respect to linen and cotton, the same might have been said of all our armies. So easily did our mills supply one of the first necessities of armies in the field, that, at the close of the war, there was an overplus of three million overcoats.

Sanitary Influence. Before proceeding to demonstrate the proposition in hand, we will pause a moment to consider the sani-

tary influence of abundant woollen clothing. Recent life statistics have shown that the average period of life in civilized nations has been lengthened several years during this century. The more extended use of woollen clothing has materially contributed to this result. The soldiers of our Revolutionary war were largely clothed in linen. For general female use there was nothing better than the linsey-woolsey, with linen warp and woollen woof. This was not abundant on account of the scarcity of the wool. As wool became more abundant, the cloth was made in families, the best homespun was scarcely thicker or warmer than a common flannel of our times. Half a century ago, even the cloths worn by the wealthy were light and thin compared with those now in use. The use of woollen underclothing, such as flannel or knit shirts and drawers, was almost exclusively confined to men of the easy classes. Women in moderate circumstances wore only cotton dresses; for the invaluable mixtures of wool and cotton, the mousselines-de-laine and alpacas, were unknown. Women and children of wealth were clad more thinly than the poorest of our day; and consumption stalked with its deadly scythe over all our northern land. To-day, in our New England districts at least, the wool-knit undergarments are worn by all classes of every age and sex. Every working woman has her mixed woollen dress and her warm woollen shawl; every workman, his knit cardigan. No laboring man is so poor as not to have an overcoat. We remember the time when not one man in ten in the country districts had such a garment. The cloths for common wear are of double the thickness and warmth that they were even thirty years ago. Some of them, such as the Esquimos and beavers, are impenetrable to the cold. For out-door winter wear, the material for clothing of men and women is almost identical. Women discard "ladies' cloth," and don cloaks of beaver or kersey and dresses of fancy cassimeres; while the universal waterproof makes rain and snow innocuous. Physicians concur in declaring that, as a result of this improved clothing, colds and pneumonia are less prevalent, and the ravages of consumption have been largely checked. The *sanitary* influence of the woollen industry is, therefore no mean part among those which it plays in the national economy.

Capacity and Product of American Mills. The question next arises, Can our own industry perform the great work of clothing

our people *cheaply, abundantly,* and *well* without help from abroad? In answering this question, we must repeat facts elsewhere stated in other connections, and familiar to many of our readers.

First as to our machine capacity. It will serve the purpose of our argument equally to take the census statistics of 1870, while they have official authority.

The number of sets in the manufacture of woollens proper, consisting of cloths, flannels, and blankets, and yarns, is placed at 8,336. In the worsted manufacture, the number of combers is set down at 193, and the number of sets at 98.

One comber being the equivalent of three sets, the total in sets is 677.

In the carpet manufacture, the number of sets is 241, with 100 combers, making a total in sets of 541.

In the hosiery manufacture, including cotton, but principally wool, 519 sets.

RECAPITULATION.

Woollens	8,336
Worsted	677
Carpets	541
Hosiery	519
Total	10,073 sets.

The value of the products of this machinery, as given by the census, was as follows :—

Woollens	$155,405,356
Worsteds	22,000,331
Carpets	21,761,573
Hosiery	18,411,564
Total	$217,578,824

Our imports in that year were :—

Woollens	$14,660,403
Worsted Dress Goods	15,447,960
Carpets	3,940,707
Total	$34,049,070

Add to this, which is the foreign valuation, the custom duties, premium on gold, and profit of importer, making the home valuation double that of the foreign, the home value of these imports equalled $68,098,140. This, added to domestic production, made our whole consumption in 1870, $285,676,964. So that our domestic production constituted three-fourth of our whole consumption. As to the character of the machinery and processes used

in the above named 10,073 sets, which, in fact, represents the degree of skill attained, we repeat the statement made to us personally by one having the highest authority; viz., Prof. Herm Grothe of Germany, the author of the latest and most esteemed European treatise on the manufacture of wool, who, the last summer, visited our principal representative establishments. He declared that our mills had all the recent machinery and processes found in the best mills abroad, and that he saw nothing to be improved either in the mechanical appliances or administration of our establishments.

Character of our Products. Having had the opportunity of an official study at the International Exhibition, for many weeks, in company with able foreign and American experts, of our own wool products in comparison with those of other countries, we feel authorized to express an opinion as to the character of our products with confidence. In woollens proper, we make, with no exception now occurring to us, all the classes of fabrics made in the best European mills. The same may be said of hosiery. In worsteds, we make all mixed cotton and wool dress goods,—the classes of dress fabrics entering into most general consumption, and therefore of the first utility,—and many all-wool worsteds. We do not make the all-wool merinos and cashmeres, which are not made successfully even in England, nor some other fine wool novelties in dress goods, which are obtained wholly in France. Their use is confined to the wealthy and fashionable classes. Some we have very recently attempted with signal success,—such as the all-wool merino plaids and matelasses,—and shall doubtless make them all, except possibly the merinos and cashmeres. In carpets, we produce every variety except the Persian and Turkish and the Aubusson hand-made carpets, used only by the opulent classes.

In woollens, we are inferior only in broadcloths, and that not in quality, but in quantity of production, the general disuse of broadcloth, except for dress suits and by the wealthy, making it more profitable for our mills to run on goods in general demand. That we have no want of capacity is shown by the product of the few mills who still pursue this branch of manufacture, and by the fact that the finest sample of broadcloth shown at the Exposition, though not for competition, was made in this country twenty-three years ago. In blankets and flannels, our products are absolutely unequalled by any made abroad. In fancy cassimeres and

worsted coatings,—the great articles of consumption all over the world,—we equal any, surpass most, made abroad, in texture, finish, and beauty of design; foreign manufacturers eagerly seeking samples for imitation in their mills. Our thicker cloths for overcoatings suffer nothing in comparison with those made abroad.

In dress goods, there was little opportunity to make comparison, as Bradford, the principal competitor in classes of goods made by us, did not think it wise to enter the field. But the command of our own market against foreign competition settles the question as to the quality of our goods. In carpets of the cheaper and medium qualities, up to two and three ply ingrains, we are without competition, making the cheaper kinds so abundantly and cheap, that no home, however humble, need be without this most characteristic of household comforts. The extent of their use in our homes was a subject of surprise to our foreign visitors. The higher classes of tapestries and Brussels, and still higher, of Wilton and Axminster, in taste of design and perfection of texture, were absolutely equal to the best foreign samples; and, judging from the length and closeness of the pile, surpass them in wearing qualities. In this department, we have nothing to learn abroad.

The question of comparative cheapness of goods is more difficult to fix exactly. Foreigners declared that our fancy cassimeres were equal to those of Elbeuf, and cheaper than similar goods could be obtained in the French market. On the other hand, the cloths of Belgium and Yorkshire were unquestionably apparently cheaper than our own; but this apparent cheapness is illusory in a great degree, when we consider the low character of the materials which enter into their fabrication,—in one case, weak Mestiza wools; in the other, shoddy,—when compared with the substantial material of the American cloths. We do not hesitate to assert that there are no medium woollen goods, such as constitute the great bulk of consumption, which, in wearing qualities, will compare with American fabrics. The English admit that they consume not less than *thirty-eight thousand tons* of shoddy annually in making their woollen goods. The Belgians boast that they use the cheap Mestiza wool, and laugh at the Americans because they "stick to the old-fashioned, strong-bodied, long-stapled wools," which are so valuable that they ought to be used for combing purposes, and because we do not "turn to advantage all wastes and refuses, which now, skilfully mixed, play such an important part in lowering the cost of fabrics."

The point which we make is, not that the English and Belgians do not obtain their cloths more cheaply than we do, but that it is more *economical* for us to consume our own products than to depend upon the English and Belgians. The question of economy involves the wearing qualities of our cloths, the facilities for paying for them by domestic exchange,—as with wool by the farmer, with labor by the mill operative, with market produce by the gardener, or other facilities which attend home consumption. One of these facilities deserves attention, as it is the very climax of our wool industry. We refer to our ready-made clothing manufacture. Nowhere has this manufacture attained such perfection and economies as in this country. It is founded upon our wool manufacture; for seven-eighths of its raw material is furnished by our mills. So important is this industry, that it employs directly in Massachusetts alone 28,935 persons. Upon so vast a scale is it conducted that one establishment in Philadelphia, John Wanamaker's, covers two and a half acres, and one floor contains two million dollars's worth of goods. This manufacture clothes all the boys and the great bulk of our male population. It is declared by experts in this industry that "the wholesale manufacture has reduced the cost of clothing to the masses *one-half* certainly, and, making allowance for the difference in the value of money, even more." That system of production and consumption proves itself to be most economical to the people which makes consumption the most *abundant*. That our people are the most abundantly and substantially clothed of any in the world needs no demonstration. It is shown in our army and the vast superiority of its cloths over those furnished to any foreign troops. It is shown in what foreigners at Philadelphia so much admired,—the beauty of the uniforms of our volunteer troops. It was shown in the costumes of the millions at the Exposition; and, especially, in the absence of all distinction of garb in the people of the seaboard cities and the remotest interior. The personal appearance of a population indicates its social condition. And thus the woollen industry performs its last part in the national economy by abolishing the outward distinctions of class, and cultivating the personal self-respect of the individual citizen.

A question of public economy like that which we have discussed addresses itself directly and imperatively to those who control and influence national legislation. We have failed in our purpose, if they do not apply the lesson which these facts teach.

HISTORICAL SKETCH OF THE STATE COLLEGE.

Its Aims and Methods.

It needs no argument, in this day, to prove that knowledge is power, that the educated man is the successful one—not only in the professions which are usually regarded as "learned," but in all the industrial avocations of man. In the arts, in factories, in manufacturing establishments—educated men are being employed in preference to those not educated, and the proprietors of these works, in every instance possible, apply the principles of science and education to the prosecution of their business, and to the saving of material and manual labor. In some large establishments, educated men are employed whose sole duty it is to keep the concern informed upon every discovery and improvement which is made by science affecting the prosecution of their business, that it may take advantage of the same, and produce goods as cheaply as other establishments, and be enabled to successfully compete with them in the markets of the world. And what is true in the arts is true also of agriculture. In all its varied and intricate processes it demands the assistance of science and education, and where these are judiciously applied, the work of the farm is more intelligently pursued and the results far more satisfactory. In breeding domestic animals, in the various processes of the field and garden, in the training and care of fruit trees, in compassing the hosts of insect foes, and in numerous other directions the aid rendered by science and by educated brains is of vast importance. In our own country, agricultural and industrial education has been a thing of recent origin and slow growth; while in England and on the continent of Europe, agricultural education has long been recognized and promoted by government, and the number of schools, colleges, experiment stations, seed-control stations, and similar institutions for instruction in scientific agri-

culture, chemistry, veterinary science, forestry, &c., is very large. In this country all our former efforts at education were in the direction of the professions, the colleges were for the few, not the masses—and farmers and artisans were kept in the background. Education was tending away from the farm and shop rather than towards them. The need for education was recognized in the establishment of agricultural journals, societies and clubs, and these led the way for the higher institutions which have since been organized. The early efforts—if we make one exception—towards agricultural schools in this country, were not successful, because the promoters of them did not understand exactly what was wanted. The efforts were patterned after the existing foreign schools, which were not adapted to us, on account of the different conditions of society and the people in our own country and the old world. The exception is that of the Michigan Agricultural College, founded by that State in 1855, more than twenty years ago, which is now in a most flourishing condition and well endowed. By the National grant of Congress in 1862, agricultural and industrial education was rendered possible to the masses through the establishment by the different States of colleges under its provisions. By this act of Congress, 210,000 acres of land were given to Maine on condition of establishing a college in this State in conformity to its provisions. This act was accepted by the Legislature, and in 1863 the subject of the new college was very generally discussed by the Legislature, the Board of Agriculture, and the press and people. A proposition to connect it with Waterville College was not accepted by the Legislature, and the Board of Agriculture passed resolutions deeming it advisable and expedient to establish an independent institution, on a different basis from that of any existing college. In this year—1863—a resolve was passed by the Legislature to choose thirteen Regents of an agricultural college to be established, but the resolve was never carried into effect. In 1864 a commission was appointed by the Governor, consisting of Hons. W. G. Crosby, Joseph Eaton and S. F. Perley, to receive donations and proposals for the location of the college, and the Governor was authorized to sell the Land Scrip in its aid. Proposals were made by Hon. B. F. Nourse, of his farm in Orrington; by Hon. F. O. J. Smith, of his land and buildings in Gorham, and by President Woods of Bowdoin College, of buildings, teachers, library and experimental farm to be furnished in connection with Bowdoin

College. The Commissioners, in their report, advised the acceptance of this proposition; but after a thorough discussion in the public journals, the Board of Agriculture and the Legislature, this recommendation was not adopted.

In February, 1865, the "Maine State College of Agriculture and the Mechanic Arts," was incorporated, and sixteen Trustees were recognized, representing the different counties of the State. On the 25th of April, the Trustees organized by the choice of Hon. Hannibal Hamlin as President, and they also issued an address calling upon the citizens of the State to come up to the work of the endowment of the Institution. At a subsequent meeting, held in 1865, Mr. B. F. Nourse of Orrington, renewed his offer of his farm and buildings, provided $50,000 could be secured for the erection of the necessary buildings by subscriptions or donations. This farm was visited by the Trustees, and durnig the year they also visited sites for the proposed location of the College in Topsham, Gorham, Augusta, Fairfield, Newport and Orono, but no decision was made during the year. At a meeting held in January, 1866, the offer made by the towns of Orono and Oldtown, accompanied by an offer of $10,000 from the citizens of Bangor, was accepted—it being considered by a large majority the most advantageous offer that had been made. In April of the same year, Dr. J. C. Weston of Bangor, was elected Clerk of the Board of Trustees, and in September, Mr. Hamlin having previously resigned, Hon. W. A. P. Dillingham of Sidney, was elected President of the Board. This Board, at a meeting held January 22d, 1867, elected as President of the College, Hon. Phinehas Barnes of Portland, a gentleman who had previously been elected Treasurer, and who had from the first inception of this movement taken a deep interest in its success—having written a series of articles on the establishment and management of the College which had attracted wide attention. The election of Mr. Barnes was the last act of this Board. It had found from its large number, and the difficulty of calling meetings at which a quorum would be present, that a re-organization would be desirable. Accordingly a new Board was constituted, consisting of seven members, of which Hon. Abner Coburn of Skowhegan was elected President, and Hon. Lyndon Oak of Garland, Clerk.

In 1867, a college building, now known as White Hall, and used for recitation purposes, was built, and the general farm buildings thoroughly repaired. At the meeting of the Trustees held

July 2, 1868, M. C. Fernald, A. M., was elected to the position of Professor of Mathematics, and Samuel Johnson of Jackson, was elected Farm Superintendent. The necessary arrangements having been made, and with these two instructors, Prof. Fernald acting as President, the Institution was opened in September with a class of thirteen students. The erection of a laboratory building was commenced this year, the same being built upon the plan, somewhat improved, of the laboratory at Brown University, Providence, R. I.

The towns of Orono and Oldtown had given a warranty deed of the farms, in which was inserted the condition that the property should revert to the town of Orono, should the location of the College ever be changed; the Trustees desired to change the conditions of this deed so that they might have the alternative of paying the present worth of the land, or abandoning the property if the location of the College was changed. Pending the settlement of this matter between the Trustees and the town of Orono, a year went by, during which the Legislature refused to make further appropriations to the Institution till the change was made in the terms of the deed, conveying the land to the State without qualifications. Of course this action suspended all building operations for the year; but with the giving of a satisfactory deed to the State, the Legislature, in 1870, made an appropriation of $50,000.

In 1869, the statute concerning the Board of Agriculture was so amended that its Secretary was created a Trustee *ex-officio* of the Institution; and one of the two sessions of the Board to be held annually was fixed at the College, or near enough for the students to attend. Through the courtesy of the Presidents and Superintendents of the several railroads in the State, free passes have been obtained for the students to attend meetings in the different counties—this being regarded as coming within the requirements of the statute—and the meetings so held have been very interesting and profitable to the students. Besides, by visiting the different parts of the State, the students have been enabled to make decided friends for the Institution, and to give a good idea of its course of study and discipline to those who could not well visit it.

The College, since its establishment, has received the following appropriations from the State: In 1867, $20,000; in 1868, $10,000; in 1870, $50,000; in 1871, $6,000; in 1872, $18,000; in 1873,

$24,000; in 1874, $12,500; in 1875, $10,500; and in 1876, $8,000: a total of $159,000. If the above amounts seem large, it must be borne in mind that they are small compared with the appropriations which other States have made for institutions of a similar character. Thus, Michigan has given its College $419,000 in eighteen years; Iowa, $329,000 in seven years; Massachusetts, $313,000 in seven years; Illinois, $235,000 in five years, and Pennsylvania, $270,000 in four years.

The laboratory building was completed in 1870, and the dormitory and boarding-house built in 1871. The dormitory is three stories high, and has forty-eight rooms. The President's house was built in 1872, a Professor's house in 1873, and the large barn in 1874. The students erected a building for their own purposes in 1876. The total number of buildings belonging to the College is as follows: Three for College purposes, one boarding-house, four dwellings for the use of the instructors, and four barns and stables.

Changes have been made from time to time in the Faculty of the College which it is not necessary here to specifically mention; but as constituted during the present year, 1876, the Board of Instruction has been as follows:

Rev. Charles F. Allen, D. D., President, English Literature, Mental and Moral Science.

Merritt C. Fernald, A. M., Mathematics and Physics.

William A. Pike, C. E., Mechanical and Civil Engineering.

Charles H. Fernald, A. M., Natural History.

Alfred B. Aubert, B. S., Chemistry.

Winfield S. Chaplin, C. E., Modern Languages, and Military Instructor.

George H. Hamlin, C. E., Librarian and Assistant in Engineering.

Joseph R. Farrington, Instructor in Agriculture.

Courses of Lectures have been given by non-resident professors, at different times, among which are the following: Dairy Husbandry, by X. A. Willard, A. M.; Market Gardening, J. J. H. Gregory; Anatomy and Physiology, Calvin Cutter, M. D.; Entomology, Prof. A. S. Packard, Jr.; Veterinary Science, Prof. James Law.

The following table represents the number of students in each year since the opening of the College:

Years.	Seniors.	Juniors.	Sophomores	Freshmen.	Special.	Total.
1868	–	–	–	13	–	13
1869	–	–	13	10	–	23
1870	–	9	9	14	–	32
1871	6	6	6	24	–	42
1872	7	7	25	32	–	71
1873	7	20	41	34	1	103
1874	19	42	30	28	2	121
1875	33	20	22	35	5	115
1876	18	16	37	20	3	94

The appropriations made by the State have been expended for the erection of buildings, the purchase of scientific apparatus, implements and farm stock, and for supplementing the income from the National grant in defraying the expenses of salaries. While the income from the grant is but $8,400 per annum, the salaries of professors and teachers amount to $12,500 per annum; the balance of which has to be made up from the sums appropriated by the State from time to time. It has been found necessary, in order to keep up the character of the Institution, to furnish the instruction demanded by the increased number of pupils, and to sustain teachers of positive ability—to pay as good salaries as are paid by other institutions of a similar nature; consequently the annual expenses in this direction have exceeded the income for the purpose provided by the endowment of the National Government, and the assistance of the State has been necessary. The College farm is worth $15,000; while the value of the scientific apparatus is $9,000; of the library, $4,000; of the farm stock, $3,800, and of farm implements, $1,500.

Such, in brief, is the history of the Maine State College of Agriculture and the Mechanic Arts. It has been in operation but a very few years, has had to contend with much opposition, has been operating upon new groumd, has been cramped for means—and yet there are some persons in our State who seem by their criticisms to be quite dissatisfied because it does not show greater results, beause its graduates are not all becoming farmers, because it does not begin to pay back to the State something in return for what it has received. As if startling results could be obtained in a dozen years; as if a graduate, in half as many years, could

purchase and stock a farm, become a successful farmer, and show to the State the value of a course of training at the State College! These results come slowly. All results of this kind are only reached after the most patient and the most persistent efforts. It is not to be expected of a young man a few years from graduation, that he shall be successfully established in business, unless he have large financial resources. Most of our graduates have to work their way through College, depend upon themselves, and do that first which offers the best immediate returns. Subsequently, they enter upon the business of life, or engage in that profession or occupation towards which they have long been looking. Moreover, it is not expected that all who take the course at Orono will become farmers: many will become teachers, some lawyers, some engineers, some manufacturers. But graduation determines nothing in regard to the profession a man will follow. Dr. Abbott, President of the Michigan Agricultural College, states on the authority of a member of the State Legislature, that out of a class of twenty-four, who graduated with him in law, only four were practicing lawyers. He also says that not over half the graduates of the professional schools practice the professions, although to do so requires no large outlay as a farmer's business does. But it is the aim of our State College to create a bias towards, and not away from the farm, to make the atmosphere of the place one of respect for all kinds of work and of a feeling of fellowship with farmers. In carrying out this idea, the labor system and the instruction are planned to match each other, to illustrate each other; so that to the labor is given some of the dignity of scientific work, and to the scientific instruction labor serves as a kind of laboratory practice for instruction. For the purpose of making better known to our people the aims and methods of this Institution, I copy from the last report of the Trustees, their general statement concerning the same, which, in the form in which it is printed for the College, has but a limited circulation among our young farmers and mechanics, those who are looking towards the College for giving them that scientific and practical training which they need to become better citizens and more skilled and intelligent workmen:

"DESIGN OF THE INSTITUTION. It is the design of the Maine State College of Agriculture and the Mechanic Arts, to give the young men of the State who may desire it, at a moderate cost, the advantages of a thorough, liberal and practical education. It

proposes to do this by means of the most approved methods of instruction, by giving to every young man who pursues the course of study an opportunity practically to apply the lesson he learns in the class-room, and by furnishing him facilities of defraying a part of his expenses by his own labor. By the act of Congress granting public lands for the eudowment and maintenance of such colleges, it is provided that the leading object of such an institution shall be, 'without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to Agriculture and the Mechanic Arts.' While the courses of study fully meet this requisition, and are especially adapted to prepare the student for agriculture and mechanical pursuits, it is designed that they shall be also sufficiently comprehensive, and of such a character, as to secure to the student the discipline of mind and practical experience necessary for entering upon other callings or professions.

Conditions of Admission. Candidates for admission to the Freshman class must be not less than fifteen years of age, and must pass a satisfactory examination in Arithmetic, Geography, English Grammar, (especial attention should be given to Orthography, Punctuation and Capitals,) History of the United States, Algebra as far as Quadratic Equations, and five books in Geometry. Although the knowledge of Latin is not required as a condition of admission, yet the study of that language is earnestly recommended to all who intend to enter this Institution. Candidates for advanced standing must sustain a satisfactory examination in the preparatory branches, and in all the studies previously pursued by the class they propose to enter. Satisfactory testimonials of good moral character and industrious habits will be rigidly exacted. The day after commencement, which is the last Wednesday of June, and the day before the beginning of the first term, are the appointed times for the examination of candidates.

Course of Instruction. Five full courses are provided, viz.: A course in Agriculture; in Civil Engineering; in Mechanical Engineering; in Chemistry; and in Science and Literature. The studies of the several courses are essentially common for the first two years. There will be regular exercises during the four years in English Composition, Declamation and Military Tactics. Lectures will be given to the Freshman class, on Physics, Meterology, Physical Geography and Botany; to the Sophomore class, on

Chemistry, Horticulture and Practical Agriculture; to the Junior class, on Anatomy, Physiology, Astronomy and English Literature; and to the Senior class, on Rural Law, Mineralogy, Geology, Stock Breeding, Cultivation of Grasses and Cereals.

Special Course. Students may be received for a less time than a full course, and may select from the studies of any class such branches as they are qualified to pursue successfully. Students in the Special Course are not entitled to a degree, but certificates of proficiency may be given them.

Degrees. The full course in Civil Engineering entitles to the Degree of Bachelor of Civil Engineering; the full course in Mechanical Engineering, to the Decree of Bachelor of Mechanical Engineering; the full course in Agriculture, Chemistry, or Science and Literature, to the Degree of Bachelor of Science. Three years after graduation, on presentation of a thesis with the necessary drawings, and proof of professional work or study, the Bachelors of Civil Engineering may receive the Degree of Civil Engineer; the Bachelors of Mechanical Engineering, the Degree of Mechanical Engineer; the Bachelors of Science, the Degree of Master of Science.

COURSES OF STUDY.

FIRST YEAR.

First Term.	*Second Term.*
Physical Geography,	French,
Meterology,	Algebra and Geometry,
Algebra,	Farm Drainage and Botany.
Rhetoric.	P. M. Book-Keeping and Labor.
P. M. Labor on Farm.	

SECOND YEAR.

French and Farm Implements,	Mechanical Cultivation of the Soil, and Surveying, or History of England,
General Chemistry,	English Literature and Physics,
Trigonometry,	Analytical Geometry and Calculus or Qualitative Chemistry.
P. M. Free Hand Drawing and Chemistry.	P. M. Mechanical Drawing and Field Work.

THIRD YEAR.

COURSE IN AGRICULTURE.

Physics,	Zoology and Entomology,
Physiology, Human Anatomy and Hygiene,	German,
German,	Astronomy and Mechanics.
Agricultural Chemistry or English Literature,	P. M. Chemistry and Experimental Farming, or
P. M. Chemistry or Analysis of English Authors.	Analysis of American Authors.

COURSE IN CIVIL ENGINEERING.

First Term.	*Second Term.*
Calculus,	Astronomy,
Hincks' Field Book,	Descriptive Geometry,
Physics,	First Part of Rankine's Civil Engineering and Mechanics,
German.	German.
P. M. Field Work and Shading.	P. M. Isometric and Cabinet Projections and Perspective.

COURSE IN MECHANICAL ENGINEERING.

Calculus,	Astronomy,
Machinery and Mill Work,	Descriptive Geometry,
Physics,	Machinery and Mill Work,
German.	German.
P. M. Machine Drawing and Shading.	P. M. Machine Drawing and Designing.

COURSE IN CHEMISTRY.

Physics,	Zoology and Entomology,
Physiology,	German,
German,	Chemistry.
Chemistry.	P. M. Laboratory Work.
P. M. Laboratory Work.	

FOURTH YEAR.

COURSE IN AGRICULTURE.

Comparative Anatomy,	U. S. Constitution and Political Economy,
History of Civilization,	Mineralogy and Geology,
Dairy Farming and Stock Breeding,	Cultivation of Cereals, Landscape Gardening,
Logic.	Rural Architecture and Sheep Husbandry,
P. M. Experimental Farming and Agricultural Botany,	Mental and Moral Science.
Historical Readings and Analysis.	

COURSE IN CIVIL ENGINEERING.

Second Part of Rankine's Civil Engineering,	U. S. Constitusion and Political Economy,
Logic,	Mineralogy and Geology,
Physiology,	Third Part of Rankine's Civil Engineering.
P. M. Stereotomy, Topography and R. R. Work.	P. M. Machine Drawing and Designing.

COURSE IN MECHANICAL ENGINEERING.

Steam Engine,	Steam Engine Designs and Specifications,
Logic,	U. S. Constitution and Political Economy,
Physiology.	Mineralogy and Geology.
P. M. Applied Descriptive Geometry and Machine Drawing.	P. M. Machine Drawing and Designing.

COURSE IN CHEMISTRY.

Comparative Anatomy,	U. S. Constitution and Political Economy,
History of Civilization,	Mineralogy and Geology.
Logic.	Chemistry.
P. M. Chemistry.	P. M. Laboratory Work.

Special Features of the Course. The prominence given to the Natural Sciences, and the practical element associated with the studies, render the first two years exceedingly valuable, as the groundwork of whatever more specific department may be pursued. Those who complete the course in Agriculture will have attained a good knowledge of Mathematics, French, German and English Literature, besides the studies in Natural Science that have a direct bearing upon agriculture. The study of Botany extends through nearly a year, commencing early in the Spring and extending late in the Autumn. General Chemistry and Physics continue through a whole year. Under Agricultural Chemistry will be considered composition of soils, relations of air and moisture to vegetable growth, chemistry of farm processes, methods of improving soils, fertilizers, and other topics which properly come under this department. This course, slightly modified so as better to adapt it to those wishing a thorough, practical education for other employments, is called the course in Science and Literature. This includes mental and moral science, logic and more of general literature. The student in Civil Engineering having laid a good foundation of general culture in literary studies, modern languages, mathematics and natural science, in his Junior year enters upon his engineering studies, embracing the theory and practice of constructing roads, railroads, bridges, canals, dams and other structures, and has thorough instruction and practice in mechanical and topographical drawing. The afternoons are devoted to field work and drawing. With the same instruction in general studies, those who take the course in Mechanical Engineering study the elements of mechanism, machinery and mill work, steam engines, water wheels, estimates and specifications for machinery. They are instructed to draw working plans from descriptions, models and inspection of machinery, as well as to design machines. The course in Chemistry includes general, analytical and agricultural chemistry. Under analytical chemistry is comprised the qualitative and quantitative analysis of minerals, alloys, earths, fertilizers and farm products. The students devote three hours a day to laboratory practice.

Labor. It is a peculiarity of the college, that it makes provision for labor, thus combining practice with theory, manual labor with scientific culture. Students in this institution are required to labor a certain portion of each day, not exceeding three hours,

for five days in the week. The labor is designed to be as much as possible educational, so that every student may become familiar with all the forms of labor upon the farm and in the garden. In the lower class the students are required to work on the farm, and they receive compensation for their labor according to their industry, faithfulness and efficiency, the educational character of the labor being also taken into account. The maximum amount paid will be thirty cents for three hours labor.

MILITARY. Thorough instruction is given in Military Science by a competent officer. The instruction extends through the whole college course, and embraces personal, squad, company and battalion drill. The students are enrolled in companies under their own officers. Arms are furnished by the State. The uniform is navy blue yacht cloth, sack coat and pants, without brass buttons or trimmings that attract attention.

FARM AND BUILDINGS. The college farm contains three hundred and seventy acres of land of high natural productiveness, and of great diversity of soil, and is therefore well adapted to the experimental purposes of the institution. White Hall, the first building erected, affords excellent accommodations for a limited number of students. The lower rooms of this building are appropriated to general and class purposes. Brick Hall contains forty-eight rooms. The boarding house connected with the College buildings is open to students. With these buildings, the institution furnishes desirable accommodations for one hundred and twenty-five students. The chemical laboratory contains two apparatus rooms, a lecture room, a cabinet, a library and weighing room, a recitation room, and rooms for analytical and other purposes, and is in all respects admirably adapted to the wants of the chemical and mineralogical departments.

APPARATUS. The College is furnished with new and valuable apparatus for the departments of Physical Geography, Natural Philosophy and Chemistry, and for Surveying and Civil Engineering, to which additions will be made as the exigencies of the several departments require. Models have been obtained from the United States Patent Office, and others have been purchased, that serve for purposes of instruction.

LIBRARY. The library already contains 2,640 volumes, some of which have been obtained by purchase, while others have been

kindly given to the College. The volumes secured through the liberality of Covernor Coburn, and the gifts of other friends, are a valuable addition to this department. It is earnestly hoped that so important an auxiliary in the education of students in the College will not be disregarded by the people of the State, but that liberal contributions will be made to the Library, not only of agricultural and scientific works, but also those of interest to the general reader.

Cabinet. Rooms have been fitted up with cases of Minerals, and specimens of Natural History, and several hundred specimens have been presented to the College. The valuable private cabinet of Prof. C. H. Fernald is placed in these rooms, and is accessible to the students. All specimens presented will be properly credited and placed on exhibition. Rocks illustrating the different geological formations, and minerals found within the State, are particularly solicited. Additions have been made during the past year.

Literary Societies. Flourishing societies have been organized by the students of the College, which hold weekly meetings for declamations, discussions, and other literary exercises.

Public Worship. All students are required to attend daily prayers at the College, and public worship on the Sabbath at some one of the neighboring churches, unless excused by the President.

Expenses. Tuition is free to students residing within the State. Those from other States will be charged twelve dollars per term. Rooms are free; all bedding and furniture must be supplied by the students, who will also furnish their own lights. Board, washing, and fuel will be furnished at cost. The price of board will be two dollars and sixty cents per week, the fuel and washing fifty cents per week. These bills, with those for incidental expenses, are payable at or before the close of each term. The terms are so arranged that the long vacation occurs in the winter, that students may have an opportunity to teach during that time. By means of the amount thus earned, together with the allowance for labor, the industrious and economical student can cancel the greater part of his College expenses."

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