Public Documents of Maine:

BEING THE

ANNUAL REPORTS

OF THE VARIOUS

PUBLIC OFFICERS AND INSTITUTIONS

FOR THE YEARS

1872-73.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1873.

SEVENTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Maine Board of Agriculture,

FOR THE YEAR

1872.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1873.

BOARD OF AGRICULTURE.

Z. A. GILBERT, President.
WILLIAM SWETT, Vice President.
S. L. GOODALE, Secretary.

Members at Large appointed by Governor and Council.

Name.	P. O. Address.	Term Expires Dec. 31.
C. F. Brackett	Brunswick	1872
C. M. Allen	Orono	1872
M. C. Fernald	Orono	1873
George L. Goodale	Brunswick	1873
Samuel L. Boardman	Augusta	1874

Member chosen by State Agricultural Society.

Warren Percival	Cross' Hill	1874

Members chosen by County Societies.

Name.	County.	P. O. Address.	
Seth Scamman	Cumberland	Scarboro'	1872
William Swett	Oxford	South Paris	1872
L. L. Lucas	Somerset	St. Albans	1872
Ira C. Doe	York	Saco	1872
W. P. Walker	Sagadahoc	Topsham	1872
Samuel Wasson	Hancock	Ellsworth	1873
A. L. Simpson	Penobscot	Bangor	1873
Lorin Adams	Franklin	East Wilton	1873
A. M. Robinson	Piscataquis	Dover	1873
Silas Hawes	Knox	Union	1873
Elisha E. Parkhurst	Aroostook	Maysville	1873
Horace Colburn	Kennnebec	Windsor	1874
Z. A. Gilbert	Androscoggin	East Turner	1874
J. W. Lang	Waldo	Brooks	1874
W. R. Waterman	Washington	Robbinston	1874
Lyman H. Winslow	Lincoln	Nobleboro'	1874

REPORT.

To the Senate and House of Representatives:

The winter session of the Board of Agriculture was held in Paris, commencing on Tuesday, January 23, and continuing during the three following days. The attendance of farmers and others interested, directly or indirectly, in matters pertaining to agriculture, was unusually large, and the interest manifested in the addresses, lectures and discussions was of a most gratifying character.

The forenoon of the first day was devoted to organization, admission of new members, choice of officers, (as given on the preceding page,) and the transaction of business.

The topic of most public importance related to directing the use to be made of that portion of the State bounty which is placed under the control of the Board. The deliberations resulted in the passage of two votes, which the Secretary was directed to communicate to the Societies, together with a concise statement of the doings of the Board in relation to the second vote, and suggestions relative to its being carried into effect. This he soon afterwards did in the following circular:

OFFICE OF SECRETARY OF THE BOARD OF AGRICULTURE,
February, 1872.

To the Trustees of   Society.

GENTLEMEN:—It has become my duty to communicate to you the following votes passed by the Maine Board of Agriculture, at its late session, January, 1872, compliance with which is necessary if you desire to secure continued aid to your society from the bounty of the State, the Board being empowered to determine for what purposes and objects one-half said bounty shall be expended:

VOTED—That the several Agricultural Societies receiving State bounty be and hereby are required to expend, during the current year, for the formation, support and encouragement of FARMERS' CLUBS, a sum not less than one-fourth of the bounty so received from the State.

VOTED—That the several Agricultural Societies receiving bounty from the State be and are hereby required to offer, during the present year, premiums for FARM IMPROVEMENTS, to be awarded in the autumn of the year 1874, to an amount not less than one-fourth of said bounty.

The first vote simply continues the policy which has been acted upon for several years past and which has been productive of highly satisfactory results. If a sufficient number of Clubs have already been formed, you can expend the whole amount (to wit: one-fourth of what your society receives from the State,) for books, lectures, or such other aid as you deem best adapted to promote their prosperity and efficiency.

The second vote is in place of one requiring premiums to be offered for several years past on wheat culture. That was efficacious of good, but unequally in different parts of the State. The present requirement promises more uniform good results in all sections.

It inaugurates a new policy. The principal reason (among others) for this action by the Board lies in the fact that of late years encouragement by means of premiums offered by Agricultural Societies has been almost, if not wholly, confined to such objects as contribute to the attractions of the Annual Exhibitions, to the exclusion of other improvements which may be more needed but cannot be competed for or exhibited upon the show grounds.

The desire of the Board is that the improvements to be made should be those which are most needed upon the farm of the person competing for a premium, whether they pertain to buildings, fences or tillage, whether to underdrains, manures, orchards or forests, whether reclaiming waste land, renovating impoverished lands, re-seeding grass lands damaged by drought and grasshoppers, or whatever else is most wanted to improve the farm.

It is further the desire of the Board that the premiums *be so offered as to stimulate improvement among those of small means equally with those possessing larger means;* that is to say, that they be offered not for the greatest amount of improvements irrespective of cost, but for the highest degree of skill and judgment manifested in adapting means to ends, or, in other words, for the most economical results *in proportion* to the time, labor or money expended in making the improvements, or for the greatest results at least cost, a reasonable amount being accomplished.

It is obvious that no one competing for premiums offered upon such terms is in danger of suffering loss by reason of devoting his energies and means to such competition. Undoubtedly every one will be well repaid in the direct results of his labors, and there will be the additional motive of a handsome prize besides.

Let me suggest also, that you offer and publish the premiums for Farm Improvements, together with the conditions upon which they are to be awarded, at an early day, making them as widely known as possible, and fixing a suitable time for the close of entries, (say in early summer,) so that a committee, to be carefully selected by you, consisting of judicious and impartial men, may visit the farms of the several competitors during the coming summer or autumn. This committee should observe carefully and write down accurately, before leaving the spot, the existing condition of things, taking notes of what has been done since the entry was made, together with what is proposed to be done during the remainder of this and the two following years. These memoranda should be carefully preserved for reference at the final visit in autumn of 1874, removing, so far as possible, any liability to forgetfulness or mistakes; and with carefully prepared notes in hand of what appeared in 1872, the committee can judge understandingly and decide according to comparative merit in 1874.

I may be allowed to add that when this plan was tried in Cumberland county some years ago, it was found that a spirit of improvement sprang up, not only among those competing for premiums, but also widely among their neighbors, who did not like to be left behind or to be outdone. It is believed by those best acquainted with the facts of that case, that no other equal sum was ever expended by that Agricultural Society which effected so much good.

Although the Board saw fit to pass no binding action for more than one year, I am authorized to say that no reasonable doubt exists that a similar vote will be passed at the winter sessions of 1873 and 1874, and consequently, you would do well to state, with your offers, the probability that the premiums will embrace not only the sums named by you at this time, but may be doubled or trebled by reason of devoting a similar share of the State's bounty for two years more to the same object.

Respectfully yours,

S. L. GOODALE, *Secretary.*

The Secretary and Professor M. C. Fernald, were appointed delegates to the National Convention called by the Commissioner of Agriculture to meet at Washington, February 15th.

AFTERNOON.

The public exercises commenced at 2 o'clock P. M., the newly elected President, Z. A. Gilbert, Esq., in the chair.

THE PRESIDENT. We have first upon our programme this afternoon, the name of one who has long been closely identified with the great interest which we are now assembled to promote, and one personally familiar with the details of practical agriculture. It is true that for some years his attention has been directed in other channels, and to many he is doubtless better known in connection with public affairs, than as a farmer of Oxford county. We have no reason to think that change of position has abated in the least either his interest in, or his ability to serve the cause of agriculture. I have the pleasure of introducing Governor Perham, who will now address you.

ADDRESS OF GOVERNOR PERHAM.

Mr. President and Gentlemen of the Board of Agriculture:— It is my pleasant duty to bid you welcome to the county of Oxford. I do this with very great pleasure; at the same time, with distrust of myself, since I am compelled to come before you with very little preparation. I come, however, feeling an interest in this work. About nineteen years ago, in 1853 and '54, it was my good fortune to be a member of the Board of Agriculture of this State. It was at the earliest organization,—the incipient stages of this movement,—and I was happy in the privilege of taking some part in the proceedings which have led to the establishment of the office of Secretary of this Board, and I trust to some of the results which have followed your efforts.

Although unable to say a word that will be instructive to these gentlemen present, I would refer to some general matters appertaining to the interest which you have at heart, and which you have met here to consider. We all feel very deeply the fact that the last two years have been to some extent unfortunate for the farming portion of the State of Maine. The failure of the grass crop, especially, which was reduced from about a million of tons to some seven hundred thousand tons in 1870, and reduced still further, below five hundred thousand tons,—more than half,—in 1871, is a consideration of great importance, and very damaging to the agricultural interests of the State. It has not only created a necessity to dispose of a large amount of stock, which otherwise would have been kept, but it has compelled extensive purchases of corn from abroad, paying money which many needed for other purposes. It has done more and worse than this, in that it has undoubtedly injured the prospects of the grass crop for some time to come; to what extent, it is impossible for us now to tell. We all know that the two years past have been such that not only has our crop of hay been reduced upon old grass fields, but the growth of new grass has been prevented. Many lands which were laid down and expected to produce a new crop of grass, must be plowed again and cultivated, before it will be possible to get the crop of grass that we obtained before. And when we consider the fact that the grass crop of the State of Maine is the most important we have, it becomes a matter of very serious consideration whether this Board may be able to devise some means or make some recommendations that shall aid the farmers of this State in getting back, as soon as possible, the hay crop which was formerly produced.

The statistics of this State, gentlemen, as furnished by the census which was taken in 1870, are also somewhat discouraging. We see by these that in the rural portions of the State, in the older portions of the State, there has been a decrease, rather than an increase, in the population. It is particularly unfortunate that we have not been able, during the last decade, to increase our population; but such is the fact.

It may not be improper for us to consider, briefly, some of the causes which have led to this result. It is very well understood that the business which you have met to consider, the agriculture of this State, lies at the very foundation of all other business, and at the foundation of the prosperity of the State. No other business can succeed well unless agriculture succeeds. It is, nevertheless, true, that the agricultural interest is, to some extent, dependent upon the other interests of the State. I mean by this, that every professional man, every man who builds a ship, every man who goes out fishing from our coast, every mechanic, every operative in our factories, every man who works upon our granite and in our slate quarries, and in the quarrying and burning of our lime,—every one of them requires what the farmer produces, and the more we have of those interests, the larger number of persons there are employed in those occupations, the greater will be the benefit to the agriculture of the State. We are not able to compete in the raising of breadstuffs with the grain-growing States of the West, but there are some things that we can raise, and in which we can compete with any other portion of the country. We can raise potatoes here as well as anywhere, and the potato crop that we export now is one of our largest sources of income, and a very important crop with us. There is another thing we can do. As you establish manufactures, or any industry, it makes no difference what, anywhere in the State, that requires operatives, that requires men and women to carry it on, you have there a market for such of the surplus of the garden and the farm as cannot be brought from abroad. In respect to these products, we have no other part of the world to compete with us. It appears to me, therefore, that in the older farming portions of this State, nothing will tell more favorably upon the agricultural interest of those communities than the establishment of other industries in our midst. Everybody knows that in the immediate vicinity of some of our manufacturing towns, the price of farms has increased more than three hundred per cent. within the last fifteen or twenty years, in consequence of the establishment of this other business. There are a good many farmers here who know that, living as they do in the immediate vicinity of some of these manufacturing establishments, they are enabled to get a large surplus from their farms, for which they can obtain ready cash in these places, which before the establishment of these factories, was almost valueless. Hence it appears that all these interests depend upon each other; that if you increase the manufacturing interest of the State, you increase the farming interest of the State, and increase the profits of the farmer. If you increase our shipbuilding, if you increase the work upon our quarries, if you increase the amount of fishing operations in the State, in short, if you increase any of the different industrial avocations of life, you to a certain extent, at least, improve the agricultural interest of the State.

It is, perhaps, somewhat unfortunate that we have not, in the past, been able to retain a larger proportion of the men we have raised in our own State. It is somewhat unfortunate, it would seem to us now, that so large a number of the leading men of Massachusetts, Connecticut, Rhode Island, New York, and the Western States, in the professions, in trade, and in the mechanical pursuits, are men who were raised in Maine, and who left this State, because, as they thought, we had not sufficient room for them here; men who left Maine because in their judgment there was not enough for them to do in Maine; men who left Maine, undoubtedly, some of them, because of a mistaken policy on the part of the State, in consequence of which we have not been able to create more business that should keep our young men at home. It is a fact, that you may go into almost any of our Western States, and you will find that a large number of the leading mercantile and professional men,—a large number of the men who are holding, at the present time, offices of trust and of profit, are men who were educated in Maine, and who went out from us. It has become a serious question how we are to retain, in the future, such a portion of this talent as we need. It seems hardly right that we should furnish so large a portion of the mental and physical forces that have built up other States and made them prosperous and powerful. It seems unfortunate that we have not kept a larger portion of these elements at home. How shall we do it? I have an idea that the declaration made some time since, which has grown into a law, so to speak, that "Westward the course of Empire takes its way," has of itself, by the very force which to a certain extent lay in that declaration, had a tendency to take a great many men away. We have accepted it as a matter of course that empire must take its way towards the West. Now, to a certain extent, that is true; to a certain extent it is proper. The history of our country shows that this has been the case, and it undoubtedly will be so, to a certain extent, in the future; but if the young men of this State could understand fully the resources we have, if they could understand the hidden treasures waiting to be developed within the borders of their own State, there would not be so strong a tendency to go; and I believe that this exodus from our State grows more out of the fact that we have failed to appreciate our own resources, and to employ the means to make them contribute to our prosperity, than anything else.

Now, what is the State of Maine? I know it is regarded by a great many as a State lying away out in the extreme northeast of the country, a frozen region, very near "the jumping-off place," where not much can be raised; and good for little except to raise men and women. We have proved that our State is good for that, by the men and women we have sent into other parts of the country. But I have an idea, that when we take all its elements into consideration, we shall find that Maine, even, is, to some extent, a favored land. We are located on the borders of a rich, although a foreign country. This State has become the thoroughfare through which a large amount of business between England and the Provinces, north and south, from Portland to Montreal, is being done. It is soon to become the highway through which is to pass a large amount of travel, and some of the freight, at least, between Europe and the western portion of this continent. The road just completed through this State, extending now to St. John, and soon to go as far as Halifax, must become a great thoroughfare, through which will flow a very large part of the travel between the western part of this country and Europe. It cannot possibly be otherwise.

In our sea-coast, we have very great advantages. Every one who has traced the map, or who has gone along our borders, must have been struck with the fact that our sea-coast makes deep indentations,—in some places our harbors penetrating almost to the very heart of the State,—and then passing on in its winding way, making a sea-coast of somewhere between two and three thousand miles on the border of the State of Maine. We have in this sea-coast immense opportunities. Our bays are sufficient to float all the navies and all the commerce of the world. It gives us facilities for ship-building, so far as the mere opportunities of getting to the ocean are concerned, that cannot be rivalled by any other State in the Union. For the purpose of the fisheries, which is a very important interest with us and with other parts of New England, it certainly has advantages in many respects superior to any others. We have in what has been denominated our "rock-bound coast," we have in our very granite, where nothing can be made to grow, we have upon our hills and upon our shores, mines of immense wealth. I have made some inquiry into this matter, and as near as I can learn, within the last year, we have dug out of those quarries of granite about two and a half millions of dollars; and this business is increasing rapidly. We are sending it to almost all parts of the country, clear round to New Orleans and up the Mississippi river as far as St. Louis. The Superintendent told me a short time since that he was hoping they would be able to furnish the stone for the new public buildings to be built in Chicago, in place of those that have been burned down. Such is the reputation of Maine granite abroad, that he thought the persons having control of the matter would conclude that they could afford to transport it all the way from Maine to Chicago, rather than to use stone of an inferior quality, that could be obtained nearer home. Something like three thousand men are now engaged in this branch of industry in this State.

The very coldness of our climate, which in the opinion of so many is objectionable, produces for us a large revenue, in the ice which is accumulated in our rivers and lakes. On the Kennebec river between Gardiner and Richmond, a very short space comparatively,—I cannot tell just how long,—the crop of ice in 1869, '70, amounted to about a million dollars. Quite a large income; nothing destroyed, nothing lost; just so much clear gain from the labor of our people.

Then we have other sources of profit. Our slate quarries are becoming of great consequence. They are being opened now to an extent which shows that the supply is inexhaustible, and they are being worked to great advantage. Our railroads are being extended into the vicinity of those quarries, and the business increases to such an extent that we may reasonably expect in the future to reap a very large revenue from it.

Then, again, when we consider our facilities for manufacturing, we have no hesitation in saying that there is no State in the Union which has facilities equal to our own. Our water-power is unlimited, and in centuries on centuries, under the most favorable circumstances, we could not be expected to use it all. Some of our rivers have their rise in localities fifteen hundred feet above the sea, making a descent of fifteen hundred feet from the place where they rise to the place where they empty into the ocean, furnishing opportunities for the establishment of factories all along. The average descent of our rivers from the place where they take their rise in this State is something more than six hundred feet. You see there is a very great fall.

But we have something more than this. Only about one-third of the area of this State is now cultivated, or included in what are denominated towns. About two-thirds, or a little more than twenty thousand square miles, are to-day in forest. About fifteen thousand square miles of that are in the northern and northeastern portion of the State, where the hand of cultivation has never gone. In those forests fall our heavy and deep snows, which, melting all along from early spring to June and July, furnish a continuous flow of water, even in the dryest seasons of the year, to keep up the flow of those rivers and supply the water-power on their courses.

We have still other advantages. Most of the rivers, of any considerable importance in this State, take their rise in some large lake or other large reservoir, which serve to retain the waters until they may be needed in the drouths which may occur in the summer. At a small expense, dams can be raised that will keep back all the water that we may need to reserve, so that, in the dryest season of the year, the wheels will continue to run. We have, then, an important advantage in this respect.

What shall we say of the agricultural advantages of our State? It is well known that, although they are not equal to those of some other States, yet, in many respects, they will not suffer by comparison with many of the States that have outstripped us in agricultural wealth. In the valley of the Saco, of the Androscoggin, on the Kennebec and Sandy rivers, and on the Aroostook and St. John, we have some land about as good as can be found anywhere in this country. It is true, that in the valleys of the first rivers named, you cannot find so large an amount of such land together as may be found in some other places, but you find farms and neighborhoods, scattered all around over this territory, of the very best land, where you have the most successful kind of farming; and upon the uplands in many portions of the State, we find farms, and very many of them, too, that are producing large profits to their owners.

In Aroostook county, a county that has not been very much developed, and of which we know comparatively little, we have a large amount of land still uncultivated, still untouched by the axe, that that is equal to any that can be found in this part of the country, producing crops in many instances almost marvellous. I noticed just now a bunch of clover that was sent all the way from Aroostook county down here, showing what can be raised on that land.* I am informed by persons who have been farming there for some time, and who have been engaged in clearing the land, that the better way, after the land is cleared, is to raise three crops of wheat in succession, before seeding down. You cannot do that in other portions of the State. They say they get good crops of wheat for three years, and better grass if laid down the third year than if laid down after raising only one crop. You can see from this fact that the land is very rich. In a little colony which has been established there, called New Sweden, where some foreigners have collected together, crops were raised last year which to me were really marvellous. They went in there only a year ago last autumn, and began to fell their first trees, and the latter part of last September or first of October, when I visited them, I found they had raised crops of wheat that perfectly astonished me. The snow lay on the ground very late last spring, and some of you may recollect that a freeze came on very early in the fall. You are aware that in small openings, such as those men made there, of ten to fifteen acres in a place, it takes longer for crops to mature than in larger fields. The freeze came upon that wheat before it was fully grained, but the kernels were sufficiently formed

* The clover referred to was a bunch forwarded to the Secretary of the Board by Daniel Stickney, Esq., of Presque Isle, grown by Mr. Henry Bragdon of Perham, consisting of 80 stalks, apparently grown from one seed, about four feet in length and weighing three pounds and six ounces. A single stalk had twenty heads, and one head taken at random counted out forty seeds. It was grown on land which had been cleared and cultivated four years. [S. L. G.]

for a yield of at least thirty bushels to the acre, and that is double the average crop of the wheat lands of the West. I supposed, when I was there, that the crop must be very small, in consequence of this freeze; but I am informed that the average yield was upwards of twenty bushels to the acre, notwithstanding all these unfavorable circumstances. I am certain that, in an ordinary year, there would have been at least thirty bushels. Each man cleared ten to fifteen acres, from which he reserved enough for his buildings, his garden, a yard for his cows, &c., and on the balance they raised 125 bushels of very excellent wheat, or nearly 25 bushels to the acre; and the other crops grown were in proportion to this. I have to say here, that whatever may be said of the West,—and I am not here to deny its advantages at all,—I am very certain, that the man who is comfortably settled here, or the man, even, who desires to change his position, will find, all things considered, advantages in that section of country that are sufficient, if he rightly considers the subject, and takes every thing into consideration, to prevent him from going West. I have an idea, that if more of our people who have made up their minds to leave the places where they now live, would go into that section of the State, they would in a few years find themselves better situated than they have any good reason to suppose they would be in the West.

You will pardon me for dwelling upon this subject; for I feel that unless we in the State of Maine say something for our State, nobody else will be likely to do so, and I feel that the few facts I have stated, and I have mentioned but a very few, and what I have stated, I know to be within the bounds of truth, might be properly mentioned here for our encouragement.

It may be expected that I should say something of the county in which you assemble. As a farming county, Oxford boasts of nothing very remarkable, still we have some excellent farms and excellent farmers; men who have made money in farming. We have some of the very best land in the valley of the Saco, and we have upon the Androscoggin river some superior farming land. The proof of this is to be found in the success which our farmers have had in cultivating those lands. We can furnish in Oxford county as good soil for fruit-growing,—for apples, at least, as any other portion of the State. My impression is, that it may be superior to any other; I am quite certain it is equal to any. A visit to the orchards of this county, in seasons when we have a tolerable crop, I think would convince any one of this fact. For manufacturing, which is to be one of the great aids in advancing the agriculture of the State in the future, we have unlimited resources. The Androscoggin river and its tributaries, the Saco and its tributaries, and various other large streams running through this county, furnish water-power which, under the most favorable circumstances, cannot be fully employed for a large number of years.

There is another thing to be said of this county. I have remarked that some people regard the State of Maine as good for little else except to raise men and women. It is, I believe, a fact, that Oxford county has been as successful in this respect as any other county in the State. I am inclined to the opinion that you may go into any of the States where the people of Maine have gone, and you will find the "Oxford bears," as they are sometimes called, pushing themselves there as they are pretty apt to do at home. There is something more than this. If you go into the two largest cities of our State, you will find that a very large number of the leading business men are men who went from Oxford county. Go to Bangor, and you will find that the Herseys, the Stricklands, the Hamlins, the Rawsons, the Flaggs,—and I might name a large number of other leading business men in that city,—are men who had their education, who imbibed the first principles of that energy which has so well carried them forward in life, here in Oxford county. Go to Portland, and if you have never thought on the subject, you would be surprised at the number of leading business men there who came from this county. The Smiths, the Twitchells, the Shurtleffs, the Browns, and among the mechanics, the Kimballs, the Kings, the Chases, and a very large number of others, leading business men, eminent in the various professions there, are men who went out from this county. Now, if we could have kept all these men, if we could have had those energies exercised in the development of the resources of our own county, I think we might have had something to boast of in the county of Oxford. As it is, although we have not been able to accomplish in these directions all we might wish, we point you to what some of our sons have done in other parts of the country.

Thanking you, gentlemen, for the pleasure which your visit affords our people, and for the profit which we expect to derive from the discussions to which we shall have the pleasure of listening to here, I desire to bid you a hearty welcome to the county of

Oxford. I welcome you not only to this county, but to this town, to this village "set on a hill," and to this temple of justice, and express the hope, in conclusion, that your deliberations here may be such as will result in much profit, not only to the agricultural interest of this county and of this State, but to all the interests of the State.

THE PRESIDENT. In behalf of the Board, and of the farmers here gathered, I feel it my duty to express their cordial thanks to the Governor for his words of welcome, so fitly spoken. And here I may as well say, as at any other time, that you will see by the call of the Secretary, that this meeting is not exclusively a meeting of the Board of Agriculture. It is a Farmers' Convention, to which the farmers of the State at large, and of this county in particular, are invited; and it is not only desired, but expected, that you will take part in the deliberations and discussions.

These Conventions were conceived in the idea that the interests of agriculture need to be promoted as well as all other interests. You are aware, every keen observer is aware, that great changes have taken place within the memory of those now assembled. Formerly, large and paying crops were harvested almost for the asking. The seed was sown, and we had then only to reap the harvest. That time has long since passed away; but notwithstanding these great changes, how is it with the agriculture of to-day? Has that changed correspondingly? I think you will say it has not; that the practice of agriculture to-day follows altogether too much in the routine of years gone by forever. Since, then, the conditions under which we live have changed so materially, ought not our practice to undergo corresponding changes? and if so, what shall these changes be? These are momentous questions to us all; and whether producers or consumers we are alike interested in their satisfactory solution, and all alike are invited to participate in our deliberations. Again, let me thank the speaker for his kind words of welcome.

Next upon the programme is an address from President ALLEN of the State Industrial College, whom I have now the pleasure of introducing to you.

President Allen then delivered the following Address upon

THE AIMS AND METHODS OF THE MAINE STATE COLLEGE OF AGRICULTURE AND THE MECHANIC ARTS.

To extend the principles of a liberal education to that large class of our people, who are to engage in industrial pursuits, and who wish to prepare themselves most fully for the business and labor of life, is the design of the Maine State College.

Perplexing questions concerning the relations of capital and labor are forced upon the attention of statesmen. The peaceful solution of these problems depends upon the intelligence of the laborers. All thoughtful minds are convinced that the better education of the working class will preserve us from the evils that threaten the prosperity of our country. The antagonism of interests, real or imaginary, when the capitalist alone has an education, and the laborer is to be guided by the superior intelligence of a ruling class, will always tend to foster prejudices and prepare the way for riots and lawlessness. Enough has been said of the value and dignity of the industrial pursuits. Professional men are not unwilling to speak of the manly independence and sterling integrity of artizans and tillers of the soil. Politicians talk about the bone and sinew of the country, and think they flatter working men with such appellations; as though it were praise enough for a man to have strong sinews for others to control, and to be bone and muscle, while others are the brain. As in manufactures, the division of labor is the most skillful mode of employing human agency to multiply the production, so it is rashly concluded that there must be a divorce between the planning mind and the toiling hand, in order to give the highest efficiency to each of these departments. But our Creator never intended that a man should become a mere machine, however productive. Nor is it for the highest good of any class to be relieved from physical toil.

The highest civilization can only be attained when labor is honored and respected, and when laborers have the opportunity of mental discipline and the acquisition of knowledge. Just as sure as the maxim holds true, that "knowledge is power," so true it is that those who make the most and best use of their heads will be the most influential; they will stand the highest in the community. No flattery or compliment can evade this great law of nature. Those who bestow the most pains in the cultivation of their minds, will, other things being equal, have the best minds, and those who neglect mental improvement will have less means of influence. The minds which become the best by culture will be the more likely to be best used, and will take the leadership in any society. The ignorant laborer may claim that he is as good as any one, and more useful than many who are rated above him; we do not deny this claim, but goodness is one thing and intelligence is another; and he who is not intelligent, must be comparatively uninfluential, however useful he may be in society.

While all are ready to admit that knowledge and mental discipline are requisite for success in other departments, there prevails a vague notion, that *farming*, least of all, requires much head work; and that a fondness for books and study is actually detrimental to those who would succeed in husbandry. Yet they complain that farmers are not respected as they should be—they drive out from them the more intelligent, and yet demand the influence which intelligence can alone command. If the farmer's boy is bright and quick to learn, it is thought a pity to bury his talents on a farm, he must be educated for one of the learned professions. Thus farmers undervalue their own employments, and then complain that they are not justly appreciated. The impression that farming is a mere mechanical employment, and that success is to be attributed to superior force of thews and sinews, moved in the ruts of old routine, drives intelligent and enterprising boys into other occupations. Farms in Maine are deserted by the families of the old proprietors; the girls are in factories, and the boys are clerks in city stores, teachers, or professional men. The industrial class do not undervalue education in other departments; and they certainly prize highly the privileges that culture will give to their children. Three-fourths of all the graduates at our colleges are farmers' or mechanics' sons. The difficulty in raising the standard of education in the industrial class is that the sons of workmen are educated out of this class. When these students have obtained a liberal education they do not think of going back to the farm or the shop, for they were not educated for industrial pursuits. The farmer did not design so large expenditures to make his boy a successful farmer; nor is the boy inclined to the occupation of his father. To change this sentiment, and, while giving a liberal education to those really aspiring for it; and who "covet earnestly the best gifts," yet to retain them in industrial pursuits requires some other training than that received in our ordinary colleges. The time so largely spent in classical studies, which tend rather to mental discipline than to the attainment of practical knowledge, diverts the attention from utilitarian pursuits. The associations formed, the tastes created, and the aspirations for a life free from what is considered the drudgery of daily toil, prevent the graduates of classical colleges from returning to the shop or the field for a living. And if they do undertake the toil of industrial pursuits they find their learning has not qualified them for success in this department. What avails it that the student can give the name of a horse in different languages, if he cannot harness the animal, or that he can give learned terms to describe the anatomy of his steed, if he does not know how to feed him? The divorce of the practical from the theoretical in systems of liberal education has occasioned the deep rooted prejudice against book-knowledge and scientific farming which pervades the industrial classes. The costly style with which many amateur farmers conduct their agricultural pursuits, enjoying the luxury of raising their own vegetables and dairy products at double the expense such articles would cost in the market, is a matter of derision to practical men. What mere literary men know about farming will be as sure a guide in agriculture as what mere farmers know about navigation would be to mariners in a storm at sea.

The demand for a practical and available method of liberal education, especially fitted for the active pursuits of life, has occupied the thoughts of our best educators and wisest statesmen. While many chimerical schemes have been suggested, and many abortive efforts have been put forth, some true advance has been made in the right direction. The Congress of the United States has made provision for the endowment of at least one college in every State where the leading object 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, in such manner as the Legislature of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." Our State accepted the legacy, and in connection with the donations of individuals and towns, has furnished the means to commence the grand enterprise. The most of the States have applied this endowment to establish or foster a department of practical, scientific education in some existing literary institution; but Maine adopted the bolder policy of establishing a college on an independent basis; which is evidently most in conformity with the design of the original grant. Among the advantages of an independent organization are the absence of all invidious distinctions among students pursuing different courses of study, uniformity in the requirements of manual labor and practical studies, and greater economy on the part of the students. There are not such strong inducements to extravagance as surround pupils in our older literary institutions, where every generation seems to impose new customs, more costly and imperious than those which have come down from previous classes. These are the fashions that lay such a heavy tax upon students, many of whom, from their limited resources are little able to bear the load. There is no need of a costly gymnasium with its apparatus for physical training; no boat club is needed to develop muscular energy, with such a depletion of the purse, and drain upon the morals, as usually attends such sports. On the contrary, there is found a value in such muscular activity, that in its training can be made useful, and thus rendered more capable of ultimate utility. For the more thoroughly the idea of value is attached to power, the more certainly will the expenditure of power have an economic, as well as a disciplinary use. An independent institution is tied down to no servile compliance with antique formulas of education. In the broad domain of knowledge it is free to seize upon that which brings the most ample rewards. It can heed all the lessons of experience, and have the vitality and freshness of youth.

The Maine State College is not a professional school to prepare the students exclusively for any trade or occupation in life. It is not designed alone for those who are to be farmers and mechanics. It does not teach fully the art of farming, or any of the useful arts. A full knowledge of any art, and skill and proficiency in its use, can only be attained by one who gives his exclusive attention to such an avocation, as the business of life. Its design is to lay the broad, deep foundations of a liberal education which is best adapted to industrial pursuits; so that in whatever department of industry it graduates may enter, they will be successful business men, farmers or mechanics; and also intelligent educated men; prepared to guide the thought and intelligence of the whole community where they dwell.

It is not a high school nor an academy; for its course of study lies beyond the range of the studies taught in these institutions;

and its requirements are adapted to maturer minds and more advanced intelligence. A thorough knowledge of the common branches taught in our academies is required as a condition of admittance to this college.

The course of study is sufficiently comprehensive to meet the requirements of a thorough, liberal education. No one can be fully educated without a thorough training in the Natural Sciences, the higher Mathematics, Physics, Mental and Moral Science, English Literature and the Modern Languages. It may be conceded that to be "a scholar, a ripe and good one, exceedingly wise, fair-spoken and persuading," the classical studies are of great advantage. The discipline acquired in the mastery of the learned languages and in "the study of the intelligible forms of ancient poets, the fair humanities of old religions," which deified the forces of nature, and peopled fountains, groves, caves, mountains and seas, with nymphs, muses, sirens and tritons, and which threw such a sculpturesque humanity into their creed, may refine the taste and elevate the culture of the student. Such study is well enough for those whose great object is literary excellence. But for those who are to be business men, mechanics or farmers, it may well be questioned whether the utility of these studies compensates for the labor and time bestowed. The years spent in classical studies, which are usually entirely laid aside after graduation, appear to business men lost time. The information obtained by the study of dead languages is so meagre, and equal or superior mental discipline can be secured by more practical studies; therefore many of our best educators prefer to teach the bright realities of modern science rather than the wild mythology of old poets. The conviction is everywhere prevalent that modern science, which has produced such beneficent results in social life and in elevating the condition of our race, should be sought, not alone for its obvious advantages, but also as the best discipline to educate the mental faculties. The knowledge which, in its practical application, has prolonged life, assuaged pain and provided a remedy for the diseases of the body, may in its attainment, cultivate the perceptive powers by requiring such careful inspection of minute details. The science, which has spanned continents with means of conveyance unknown to the ancients, which has furnished new implements to the farmer, new machinery to the mechanic, and new securities to the mariner, can also develop mind. The study of its laws must elevate thought. The study of modern science which writes with the electric flash and sends its messages through the depths of the sobbing ocean to distant lands, which spins, weaves and sews with such wondrous facility with iron fingers, which paints with the solar rays, which analyzes by the spectroscope the light from celestial worlds, and forces it to tell of what material these orbs are made, can adorn the soul with its brilliancy, and fit it for the broadest activities of life. To such studies therefore we look for discipline of the mental powers, as well as for the practical advantages they afford.

The study of modern languages will not only unlock the rich stores of knowledge contained in their literature; it will better prepare the student to understand and use our own language, and thus answer one great end of classical studies. The practice of translating from one language to another gives a facility in the use of words. That style is best which comes freighted with the richest thoughts, most clearly and purely expressed. Such a style can only be secured by a thorough study of English literature and rhetorical practice.

The higher mathematics both pure and mixed have such obvious utility in their application to scientific investigation and to the practical arts, while the effort put forth in the attainment of this kind of knowledge is such an excellent discipline of the reasoning powers, that all systems of education give a prominent place to this important branch of study. Mental and moral sciences are demanded as essential to a thorough course of education. We should thoroughly understand the laws of our mental action, and study those faculties on which the great Creator has placed his own imprint.

Military instruction is also an important element of a thorough education. Before the late civil war the study of military tactics was entirely ignored in our institutions of learning, except at the national academy at West Point. The extent of the ignorance which prevailed among our people in the art and science of war was one of the strong inducements that led the conspirators to engage in the great rebellion. This neglect and ignorance cost our nation so much of humiliation, the loss of so many millions of treasure, and so many precious lives, that there is now no doubt of the expediency of the thorough military drill of all our educated young men.

The scheme of study adopted by the Trustees of the Maine State College has made ample provision for all these great departments of a liberal education. The requirement of manual labor from all the students has its obvious advantages. For physical development and the preservation of health three hours daily toil is none too much. As there is pay for this work according to the faithfulness and ability of the student, industrial habits are fostered, and important assistance is furnished in paying the expenses of the student. A collegiate course of study without manual labor destroys the inclination, if not the ability, to engage in the hard work of life. Manual toil is an essential requisite to combine the practical part of an education with the scientific. While this labor is educational in its character, teaching the pupils to combine the theory of Agriculture and the Mechanic Arts with the varied labors of the field and the shop, its effects are also beneficial upon the moral character of the students, and the discipline of the institution. True, there may be a lack of fashionable foppery and elegance, but young men trained up under the combined influence of physical and intellectual culture are manly in their deportment. The habits of industry and economy formed under such a regime will not so readily allow the manifestation of the wild frolics and reprehensible sports, to which those shut out from profitable bodily exercise are inclined. That self-reliance felt when there is a command of physical energy, resulting from constant practice in useful and intelligent labor, contributes alike to the pleasure and the utility of life.

While we do not expect that the forty thousand young men of Maine who are entering upon industrial pursuits will all receive a liberal education, we do wish to do something in breaking down the wall that has so long separated the educated from the laboring class of the community; so that those who labor may have an opportunity to secure a thorough education, and those who are educated will not be unfitted for manual toil. That those who are educated in professional callings will not be considered as the only class of educated men. That the laborer will not look up with envy to the advantages of a superior class, nor be looked down upon by any, as a class inferior in intelligence and culture. We do expect to stimulate the working men of our State to secure for their children that mental culture which will fit them more thoroughly for their varied employments. We desire to contribute some share in the great work of advancing the intelligence and prosperity of the State, the happiness and comfort of individuals, and the true dignity of man.

Whatever promises to advance among our farmers the science of agriculture, to put more skilled mechanics in our shops, and to give a broader culture to our business men, is certainly worthy of the careful attention of our people. To retain, by the development of our State's resources, our native population, is better policy than to import vast colonies of foreigners, ignorant alike of our language and institutions. In the restless fever of emigration we shall find that "wisdom and knowledge are the stability of the times."

QUESTION. I would like to inquire how long it is necessary for a young man to stay at the college to get such an amount of information as will prepare him for the business of life.

PRESIDENT ALLEN. Our college course occupies four years. We have a course similar to that of any college designed to afford a liberal education. I do not suppose that it can be very much shortened.

GOV. PERHAM. Having been one of the official visitors of the State College, it may be proper for me to say a word in regard to the appearance of the students, and the progress which they have made; and I may be excused for some enthusiasm in this matter. It is now almost twenty years since I began to argue that we need a different course of study for that portion of our young men who intend to follow the industrial pursuits of life from any then furnished by our schools, and I have pressed this view at every opportunity, in season, and perhaps some of my friends have thought, out of season. I have felt all the time that the course of study which this college proposes to furnish to the young men of the State was just what was needed. I have had the privilege of visiting that institution three times, once last winter, last spring, and again in the fall; and I can say here without making an extended speech, that I think President Allen and Professor Fernald (who has been in the institution longer than President Allen) need have no fear in putting the students of that college beside students in any other institution in the State or anywhere else, who have been engaged in their studies the same length of time.

I am confident that the three hours' labor every day is of very great value. It seems to relieve them of any inclination to cut up capers as many college boys are wont to do. President Allen will not find the trouble in his discipline that is found in other colleges. Those boys are employed; they are given something useful to do; they feel that they are learning something useful all the time, something they are going to practice, and he will not be obliged to discipline them for bad conduct.

I have had an opportunity during the past year of witnessing the exercises in a great many institutions of learning, some of them of high standing, and the students have all acquitted themselves well; but I hesitate not to say that the boys in the college at Orono, considering the time they have been there, taking into consideration their physical and mental powers and everything that goes to make up the elements of success in life, are equal, if not superior, to any class I have ever seen. I believe that every man who has heard the recitations of those boys, and witnessed their mental and physical improvement, will be ready to attest to the correctness of this statement.

PROF. FERNALD. Four years are required for the regular course, but the institution also provides that a briefer course may be taken, under certain circumstances, by those who want to go for some special purpose. If a young man has the knowledge in mathematics necessary to prepare him to enter upon an advanced course, for example, in civil engineering, it is not necessary that he take the four years' course. If he come thus prepared, he can pursue for a shorter season the studies that may be necessary to prepare himself more fully for work in the field. I have in mind now the case of a young man who called upon me but a few days ago, who was formerly a student of mine, and who has been three years in the field as a civil engineer, who wishes to enter the college at the commencement of the next term, if it is possible for him to do so, to carry his studies forward to a degree higher than he has yet been able to do, to prepare himself for wider usefulness in the profession he has chosen. There is this provision for students to study with reference to special emergencies, or for special preparation, and yet, with most young men, the full course is very much more advisable. We have had cases of young men making application to come for a term or two terms, who upon examination proved not to have advanced sufficiently to enter the college at all. We can do very little for such; but a young man who is ready to come to the college and put in time and study and faithful work there, can prepare himself for almost any useful industry that is carried on in this State or any other State.

Our President has said that the college is not a professional institution, that it is designed to give a broad, liberal culture; and yet, notwithstanding its course is broad and comprehensive, and designed to liberally educate the young men, the effort has been made, and undoubtedly will be continued to give these young men, to a considerable extent, a professional training while there. I remember that when Mr. Willard was teaching upon dairy farming, and instructing those boys in what he knew in regard to dairying, he took them into a cheese-room, and gave them practical instruction in the making of cheese, and those boys made cheese and took a great deal of pleasure in it; they learned the art so that they can make cheese as well as any women. The design is, as it has been heretofore, while giving to the students this liberal culture that has been alluded to, to give them as much training as possible in the practical avocations of life.

But, as was stated by our President, it is necessary, as you are all very well aware, in order to become really competent in the profession of farming, that a man devote his life to it, the same as it is necessary for a man to devote himself during his lifetime to any trade or profession in which he would be proficient. But the young men there have an opportunity afforded them of laboring three hours a day, and we are able to direct that labor so that it shall have some reference to what their future work is to be. On entering the institution we expect the young men to engage in whatever labor can be provided for them. Those young men go on the farm and work just the same as any man works on a farm. They are ready to make fences, to build wall, to dig drains, to attend to planting, to sowing, to orcharding and garden work—they do anything and everything that is done upon a farm. They attend to the milking whenever it is required. An arrangement has been made that the young men of a certain class shall take it upon themselves to milk the cows for the term, and they are paid a certain amount for it. They have that as their regular duty. That is, the three hours' labor that we require of every one, they devote in that way. So that these young man, while they are getting this liberal culture which is to fit them for the duties of citizenship, are acquiring practice in whatever appertains to horticltural and agricultural work.

After a time, opportunity is afforded them to direct their labor somewhat with reference to their future work. The course of study is now divided. It will be remembered that when the institution went into operation, there was but one course provided; it has been broken up into three courses,—a course in agriculture, a course in mechanical engineering, and also the briefer course to which allusion has been made, which we do not recommend to any young man who can, under fair circumstances, take the full course. We say that unless a young man is so far advanced that it is not necessary for him to go over the preliminary studies, he had better take the four years' course; but provision is made for such contingencies, where a young man can only avail himself of a few months to attend to something that shall have direct reference to the particular pursuit which he may have in view.

Then, with this division of the course, after the young men have pursued their studies for a certain length of time, two years, for example,—they determine what particular course they will follow. The studies for the first two years in the several courses being essentially the same, the young man then decides whether he will take the course in agriculture, in civil engineering, in mechanical engineering, or take the elective course, and whichever one of these he chooses, the intention is to direct his labor with reference to that special pursuit. Those who take civil engineering, for example, work in the field. Those young men occupied their hours of labor during the last term in field work, with transit and levelling instruments, acquiring that facility in the use of instruments which they must acquire in order to do efficient field work. I remember that some of the young men run a level from one of the college buildings to a school building about three-quarters of a mile away, and returned, and the error was less than a five-thousandth of an inch. That is engineering that would bring the two parts of a tunnel under the Alps together without any jog. You are well aware that in building the Mt. Cenis tunnel, or the tunnel in Massachusetts under the Hoosac Mountain, the engineer stakes his reputation upon the accuracy of his work, and in tunnelling through a mountain having a base of several miles, it is necessary that the form of the earth be taken into account and that very skilful engineering be done, or else the two parts will come together with a jog, or fail to come together at all. I thought that if those young men could carry a level three-quarters of a mile and return, with an error of less than a five-thousandth of an inch, they were doing pretty good practical work. Now, the young man who wants to pursue agriculture as a profession, how will he labor? He will devote his three hours to labor on the farm. He will carry on the precise labor, during his entire course, that he will have to carry on in actual life, after he leaves the institution. So that, in addition to the liberal culture there acquired, there is something of professional training which a young man can hardly fail to acquire in pursuing this course.

It has been my pleasure to be connected with the college from its commencement. I know the objections that have been made to it; I know the discouragements through which we have been obliged to pass; I know what are our hopes for the future; and I am happy to say that we are greatly encouraged, and are looking confidently forward to the time when the claims, the wants and the necessities of the young men of our State shall be more fully recognized, and when this institution shall be able to do for the young men of the State that which they so imperatively need,—a want which I know the members of the Board of Agriculture fully recognize and which I believe the people of this State are fast coming to recognize.

MR. PARKHURST of Aroostook. Let me inquire the expense connected with attendance.

PROF. FERNALD. Tuition is free. The board has been three dollars a week, there has been no charge hitherto for room rent, and each room has been provided with a bedstead, a husk mattrass, a table, a sink, and four chairs, without charge to the student. Two students occupy a room. The charge for washing and fuel has been fifty cents a week, making the whole charge $3.50 a week. Besides this, the student has to furnish himself with books, usually ranging in cost from ten to fifteen dollars a year. The incidental expenses have been from fifty cents to a dollar and a half per term. These include all the expenses, so far as they occur to me at the present time. At any rate, the other expenses would depend upon the habits of the student himself. On the other hand, each student labors three hours a day, for which he receives compensation. When the institution went into operation, the proposition was to pay twenty-five cents for the three hours' labor. It was not designed that it should be precisely twenty-five cents for the three hours' labor, but that the compensation should depend upon the faithfulness and efficiency of the student, greater stress being placed upon the faithfulness than upon the efficiency. That is, the aim was to encourage faithfulness in the boys; so that, although the work is in charge of a competent officer, when the work is assigned to the boys, if the officer chances to be absent, that work shall go on as well as in his presence. We recognize the necessity of developing that principle of faithfulness in labor. About a year ago, the rate was increased, so that they are now paid thirty cents for the three hours' labor. That is the maximum price, and the rate is graded according to faithfulness and efficiency; so that a young man, working his three hours a day, five days in a week, if he attain the maximum price, and as my memory serves me now there was no one who fell below eight cents an hour the last season, and only one as low as that—it would yield him $1.50 a week toward cancelling his bills; or if he attained the minimum price, eight cents an hour, it would be $1.20 a week. There are, of course, some advantages occasionally furnished to students, by which they are able to cancel more, but in following the regular routine duties, they would cancel that amount of their weekly expenses.

Mr. Perley of Naples. What opportunities do they have to teach during vacation?

Prof. Fernald. At first we allowed eight weeks vacation, but as most of the young men were wanted to teach, we have this winter allowed ten weeks. A large proportion of our students, perhaps from sixty to eighty per cent., are teaching this winter. By what they receive for teaching and the wages for their labor, they are enabled to meet nearly all the expenses at the institution, so that no energetic young man need fear falling behind much. I think no young man of energy need hesitate to enter the institution, and work his way through. If he was industrious and temperate, (as all of our young men are) I should not be afraid to guarantee that he would fall in arrears but a very small amount.

But allow me to add, that in order for all these students to make this weekly reduction in their expenses, it is necessary that we be provided with what we have not. Farm labor can only be profitably carried on during certain seasons of the year. When the term opens, two weeks hence, what can be done upon the farm? How can we employ those boys? Now if we had a machine shop, as we ought to have, if we are to teach mechanics, there would be a place in which we could employ the boys during this time, before farming operations commenced; as it is we work along as best we can. I do not know how soon we may be able to supply this want; I do not know to what extent it can be supplied, but certainly there is need. We want the means of furnishing labor that shall not only be profitable to those boys, but, if possible remunerative to the institution. During a portion of the time when they can work upon the farm, their labor can be made remunerative, but there is at the close of the season, a time when it is difficult to find work enough for them to do. We do the best we can under the circumstances; but there may be times when we cannot furnish any work which the students can do, and then of course there will be a falling off in the weekly earnings.

Mr. Lucas. Do you depend upon them to do all the work upon the farm?

Prof. Fernald. Only so far as they can in three hours daily. We do not ask more than that. There is a disadvantage under which our farm labor suffers. You are all aware that it is a great advantage to take men into the field and be able to control their labor through the day, when you have your teams and tools in the field. You can use them to much better advantage than you can a large force put on for three hours in the afternoon. We have all these things to consider. Our farm superintendent does as well as he can under the circumstances. There are necessarily some disadvantages in this method.

Mr. Lucas. Do you ever employ them all day during the busy season?

Prof. Fernald. Their primary object in going there is to obtain an education. Nothing should be permitted to interfere with that. Mental labor occupies the time until noon, then they have an hour for dinner. From one to four o'clock is occupied with physical labor, after which there are two hours for recreation, or other use if they prefer. At seven o'clock the bell for study is struck and the students repair to their rooms and pursue their studies during the evening.

Mr. Pierce. If I understand it, there is an opportunity for a young man, if he has a fair education and wishes to be a book-keeper, to go there and study book-keeping alone, if he does not wish to study anything else.

Prof. Fernald. We do not deem it best to receive students who wish merely to pursue for a term or two such studies as he could pursue equally well at an academy or a so called commercial college. In such case I would advise him to go to the academy rather than to our college. If he wishes to prepare himself more fully for the work of life we should he happy to receive him.

QUESTION. How far advanced must a boy be before he can enter the college?

PROF. FERNALD. He must be able to pass a satisfactory examination in arithmetic, grammar, comparison and analysis, and especially we examine in false syntax and punctuation and the use of capitals, in geography, the history of the United States, and algebra to quadratic equations. Young men meeting these requirements are generally admitted.

PRESIDENT ALLEN. In relation to the question of expense I may say that thirty-eight weeks board at $3 per week amounts to $114, to which about a dollar a week should be added for fuel, lights, washing and incidentals. To offset this we furnish work when we can, up to three hours a day, for which eight to ten cents per hour is paid. But at some seasons, as we are now situated, without workshops, we have no work to be done which would be remunerative. And there is a class of work for which we do not pay. For instance, the junior class goes out to take levels or to survey a railroad from the college to the village. They come back with their figures, and estimate how much excavation and how much filling up are needed—to a yard—and so of other details of the work, but we do not pay them for it. They get what is better than money in the instruction which they receive. Labor which is solely educational we do not pay for.

SEC. GOODALE. The question was asked how long a time was necessary for a boy to be at college to obtain the necessary information to prepare him for the business of life. Perhaps the question has been sufficiently answered, but it may not be uninstructive to draw attention to it. Unless I am much mistaken, it is a very small part of the business of an educational institution like the college we are discussing to impart information. Its purpose is rather to educate; and what is education, and how does it differ from the imparting of knowledge? Look at the derivation of the word *educere*—to draw out, to lead forth; education means more than obtaining knowledge; it includes the development and training of the faculties, so that they may be able to accomplish fully all which they are capable of doing. To be sure, a boy goes to college and comes home better informed than when he went, but the information obtained is mainly incidental and not the prime object for which he went. If he has gained nothing by going except knowledge, if he comes home no more of a man than he went, if his mental powers have not grown, if they have not been developed and strengthened by means of the studies pursued, if his faculties have not been trained and disciplined, his college course is a failure.

The old colleges educated young men, and educated them well. All honor to them and to their work. I would not detract one iota from their merit. Their failing is not that they did their work badly, but that—necessarily—in the use of their methods, they could only do it for so few. It was formerly thought that only the men destined for the so called liberal professions needed a liberal education, but we find that all men need it. It was formerly thought that the pursuit of agriculture required *less study than any other*, and that a boy fit for nothing else would make a good enough farmer; but we have since begun to open our eyes to the fact that he is all the while called upon to deal with problems which require, and will demand the largest amount of scientific acquisition and ability, and the noblest efforts of the human intellect. It is a long stride toward the accomplishment of "the liberal and practical education of the industrial classes," to recognize and to feel the need of it; and this we have, at least, begun to do.

The practical question now is, by what method, by means of what studies shall education be sought? The old colleges adopted the method of devoting four years to the studies mainly preparatory to the study of what was to be the calling or occupation or profession in life. After the collegiate course was finished the student begun his professional studies. The study of Latin and Greek, mathematics, rhetoric and philosophy was mainly for the purpose of laying broad and liberal and deep foundations for subsequent study—consequently, the time and cost involved in such a preparation for the business of life was so great as to prevent great numbers from enjoying its benefits who would have gladly entered upon it if they could.

Now what does the new method propose to do? Wherein do the Industrial Colleges differ from the Classical Colleges? Chiefly in this; that while they attempt to bestow a liberal culture and a thorough training, discipline and development of the man's natural powers, they propose to do it by more direct methods, by the pursuit of studies which shall be, so far as possible, *exactly in the direction of his future pursuits.* The effect of this is greatly to reduce the expenditures of time and money; and if we can reduce the time from eight years to four and the money cost one-half, or more, the effect will be, not merely to double the number who can and will receive its benefits, but to increase it in a much greater proportion. Where five now pursue the old method not twice five can pursue the new if the cost be reduced one-half, but rather five times five. The increase will not be so much by arithmetical as by geometrical ratio, or in proportions greater still.

I have no doubt whatever that there are thousands of young men in our State both able and desirous to pursue such a course of study as the college at Orono presents and that they would come forward at once if they were fairly cognizant with the facts in the case.

And now a word about the matter of labor by the students. I deem it very important that this be properly understood, and the first point I make is, that manual labor was not introduced into the college course primarily nor chiefly to support the student while studying. That attempt was made long since and failed. Some of you undoubtedly recollect the manual labor schools of a generation ago, and what became of them. But in that plan as in many other schemes and beliefs there was much truth, and very important truth mingled with the error. The error sunk those schools, but the truth did not go down with them; that floated, and it has now been harnessed to the college at Orono, to help that institution float also.

Properly viewed and properly practiced, labor in connection with study serves most important uses. In the first place the body needs exercise as really as the mind. It cannot be developed and trained without. Nor are intellectual powers, however great, of much practical utility when lodged in a feeble body. Man is a compound being—soul *and* body. The soul inhabits a material body and it is only by means of this material body that we communicate with, and operate in this world of matter in which we live. And the education, the strengthening, the training of both should proceed along together with even steps. How many of the most promising youths who entered college in years gone by broke down in consequence of forgetting and neglecting the imperative needs of the outer habitation while eagerly seeking the development of the inner man? Of late years this necessity has come to be generally recognized by the old colleges, and they have provided gymnasiums to furnish the needful exercise. But why may not this be supplied in the form of productive labor as well as in unproductive? Will not productive labor, if properly regulated, serve an equally useful purpose? We believe it can; and if so, there is the *incidental* advantage of contributing toward support. So far from hindering intellectual labor, it assists; certainly in a great majority of cases more study can be accomplished during the four years of college life in connection with a fair amount of physical labor than can be without it. Another thing, this method avoids the probable disinclination to hand labor which is the natural result of its discontinuance for four years. How many graduates of the older colleges ever returned to active occupation in the industrial pursuits which they left on entering? A small proportion only, as all admit. Now, as these new colleges were expressly designed for the "*liberal and practical education of the industrial classes,*" (such is the exact language of the congressional act endowing them) it is highly important that the students should not be exposed to an incidental *course of weaning from industrial pursuits* which would defeat the express object of these institutions so far as they differ from other colleges.

A third and very strong reason is that, by practicing the various operations the science of which they study in books or by lectures, they come to understand them better. To neglect this is somewhat as if a tailor or a shoemaker should content himself with explaining to an apprentice the principles upon which he cut out and made up his work and the ways in which he applied the measurements taken, without setting him to *do* it, also. This is, in fact, the grand object, for labor with study, properly directed, helps progress in the studies, makes them more useful, more practical than they can be without it.

Again, as has already been said, labor furnishes a safety valve for the escape of the exuberant spirits of youth. Those young men need work, they need study, they need play, and one just as much the other; and if you let them have all these in due proportions there will be small need of corrective, disciplinary measures. And with all the direct benefits there is the incidental one of assisting in a pecuniary point of view. This is really of very great importance, for with very many it will be the pivot on which the question whether they can or cannot obtain such an education, will turn. I would not detract in the least degree from its value; nevertheless I would have it looked upon as an incidental benefit rather than as the principal reason for its introduction into the college course. I dislike to have it occupy, in the minds of any, a wrong position, just as I dislike to see a man practice honesty merely because it is good policy. We have only to follow truth and do what is right because of truth and righteousness' sake, to secure all the incidental benefits which flow from such a course. These follow necessarily, and as surely as the character of a crop is determined by the seed which is sown. It is true enough that honesty is good policy, it is true enough that labor with study helps meet the cost of education; and a good deal more is just as true, and more important to be rightly understood.

T. S. Gold of Connecticut. Having been a teacher with twenty-five years' experience in training boys, partly in the school-room, and partly on the farm, perhaps I may be allowed to say a word at this time. In the institution with which I was connected, our object in teaching the boys work was their benefit; we never allowed any compensation for their work. Tools were provided and ample opportunity given them to engage in the labors of the farm and of the garden adapted to their age and ability, and the result was in the highest degree satisfactory. Boys unused to labor of any kind, learned, in connection with their studies, and without interfering in the least with their studies in the school-room, to become quite expert in the use of the tools connected with the farm, in all its varied operations. The only point I question with regard to your practice relates to compensation. I think you have fixed it higher than you can afford, in consideration of the fact that you give instruction in connection with it, which will interfere very much with practical utility of the labor. If the labor is *designed* to instruct the boys, many hours must be spent in getting out the tools and returning them to their places, and in doing many things merely for instruction and it will be exceedingly difficult for you to show as great returns for the hours of labor expended as if they were farm laborers under your control for the whole of their time. You farmers must grant a great deal of latitude in that respect. You must pardon them for not doing as much in those three hours labor as you think you could do on your own farms. If you have one boy upon a farm; or one young man partially trained, you make him very useful, but if you have a great deal of that kind of labor, you cannot make it very remunerative. I have had twenty boys ready to work for me, two, three, or four hours a day, just as I called upon them and all for nothing; still, I could not make that labor very profitable. I could do some operations rapidly and very successfully; but if the control of twenty boys in the field does not occupy much of the time of the superintendent and render his labors not very effective, I am quite mistaken. He must work pretty hard to make that labor useful and you must grant him much forbearance in respect to money results.

I would say, with regard to the relative merits of the two kinds education, that the object of the ordinary collegiate course has been to make men of thought and of language. That is accomplished by classical and mathematical studies. The *business* of life developes and makes men of *action*. The idea of these new colleges is to unite the two, and make them men of thought and men of action. I lay that down as the object you have in view,—to work out that problem which the present age is urging upon us—How best to produce men of thought *and* of action?

PROF. FERNALD. I hope the idea which President Allen advanced will be fully understood, that when the boys work at levelling or any other work that appertains especially to their own instruction, they receive no pay. Our line of division is this: when a boy works for the institution, pay him; when he works solely for his own advantage let him be paid in the advantage which he derives.

MR. PIERCE. Our Farmers' Clubs discuss the college, and in many places they discuss it in ignorance. I would suggest that the sentiments expressed by President Allen and by the Secretary of this Board be published in pamphlet form, and circulated among our Farmers' Clubs. If they could be read by the members of our Clubs, they would do away with a great deal of prejudice that now exists.

Adjourned to 7 o'clock.

EVENING SESSION.

The Evening Session was occupied by an interesting and instructive lecture by Prof. Fernald on "Protection from Lightning."

LIGHTNING AND THE MEANS OF AVERTING ITS DESTRUCTIVE EFFECTS.

In a single hour, it will not be possible to consider with minuteness, and in its varied relations, the subject which is to engage us to-night. However important might be an elaborate discussion of the nature and effects of that subtle fluid, which as our agent may speed our messages swift-winged across a continent, or as our master may bring instantly terror and disaster to ourselves and our households, we can only attempt on the present occasion to offer a *few thoughts* in regard to "Lightning and the Means of Averting its Destructive Effects," which we hope may not be unworthy of your thoughtful attention.

If it be desirable to rear homes for ourselves and our children, it is equally desirable to *protect* those homes, whatever may be the form in which the threatened danger may present itself.

If it be desirable to engage in commercial pursuits,—to fit out vessels and send them upon boisterous seas, it is equally desirable that they go prepared, not only to buffet successfully wind and wave, but to avert the shafts of the storm-cloud, which unaverted might prove their destruction.

If liability to accident and harm attend our every footstep, does it not become us as rational beings to consider, whether by any possibility any of the forces of nature which threaten us may be rendered powerless, and be made to play harmlessly at our feet?

Your attention is solicited to considerations upon—

1st. The nature of lightning as indicated by its manifestations, and effects.

2nd. The extent of danger from its stroke.

3d. Means of protection from it.

Meteorologists ordinarily recognize four forms of lightning, viz: zigzag lightning, ball lightning, sheet lightning, and heat lightning.

As regards the third and fourth forms we must content ourselves with simply a definition. Sheet lightning is a diffuse glare of light, sometimes illuminating only the edges of a cloud, and sometimes pervading the entire surface of the clouds from which it emanates, seeming to issue from their interior. This is the most common of all the forms.

Those flashes of light unattended by thunder which illumine the horizon for hours, at times, on summer evenings, have been characterized as heat lightning, and are generally attributed to reflection from the atmosphere of the lightning of clouds so distant that the thunder cannot be heard. Sometimes this light is diffused over the entire heavens, the electricity of the clouds escaping in flashes too feeble to produce audible sound. Especially may this occur when the air is moist, so that it conducts electricity with tolerable facility, and yet resists its passage sufficiently to develop a feeble light. It may here be remarked that the form under which lightning is presented, whether zigzag, sheet or heat lightning, depends upon the position of the observer. That which may present itself as zigzag lightning to one observer, may appear as sheet or heat lightning to another located differently.

While the first form of lightning is that which will principally engage our attention, yet, lightnings of the second class are so unique in their manifestations, I can hardly resist the temptation to draw examples of them from that part of the admirable meteorological essays of Francois Arago which treats of thunder and lightning.* Unlike the instantaneous flashes of the other forms, lightnings of this class are visible for one, two, or even ten seconds of time. Their movement in descending from the clouds to the earth is so slow that their march can be followed by the eye and their rate be estimated. They occupy definite spaces, are of globular form, and are seemingly balls of fire. Against them lightning conductors and all other means of protection which man has devised, seem to be essentially powerless.

We give below a few from the long list of examples referred to above:

"At Couesnon, near Brest, among the ruins of a church which had been entirely destroyed, different witnesses agreed in attributing the catastrophe to 'three fiery globes, each three or four feet in diameter which united, and then proceeded with a very rapid course in the direction of the church.'"

"In January, 1770, a thunderbolt fell on the tower of Schemnitz in Hungary. Its form was that of a *globe,* and its size as large as a cask."

* While facts have been drawn from any available sources, I desire to acknowledge particular indebtedness to the work referred to above.

"On the 14th of February, 1809, the ship of the line, 'Warren Hastings,' which had only been launched a few days before at Portsmouth, (Eng.) was struck three times in a very short space of time. On each occasion the lightning approached the mast under the form of a ball of fire."

"A short time after Philip V. had made his entry into Madrid, the palace was struck by lightning. The persons assembled at the moment in the royal chapel saw two balls of fire enter it. One of these balls divided into several smaller ones, which before disappearing, bounded repeatedly like an elastic ball."

"On the 20th of June, 1772, while a thunder storm rolled over the parish of Steeple Ashton in Wiltshire, a globe of fire was seen to hover in the air above the village for a considerable time, and afterwards to fall perpendicularly upon the houses, where it did much damage."

At the same place, and on "the same day, the reverend Messrs. Wainhouse and Pitcairn, who were in a room in the parsonage, suddenly saw appear at the height of their faces and at about a foot from them, a *globe of fire* of the size of a fist. It was surrounded by black smoke. In exploding it made a noise which might be compared to the discharge of several pieces of ordnance at once. Immediately afterwards a strongly sulphurous vapor spread throughout the house. Mr. Pitcairn was dangerously wounded; his body, clothes, shoes and watch, presented all the same appearances as those attendant on a stroke of lightning of the more usual kind. Different colored lights filled the apartment, and were violently agitated to and fro."

Professor Richmann of St. Petersburg, in 1752, was instantly killed while performing the experiment of withdrawing lightning from clouds. The engraver Solokoff who was present, declared that the lightning which killed the physicist had a globular form.

"In 1809, lightning entered the house of Mr. David Sutton at Newcastle-on-Tyne, through the chimney. After the explosion, several persons saw on the floor, at the door of the drawing-room in which they were assembled, a globe of fire which remained stationary; it afterwards advanced into the midst of the room and broke into several fragments, which exploded in their turn like the stars of a rocket."

M. Babinet communicated to the Academy of Sciences (France) on the 5th of July, 1852, the following note:

"The object of the present notice is to bring before the

Academy a case of globular lightning, which the Academy had charged me a few years ago, (June, 1843,) with the care of investigating and authenticating, and in which the ball of lightning had struck a house (Rue St. Jacques in the neighborhood of the Val de Grace,) as it withdrew. The following is a brief summary of the account given by a workman into whose room the globular thunderbolt descended and then remounted :

After a rather loud thunderclap, but not immediately after it, the workman, a sailor by trade, being seated by his table finishing his meal, suddenly saw the chimney-board fall down, as if overset by a slight gust of wind, and a globe of fire the size of a child's head come out quietly from the chimney and move slowly about the room at a small height above the tiles of the floor. The sailor said it looked like a good sized kitten rolled up in a ball and moving without showing its paws. It was bright and shining, rather than hot and burning; the man said he felt no sensation of heat. The globe came near his feet like a young cat that wants to play and rub itself against its master's legs; but by moving his feet aside and making various precautionary manœuvres,—all done by his own account very gently,—he avoided the contact. It appears to have played several seconds about the feet of the workman, who remained seated, his body bent over it and examining it attentively. After having tried some excursions in different directions, but without leaving the middle of the room, it rose vertically to the height of the man's head; to avoid its touching his face he raised his body and threw himself back in his chair, still keeping the meteor in view. When it had risen three or four feet above the tiled floor, the globe became a little elongated, and rising obliquely directed itself towards a hole pierced in the chimney three and a half feet above the mantleshelf. The hole had been made to allow a stove pipe, which the workman used in winter, to pass through, but according to his own expression, 'the thunder could not see the hole, for it was covered with paper which had been pasted over it.' The globe of fire however went straight to the aperture, unpasted the paper without hurting it, and made its way into the chimney; then when it had just had time at the pace it was going, that is to say, pretty slowly to get to the top of the chimney (at least 20 metres, or 66 feet from the ground of the court yard) it made a dreadful explosion, which destroyed the upper part of the chimney, and threw the fragments into the yard on the roofs of smaller buildings which they broke through; happily no one was hurt. The movements of the luminous globe were always slow, and not by jerks. Though bright it was not dazzling, and no sensible heat came from it. It does not appear to have had a tendency to follow conducting bodies, or to have been impelled by currents of air."

A sufficient number of examples have been already adduced to give an approximate idea of the nature of these fiery globular masses. While they are not of frequent occurrence, yet they have been seen sufficiently often, and studied with so much care, that their existence as a peculiar form of lightning is abundantly attested. Their cause has been variously assigned. Professor Loomis says, they probably result from "a charge of electricity unusually intense, which forces a direct instead of a circuitous passage through the air." By some they are thought to be agglomerations of ponderable substances in a state of great tenuity, and strongly charged with electricity.

Whatever may be their composition or their cause, in the slowness, uncertainty and peculiar character of their movements, and in the extent of the damage, resulting from their explosion, they rank among the most marvellous objects presented in the whole range of meteorology.

That form of lightning with which we are most deeply concerned presents a long, irregular jagged line of light, resembling the spark drawn from an electric machine. Its zigzag path is regarded as due to the compression of air before the electric fluid, by which greater resistance is produced. When its course is strongly resisted in one direction, it turns aside following the line of least resistance, until the air is again compressed before it, when it turns again as before. The duration of an ordinary flash of lightning as determined by receiving the light of an electric discharge upon a white disc marked with black rays radiating from the centre, the disc being made to revolve with great rapidity, has been repeatedly determined to be less than a thousandth part of a second of time. The length of the zigzag path ranges from short spaces to the distance of ten miles. Thunder clouds have been observed of all heights from less than one-fourth of a mile to at least three or four miles.

Inasmuch as low clouds come in contact with the sides of mountains, and even of high hills, the following interesting inquiry is suggested. Can clouds from which lightnings are incessantly darting be traversed without imminent danger?

However great the peril may be such clouds have been traversed without disastrous results. From many instances on record, I select the following:

In August, 1750, an ascent was made of the little mountain Boyer in France. Three-fourths the way up the mountain was a stationary cloud, from which thunder was from time to time heard. From the moment the cloud was entered, "the thunder no longer manifested itself by sudden claps, alternating with intervals of silence; it now made a continual rumbling, resembling that of a heap of walnuts rolled upon the floor. When the observer had attained the summit of the mountain he found himself above the cloud which had not ceased to be a thunder cloud, for it was traversed by brilliant lightnings, and loud detonations issued from it."

Observers upon the Pyrenees in the midst of thunder clouds have noticed that their hair and the tassels of their caps stood on end, and that a hissing sound was produced from prominent points. A position above a thunder cloud cannot be regarded as unquestionably safe. Lightning has been known to issue from the upper surfaces of clouds, and strike objects upon the summit of mountains above them. Thus on May 1st, 1700, seven persons were killed in a church on the summit of Mount St. Ursula in Styria.

The thunder which ordinarily accompanies a discharge of lightning, is regarded as resulting from the collision of particles of the atmosphere as they reënter the partial or total vacuum produced by the lightning in its swift passage through the air. As is well understood the interval between the flash and the report indicates approximately the distance of the cloud, or rather of that part of the cloud from which the sound which first reaches the ear, emanates, an allowance of about five seconds for the distance of a mile being required. The largest interval mentioned by any observer is 72 seconds, indicating a distance of nearly 15 miles. The next longest interval recorded is 50 seconds, corresponding to a distance of about ten miles. It seems remarkable that the sound of thunder has not more of a diffusive character. The sound of cannon may be heard to a much greater distance.

The average interval between flash and report is 12 seconds, and the shortest interval noted less than one-half a second. The average duration of peals of thunder is 22 seconds, and the longest duration on record is 56 seconds. The prolonged sound in the case of thunder is due to the fact that the points along the line of the flash are at unequal distances from the observer, a separate sound being produced at each point. The sound from the nearest point first reaches the ear, and then the sounds from points more and more remote in order. If the relation of the line of flash to the observer be such that two or more points are equally distant, the sounds arising from these points blending together at the ear, will give a result proportionally louder, and thus in nearly every peal of thunder maximum and minimum sounds may be observed. Generally after a low rumbling sound for five or ten seconds, a loud crashing sound occurs which continues from five to twenty seconds, when it is succeeded by the rumbling noise again which gradually dies away. Several maxima and minima of sound may occur during the same thunder peal. The rolling of thunder is also undoubtedly due in a considerable degree to the effect of echoes. A cannon fired under a clear sky gives a short, sharp cracking sound, but when fired beneath clouds from which reflection can take place, the sound becomes prolonged and rolling.

To consider in detail the questions: Does lightning ever occur without thunder and with a clear sky? Is thunder ever heard in perfectly clear weather? Does lightning take place without thunder, with a cloudy sky? Does thunder ever occur without lightning? would be foreign to our present purpose. It may be remarked however, that seemingly well authenticated examples are on record which would give an affirmative answer to each of the above inquiries. Let us now turn our attention from these general points in regard to lightning and thunder to those in which we have a more specific interest.

Other circumstances being equal lightning strikes the most elevated points. Particular instances may occur which seem to be in opposition to this rule—instances in which the causes remain concealed in the masonry of buildings or beneath the surface of the earth. Yet, no one who has compared in a given locality the strokes of church spires and tall trees with those of lower surrounding objects will question the truth of the above statement.

Lightning seeks by preference metallic bodies, whether external or concealed, and it is in making its way to them, or at the moment of quitting them that it does its principal damage. Of all the properties of lightning these are the most important to us as regards results. From numerous illustrations I select the following instructive example furnished by the stroke of an immense timber spire or tower in Newbury, (Vt.): "Lightning fell upon the upper part of the tower; it shattered and threw to a distance a timber pyramid seventy feet high. After it had overthrown this heavy mass it found in its path a metallic wire which connected the clapper of the bell with the wheelwork of the clock, twenty feet lower down, and threw itself entirely or almost entirely upon this wire, which it melted in some parts. For this length of twenty feet, the surrounding timber of the tower suffered *absolutely no injury,* although the lightning was far from having exhausted itself upon the upper pyramid. As soon as it had reached the lower end of the wire, it threw itself afresh on the timber of the tower and injured it considerably. On reaching the ground, its force was still such, that it tore up several stones from the foundations of the building, and projected them to some distance." So long as the *wire* was followed, no injury resulted; when *that* was abandoned, destruction ensued.

Still another example, not less pertinent, is adduced. On the 15th of March, 1773, lightning fell at Naples on the house of Lord Tylney. His apartments at the time contained not less then five hundred persons attending a grand reception. Yet not one of them sustained actual injury. Saussure the next day examined the rooms and found that almost all the gilt parts had been affected. "The gilt mouldings and cornices of the ceilings, metallic rods placed so as to protect the tapestries from the contact of furniture, the gilt portions of sofas and arm-chairs in contact with those rods, the gildings of the door-posts, and lastly the bell wires had all suffered more or less by fusion, discoloration or scaling off of the surface. As usual, the maximum of effect had taken place where the lightning in its course had met with interruptions in metallic continuity. A stroke of lightning capable of melting a bell wire is strong enough to kill a man; yet here, as has been said, no one was hurt. We have thus a sufficient proof that the fulminating matter or lightning, in passing through the nine rooms which formed the suite of apartments, directed itself by preference, or almost in totality to the metallic substances found in the different rooms."

From references already made a well known fact appears, viz.: that lightning often fuses pieces of metal which are struck by it. The important fact, however, for our present purpose, is to determine the largest diameter or thickness of metal, that has ever been melted by it. The loose expression of ancient writers, that "the sword is liquified in the scabbard," is not sufficiently definite for modern science. What are the actual dimensions of metals actually fused by lightning? From nearly a score of examples, I find that a copper rod two-tenths of an inch in diameter has been thus melted; that Franklin in 1787, found that a stroke of lightning had melted, at his own house in Philadelphia, a conical copper rod 9½ inches long, and rather more then three-tenths of an inch thick at its base; that "a thunderstroke may fuse completely and throughout its extent an iron chain of 130 feet in length, the diameter of the iron forming the links being .23 of an inch, and a conical iron rod .43 of an inch thick at its base—that an iron rod .47 of an inch in diameter was broken by a heavy stroke of lightning, but showed no trace whatever of fusion. From such data a tolerably correct idea can be formed of the necessary magnitude of metallic rods to convey away without harm any probable charge of the electric fluid. A stroke not sufficiently powerful to fuse small rods or wires may have the effect of shortening them. A metallic wire 16½ feet in length has been thus contracted between two and three inches. Wires stretched between fixed points are thus often broken by lightning strokes. (Is it not possible that the contraction results from a lateral escape of the electric fluid, giving rise to tension in that direction, just as a rope is shortened when from any cause its diameter is increased?)

Lightning frequently fuses and instantly vitrifies certain earthy substances. Lightning tubes or fulgurites (as they are termed) are produced when lightning descends into sandy soils, the path of the lightning being marked by a tube of vitrified sand. These tubes are sometimes three inches in external diameter, and have been known to exceed thirty-three feet in length. They generally descend vertically into the sand, but are often found inclined to the horizon at an angle of 40 degrees. They contract in descending and often terminate in a point; sometimes, however, the principal tube divides into two or three branches, each with smaller lateral branches from an inch to a foot in length. These branches are conical and all terminate in points. The sides of the tubes vary from two-hundredths of an inch to an inch in thickness. The inside part of lightning tubes is smooth and bright. It scratches glass and strikes fire as a flint.

A singular freak of lightning is that of piercing bodies with several holes in opposite directions. Of several recorded instances the following strikingly presents this remarkable characteristic: In 1777, lightning struck a church in Cremona, breaking the iron cross on its summit, and throwing to a distance the weathercock which had been placed immediately below the cross. This weathercock was made of tinned copper and covered with a coat of oil paint, and "was pierced by eighteen holes;" the edges of nine of these holes stood out prominently on one of the faces of the weathercock, and the edges of the other nine holes were equally prominent on the other side. There were no indications which led the inhabitants of Cremona to suppose that the weathercock had received several strokes of lightning. It were remarkable indeed that the strokes should be in pairs; nine on each side, and in essentially parallel lines, as the nearly identical inclination of the projecting edges would seem to require. Is there not more reason for the belief that the eighteen holes pierced in the Cremona weathercock were the result of a single stroke? Other instances of bodies pierced by lightning in a similar manner, largely confirm this view. As matter of fact, in the case of the zigzag path of lightning, it is not always easy to determine whether the stroke be downwards or upwards. There are physicists who regard the very general appearance of downward strokes of lightning an occular illusion. With a movement so rapid, and with the notion or expectation of a downward stroke by which the mind is pre-occupied, it certainly would not be strange if the eye, at times, were deceived. The clouds above and the earth or the objects beneath, at the moment before an electrical discharge, are in opposite electrical conditions, and when the tension of the electric fluids (to use the ordinary mode of expression,) becomes too great for the resistance presented by the atmosphere, they rush together producing the spark or flash—and thus the electrical equilibrum is restored. An object may, therefore, receive the stroke from the earthward side, (of which numerous instances are on record,) or even from both sides simultaneously.

The power of lightning to shatter into pieces the object struck, and to project or transport heavy bodies, is matter of frequent observation. These results can hardly be supposed to follow from the mechanical shock produced by lightning, and hence the hypothesis that some other force is brought into action. This secondary agent in rending bodies asunder and projecting the pieces to a distance is thought to be the elastic force of steam. A temperature of 400° Fahrenheit converts water into steam with a tension of 17 atmosphere; a temperature of 500° gives rise to steam with a tension of 45 atmosphere.

We know that lightning may fuse small metallic wires, or at least render them incandescent; we know that the heat developed by a stroke of lightning may be competent to fire buildings. Suppose a block of free stone containing moisture in its fissures or between its particles is struck by lightning, steam is at once developed of sufficient tension to shatter the stone into pieces, and project the fragments in all directions. The action of steam is clearly shown in the peculiar and minute division of wood by the passage of lightning. It is split in the direction of its length into "thin laths or still more slender fibres." In the vapor of water suddenly generated at a high temperature we have a force competent to displace the foundations of buildings, to raise and transport heavy masses, and give rise to the other manifestations of power which so frequently accompany a stroke by lightning. The direction of the electric discharge, (whether upwards or downwards or at an oblique angle,) cannot, as matter of course, be determined in those cases in which steam has been the immediate agency in producing mechanical effects.

The *magnetic* action of lightning cannot be safely disregarded. It always affects the needle of a compass in passing near it, sometimes wholly destroys its magnetism, and sometimes reverses its magnetic poles. The manner in which this discovery was made is always read with interest.

"About the year 1675, two English vessels were sailing in company from London to Barbadoes. Not far from the Bermudas a thunderstroke shattered the mast and rent the sails of one of the ships, while the other sustained no damage. The captain of the latter seeing that his consort had altered her course, as if making for England, asked the cause of this sudden change of purpose, and found much to his astonishment, that her captain and crew believed themselves to be still following the same course as before. An attentive examination of the compasses of the vessel which had been struck by lightning, showed that the characteristic mark on the compass cards, which before the stroke pointed, as is usual, towards the north, now pointed on the contrary, to the south, showing that the poles had been completely reversed by the lightning. This state of the compasses continued throughout the remainder of the voyage."

In 1808, a Genoese ship was wrecked near Algiers, while the captain and crew, deceived by the false indications which lightning had induced in the compasses, thought they were sailing directly away from the dangers which proved the destruction of their vessel. The effects of lightning upon the needles of sea compasses have *often* led to like serious consequences. Lightning may not only *directly* influence compass needles, but *indirectly* by magnetizing pieces of hard iron and steel throughout a vessel, which at once become agents in the deflection of the needles. Such deflections are sources of peril, especially as it is not an easy matter for the navigator on the high seas, even when he is aware that an error of the compass exists from such a cause, to determine its value. His condition is still more perilous when the steel pieces of his chronometers are also magnetized by lightning. Dangerous errors are then likely to occur in the computation of geographical longitude. The chronometers of the "New York," a packet which was twice struck by lightning while at sea on the 19th of April, 1827, were found on arrival at Liverpool to be 33 minutes 58 seconds in advance of what they would have been, but for the stroke by lightning of the vessel. Adequate means should evidently be provided on every vessel for conveying away harmlessly the electric discharge.

Without considering at present, more in detail, the properties and peculiar characteristics of lightning, let us come directly to the question: Is the extent of danger from this source so great as to give importance to means of averting it? The only answer really needed to this inquiry is a reference to our daily papers during the warm season. How many accounts do we see of barns recently filled with newly made hay struck by lightning, and of them and their contents destroyed! How often we read of persons killed, buildings fired, and other injuries done by this agent. Extended statistics showing the amount of damage by lightning through a series of years are not readily obtained. Our conception of the extent of damage may, however, be aided by the following facts:

From the month of June to the 28th of August, 1797, Volney counted up in the newspapers of the United States, eighty-four serious accidents, and seventeen deaths by lightning. It is more than probable he did not obtain an account of all.

The late Charles Peirce of Philadelphia, in his statistics of the weather, kept for more than fifty years, records in 1842 sixty-one buildings burnt by lightning in the United States during the summer of that year, and forty-six deaths from the same cause. The loss in buildings which he recorded would seem to be not a large estimate of the annual loss from lightning at the present time in any one of our densely populated States.

In a statistical report made by desire of the French Government, and published in 1852, it appears that at that time, sixty-nine persons were annually killed in France by lightning.

Arago, on reviewing a list of more than eighty vessels injured by lightning, found that "in fifteen months of the years 1829–30, five ships of the English Royal Navy were struck by lightning in the Mediterrenean," alone. He adds, "To those persons who say that damage by lightning is of very little importance in a pecuniary point of view, I would add, that the mainmast of a frigate costs £200, and that of a ship of the line as much as £400.

From a reliable statement of damage by lightning in the British navy from 1799 to 1815, a period of sixteen years, it appears that 150 vessels were struck by lightning, 70 men were killed and 133 wounded, and that the loss of materials amounted to $1,000,000. In 1821, Sir W. Snow Harris, F. R. S., proposed a system of conductors which were applied to the vessels of the navy, and in 1865, or after 44 years, it was found that losses and damage by lightning had almost entirely ceased, notwithstanding the number of vessels had been greatly increased.

A magazine of gunpowder belonging to the republic of Venice, fired by lightning in 1769, occasioned a money loss of £640,000, or more than $3,000,000, and the destruction of 3,000 human lives. Explosions of powder magazines have not been so unfrequent as to lead to the conviction that means for averting such calamities should be disregarded.

Without extending to greater length these notices of deaths of individuals and losses of property by lightning, suffice it to say the number of sufferers from such accidents is sufficiently great to make it reasonable not to neglect the methods which science has suggested, and experience has demonstrated useful for avoiding their occurrence.

What are the means of protection against lightning? It is related of the ancient Thracians, that when it thundered and lightened they were wont to shoot arrows at the sky to threaten it,—a method to which modern civilized nations would hardly deem it advisable to resort. Most precepts for personal preservation from lightning are of a negative character. Those which Franklin gave have ever been regarded as scientific and useful. For persons who, during thunderstorms are in houses not provided with lightning conductors, he recommends an avoidance of the neighborhood of fire-places. Chimneys are often struck by lightning, the internal coating of soot serving to attract it, as also the column of smoke, which rising in the air acts as a conductor for the electric fluid. Since metals attract lightning, avoid also metals, gildings and mirrors which are coated with mercury. The less the contact with the walls or the floor, the better. The middle of the room is the best place unless a lamp or chandelier be hanging from the ceiling. A hammock suspended by silken cords in the middle of the room would be regarded a very safe place.

Among the ancients, it was generally believed that persons lying in bed were safe from lightning. This notion still obtains with many people. Facts however do not show it to be well founded. If the whole body could be enveloped in feathers, they might serve for protection ; but so long as the head or any part of the body is in proximity to the bedstead, there is no immunity from the stroke of lightning, since the human body is a better conductor then are feathers or the material of a mattress.

Metals worn on the person attract lightning, and hence to an extent, are sources of danger. When lightning fell upon the prison in Swabia in 1819, of twenty prisoners together in a hall, but one was struck, and he the condemned chief of a band of robbers, was chained by the waist. Numerous examples have proved that whenever persons are struck by lightning, it particularly attacks the portions of metal worn by them. Wet clothing may be fortunate in case of lightning stroke, but with dry clothing the liability of the stroke is not so great.

Out of doors, it is a sound precept to avoid a position in proximity to tall trees. The ancients believed that certain trees are never struck by lightning. The laurel was thought to be particularly favored. The beech has been classed among trees which lightning respects. "The Chinese consider the mulberry and the peach tree as good preservatives against lightning." Observation however, shows that no species of tree can be regarded as exempt from liability to lightning stroke.

The posts supporting telegraph wires are not unfrequently struck by lightning—sometimes several posts in succession, and sometimes between the posts struck are intermediate posts uninjured. A position near telegraph posts during a thunder storm is not regarded desirable. It should not be forgotten that when lightning strikes men or animals ranged in a line, straight or curved, those at the extremities suffer most from the stroke. Bell ringers during a thunder storm occupy an unsafe place. Lightning is attracted somewhat to assemblies in consequence of the ascentional currents of warm, moist air, which serve as conductors of the electric fluid.

By what method may buildings and vessels be successfully protected from lightning? In ancient times it was thought a dwelling could be protected by surrounding it with white grape vines. Artazerxes planted swords in the ground point uppermost, to drive away clouds, hail and thunder storms. The building of large fires, the discharging of cannon, and the ringing of church bells, have been at different times among the means designed to protect towns and even extensive districts from the falling of thunderbolts.

A more rational method then any of these, is that devised by Franklin. The facts already submitted in this paper suggest the method which Franklin adopted, and point irresistably to the conclusions which he reached.

It has been shown that other circumstances being equal, lightning directs itself by preference to the most elevated portions of edifices, hence there the means of protection should be applied. It has been shown that other circumstances being equal, lightning directs itself by preference to metallic bodies. A metallic mass, therefore, placed at the most elevated part of a building, will be likely to receive the electric discharge rather than the building itself. It has been shown that when lightning falls upon a metallic mass it does damage to surrounding bodies, at the moment of quitting the metal, and in proximity to the point or points at which it escapes from it. This indicates the necessity of metallic continuity until some surface or receptacle is reached which may safely receive the electric discharge. Damp earth offers a channel by which lightning may escape from a metallic rod without producing damage of any kind. And thus we have the modern lightning conductor devised.

It is a curious and interesting fact that the Temple at Jerusalem, which so far as can be learned from the Bible or from Josephus, remained unscathed by the lightnings of Heaven during a period of more than a thousand years. In the structure of its roof, in its covering with a coating of gold; in its long, pointed, gilt iron or steel lances, projecting from its roof; in its walls overlaid with wood thickly gilt, and in its metallic rain pipes connecting the roof with cisterns for water in the courts of the Temple, presented the most ample provision for the ready conduction of electricity; in fact, lightning rods very similar to those employed at the present day.

It is a remarkable and interesting fact, that tall pyramidal spires dating back into the middle ages—spires which have been repeatedly struck by lightning—on being furnished with lightning conductors within the last century, have had entire immunity from such strokes.

The lightning rod already devised, with reference to size, form, point and connection with the earth, should be noticed more definitely.

1st. The rod may consist of iron or copper—the former metal being generally preferred from considerations of expense, and for its greater firmness when set, by which it withstands the action of winds. It should be at least three-fourths of an inch in diameter for buildings of ordinary height. For very high structures it should be made larger. In form it is usually round, although other forms are used and serve a good purpose. A copper rod has the advantage of high conducting powers for electricity, its ratio to iron in this repect being as six to one; but it is wanting in stiffness, and is considerably more expensive than iron.*

2nd. To secure the rod from rust, it should be coated with paint containing lampblack. Galvanized iron is a good substitute for the painted rod, inasmuch as the zinc coating has a conducting capacity for electricity nearly double that of iron.

3d. Metallic continuity should be perfectly maintained throughout the entire length of the rod. So far as practicable the parts should be joined together by welding. When other joinings can-

*The following table contains the electrical conductivity of several of the more commonly known metals at 32° Fah., compared with silver as a standard. The results were obtained by Matshierren by a series of careful experiments.

Silver	100.0	Platinum	18.0
Copper	99.9	Iron	16.8
Gold	80.0	Tin	13.1
Zinc	29.0	Lead	8.3

not be avoided they should be made by screwing the parts firmly together by a coupling ferule, and should be rendered water tight.

4th. It is sufficient that the rod terminates in a single point, although multiple points are frequently employed. The point which must be sharp, should be encased with platinum. This casing will not only protect the point from the action of the weather, but if of sufficient thickness, (one-twentieth of an inch) will insure against liability of melting from any probable electric discharge.

5th. The rod should be fastened to the building by iron eyes. Cylinders of glass are generally used for insulators. They are of but little service, especially after they have become wet with water.

6th. Acute angles made by bending the rod should be avoided. The more direct the communication with the earth the better.

7th. The gravest errors are sometimes made in establishing the connection with the earth. "The rod should be connected with the earth in the most perfect manner possible; and in cities nothing is better for this purpose than to unite it in good metallic contact with the gas-mains or large water pipes in the streets; and indeed, such a connection is absolutely necessary, if gas or water pipes are in the house. Electricity, by what is called induction, acts at a distance on the perpendicular gas pipes within a house, rendering them so highly negative, the cloud being positive, as to attract the electricity from a lightning rod imperfectly connected with the earth, or even from the air through the roof. Damage to buildings on this account is of constant occurrence. The above connection can be made by soldering to the end of the rod a strip of copper, which, after being wrapped several times around the pipe is permanently attached to it. Where a connection with the ground cannot be formed in the way mentioned, the rod should terminate, if possible, in a well, always containing water; and where this arrangement is not practicable, it should terminate in a large plate of iron or some other metal buried in the moist ground. It should, before it descends to the earth, be bent so as to pass off nearly at right angles to the side of the house, and be buried in a trench surrounded with powdered charcoal."—*(Prof. Joseph Henry.)*

8th. Large masses of metal within the building, particularly those that are vertical in direction, should be connected with the rod.

9th. "When a house is covered by a metallic roof the latter should be united in good metallic connection with the lightning rods; and in this case the perpendicular pipes conveying the water from the gutters at the eaves may be made to act the part of rods, by soldering strips of copper to the metal roof and pipes above, and connecting them with the earth by plates of metal united by similar strips of copper to their lower ends, or better to the gas or water pipes of the city. In this case, however, the chimneys would be unprotected, and copper lightning rods, soldered to the roof and rising a few feet above the chimneys, would suffice to receive the discharge."—*(Prof. Joseph Henry.)*

10th. The rod should be placed on that part of the building towards which showers generally direct their course, and particularly on the chimney from which currents of heated air, serving as conductors of electricity, ascend. Rods extending high above buildings should be securely braced.

11th. A lightning rod is regarded as protecting a circle whose radius is double the height of the rod above the building; hence, on large buildings several rods would be required. It is safer, however, to place the rods nearer one another then this rule would require, especially in the case of buildings in which a large amount of iron enters into the construction. There is no objection to an indefinite number of rods on a building, provided a proper connection with the ground be established. In order to safety, it should be remembered the rod must absolutely extend into water or permanently moist earth.

In the protection of vessels, copper has been advantageously substituted for iron, as in the protectors planned by Sir W. Snow Harris for the ships of the English Royal Navy. They consist of bands of copper overlapping each other, and let into the rear side of each mast. They pass down to the keel, and are continued through it by means of copper bolts into the water. They connect also with bands of copper laid under the deck beams, and continued through the sides of the ship.—*(American Cyclopædia.)*

It has doubtless been noticed that in the treatment of this subject, theoretical considerations have been largely set aside, otherwise it would have been deemed necessary to dwell upon the probable and known sources of atmospheric electricity, upon the manner in which clouds serve to condense electricity in the air, upon the influence by induction of the positive electricity of the clouds upon the earth, developing at the more elevated points negative electricity of high tension, and to treat more fully of the philosophy of the electric discharge. On the other hand the endeavor has been to fortify the statements made and the positions taken by an array of facts as large as the circumstances of the occasion would seem to warrant, but by no means as large as the importance of the subject would justify, and from these facts to make inferences which can but be regarded as well founded.

It was hoped when this paper was commenced that an amount of statistics gathered from our own State, or from our own section of country, serving more completely to demonstrate the utility or inutility of lightning conductors could be presented. With this end in view letters were addressed with the following questions or arrangements for statistical data, to the officers of about twenty fire insurance companies, including several companies in our own State. In selecting from the foreign companies, those only were chosen that have within the last three years taken risks within this State amounting annually to at least a million dollars:

SCHEME FOR STATISTICS.

1. Number of buildings insured since incorporation.
2. Number of buildings injured or destroyed by fire.
3. Number of buildings not furnished with lightning rods, struck by lightning.
4. Number of buildings furnished with lightning rods, struck by lightning.
5. Condition of the rods before the stroke, (so far as ascertained) as to points, connections and extending into moist earth.
6. Are you willing that the statistics be made public?

I regret to state that in most cases the courteous answers to the letters of inquiry did not give the desired information, but indicated that a large amount of labor would be required to eliminate from business records extending over many years the needed data.

The statistics furnished by Charles P. Wiggin, Esq., of Bangor, Maine, Secretary of the Penobscot Mutual Fire Insurance Company, are, however, to the point, and I gladly avail myself of his kindness in putting them at my disposal. The company was authorized to insure against damage by lightning in 1859. The records furnished by Mr. Wiggin date from the time of his entering upon the duty as Secretary, viz., May 1st, 1865. From that date to May 1st, 1871—

The number of policies issued by the company, was....5,842

The number of losses.............................. 222
The number of losses by lightning.................... 11

Mr. Wiggin adds, "I do not find a loss among these eleven that was protected by lightning rods."

No man has a right to suppose from the claims made by any intelligent advocate of lightning rods, that old rusty irons about a building, with loose joints and perhaps with actual breaks, and with one end planted simply beneath the surface of the soil, can furnish anything like adequate protection; but from a sufficient number of rods as large as recommended, in good condition, properly pointed, in perfect metallic continuity, and extending into the earth in the manner and to the depth previously indicated necessary, almost absolute security from lightning may with the fullest confidence be expected.

I have yet to learn of the first instance in which the conditions of protection shown to be needful, have been fully complied with, and disastrous consequences from lightning have followed.

In noticing the properties and effects of lightning—St. Elmo's fire—a discussion of the questions, "Do persons struck by lightning see the flash?" "What organs are most usually affected in death or injured by lightning?" and several other points involving considerations of exceeding interest, were necessarily omitted to give place to the treatment of topics, if not so fraught with interest, yet deemed indispensable.

This paper already too long protracted should not be concluded without a word in favor of that agent, which throughout has been treated as an enemy. By it the air we breathe is made purer; *by it,* from the combinations it effects in the elements of the atmosphere, the results of which are brought to the earth in summer showers, the soil we cultivate is made richer; by it, when under the control of man as he is learning to control it, the homes we inhabit are made happier through the advantages derived from the encomparable swiftness with which it flashes our thoughts from continent to continent, and almost literally around the world.

While remembering and acknowleding its beneficience, let us not forget that He who "directeth his lightning unto the ends of the earth," has pointed out the means by which we may protect our firesides and all we hold most dear from its otherwise terrific or fatal attacks.

WEDNESDAY, January 24, 1872.

The Board was called to order at 10 o'clock, COLONEL SWETT in the Chair.

ORCHARDS AND FRUIT CULTURE.

MR. T. S. GOLD of Connecticut.

Mr. President and Gentlemen:—In opening the discussion upon "Orchards and Fruit Culture," I shall not advert to the great enjoyment and profit to be derived by the farmer from this branch of agriculture, but shall confine myself to a plain statement of those practices which I have found in my own experience and observation to be essential to successful fruit culture, principally confining myself to those leading fruits—the apple and the pear—which are best adapted to general farm culture.

First, our attention is drawn to the soil. The essential thing is that it should be dry; that the trees planted upon it may have what is called a dry bottom, and not stand with wet feet. In some sections of the country, any artificial methods to accomplish this are entirely unnecessary; there is no hard pan underlying the soil; there is no difficulty in the roots getting down to any desirable depth; but in other sections it is very different, and provision must be artificially made for this, if it does not naturally exist in your lands. It is absolutely essential to the successful culture of fruit, that the land be naturally or artificially under-drained, so that the water can flow off freely, and not stand about the roots of the trees.

The aspect has much to do with selecting a location for an orchard. And here let me remark, that sometimes orchards succeed in one aspect and sometimes in another, even within a very limited area, and upon a single farm; an orchard one year where the fruit is brought forward early by its sheltered and warm position, escapes; another year, an orchard by its position, is late, escapes frost, and if a man wants to be sure of fruit upon his farm, for the supply of his family or for market, it is very desirable that he should select different aspects and locations for his orchard, and not confine it to one single field or enclosure.

With regard to the preparation of the soil. If the land is capable of culture, usually deep cultivation with some crop, corn, potatoes or other hoed crop which admits of high manuring, and requires it, for success, is the best preparation of the soil that you can make. On some rocky, fertile hillsides, that you could plant and plant successfully with trees, this culture cannot be adopted; but upon any land that is capable of cultivation, there is no other method of preparing it so cheaply or easily as to put it through a course of cropping of this kind. We are oftentimes advised to dig the holes six feet across and two feet or more in depth. Well, if the soil does not, from its deep drainage and thorough culture, admit of such holes—if they are but basins in a hard, cold, tenacious subsoil, such excavations are worse than useless. They may for a time favor the growth of the young trees if they are filled up with rich compost, but in planting an orchard, we should look in the main not for the immediate starting and growth of the tree for a year or two, but look forward to its permanency through many coming years.

In planting an orchard, as the work is to be done but once, it should be well done. In preparing the holes for the trees, the size and the shape of the hole are important. The size, in well prepared soil, should be large enough to accommodate the full spread of the roots of the tree that it is designed to plant The shape of the hole is also important; it should be highest in the middle, gently sloping towards the exterior. Then your tree naturally and most favorably adapts its roots to this position. If the hole has been dug by a common laborer, he will doubtless scrape it clean, and give you a plain flat surface upon which to plant your trees. That is not what you want; you want a gentle elevation adapted to the form of the roots of the tree, to facilitate planting in the most perfect manner. Prepare the roots of your tree by cutting off every wounded part with a sharp knife, in a slanting cut, and prepare the top by the removal of at least half of the last year's growth. It seems wicked to a farmer to cut away fine strong shoots—to lacerate his tree in this way; but at the end of two years, if not at the end of one, he will have a larger tree, and one of better form and proportions, than if he planted it with its full sized branches.

With regard to the age of the tree, I am in favor of planting young trees, two or three years from the bed in the nursery, rather than large trees that have grown up so that the cattle will not break them down. Farmers too often seek for large trees that have been grown closely in a nursery and have great tops, but the roots of such are small—all out of proportion to the size of the top, if so grown. In selecting trees, if you can select in the nursery, secure those not only with well balanced tops, but with well balanced roots. The tree that the nursery man has been obliged to stake in order to cause an upright growth is not a good one to select. The *variety* has very much to do with the mode of growth, and it has also much to do with the form of root growth; so much that I will warrant that if you were to go into a nursery to select your trees, there are some varieties, no matter how good the fruit, or how anxious you were to plant trees of that variety, if you saw how provokingly they grow and how awkwardly, you would not put them into your orchard. I have in mind now the Swaar, which you know has peculiarly unfortunate habits. The growth of the top affects the roots, and with a one-sided top you get a one-sided root, wanting in fibres and attachments to the soil, so that almost always the tree as it grows up will fall over. In selecting varieties, you can just as well get those that have a strong, even-balanced growth of root and top, and which are productive in choice fruit, as to get awkward growing, feeble varieties; and your success and satisfaction in orchard culture will depend very much upon a proper selection of varieties.

I cannot tell you what varieties are best adapted to this locality or any other in Maine, but every section of country has developed varieties of fruit well adapted to cultivate there, and that succeed there better than anywhere else; and it is for you, by an examination of the orchards in your own vicinity and upon soils similar to those upon which you propose to plant, and by trial upon your own grounds, to ascertain the varieties which are best adapted to your own location.

With regard to the time of planting. In some soils and sections we are advised to plant in the autumn, in others in the spring. With me, in a somewhat tenacious, loamy soil, I prefer spring planting, but I am satisfied that the failure of my experiments in autumn planting has been largely due to the fact that I planted too late. If you plant in autumn, plant early, so that the little granulations may form upon the roots, and the plant may become adapted to its position before severe weather. I planted late in autumn, with general failure. I find that nurserymen are taking up their trees as early as the frosts of autumn cause the foliage to drop, and even go into the nursery and strip the leaves from the trees; and I have good reason to believe that they may be planted successfully at that early season, say early in October, with good results; but if deferred later, until there is danger of the roots being exposed to the frost, or even without that, it is very undesirable to attempt to plant. The roots of a tree, in its transportation from the nursery, and while being planted, should never be exposed to frosts. If carefully wrapped and covered with moss and earth, they may endure this exposure, but there is a damage to the vitality of the tree, if only a part of the roots are frozen. I have seen them go back and back, through two or three years of existence, where they had been frozen, and finally take their departure, much to my satisfaction, if they could not do any better; and I could attribute it to no other cause except the freezing of the roots while they were out of the ground. If possible, the roots should always be kept moist, so that all the little fibres, which are exceedingly delicate, may be preserved. You know that this is an absolute necessity with evergreens; the roots *must never become dry;* and although the roots of fruit trees will bear some exposure of that kind, still everything in that direction is just so far wrong, and should be avoided.

In planting the tree, carefully work in about the roots with the hand fine pulverized mixed soil, just the soil that is produced by the culture of the field in corn or potatoes for a year or two, gently, very gently shaking the tree. The operation must be a gentle one, so as not to bruise the roots or cause them to lodge in a crooked position. Having spread them out carefully at first, and when carefully covered with a few inches of this fine soil, the operation will be very much facilitated by pouring in a few quarts of water, and allowing the earth to settle away before filling up the hole. This is much preferable to attempting to plant a tree during rainy or bad weather. I have never had less satisfaction in planting trees than when I have attempted to do it in rainy weather. It is an operation requiring care, and one which will not admit of being hurried; and although we like to keep the roots wet, and would think a rainy day was a good day for this work, it is not the best day; we do not do the work as thoroughly and carefully as it should be done.

If the roots are well-balanced and the top properly shortened in, there will be little if any need of staking the trees. There is as much, and perhaps more damage done to the trunk and to the branches by attempting to stake them, than by leaving them unsupported, so that I should advise the securing of trees by their roots; and if this be done the tops require nothing of the kind. A field devoted to orchard planting should be so fenced that all animals are excluded, so that the young tree may never be exposed to their depredations. Calves have proved within my observation the most objectionable animals that get into a young orchard; you never know what they will do over night. On my way here, I saw a young orchard near a barn where calves were allowed to lie, and those trees had been girdled nearly from the root to the branches this very winter; and all of you doubtless recollect cases within your experience where you have found them most unsafe animals to get into an orchard.

Should an orchard receive any culture? Here we come upon very disputed ground. The circumstances of location, the strength of the soil, products of the farm, facility of obtaining manure, and various other points, come in here and are to be considered. My practice has been, while the trees were small, to cultivate with some low, hoed crop, potatoes, roots or something of that kind; but I insist strongly upon leaving plenty of room about the tree that is not planted with any crop. In plowing an orchard, my difficulty has been to prevent my men from plowing up the trees. They would plow too close to the trees and too deep, so that oftentimes they would do more harm than good. After the trees have attained some size, unless the culture is very careful and guarded, I believe they are often as much injured as benefitted by it; and I have seen many cases of the most successful orchard culture and growth where the land has been laid down to grass and allowed to remain so. If the land is to be in grass, I advise pasturing rather than mowing. I advise pasturing with sheep and swine, if possible; with larger animals only when the trees have attained sufficient size so that the branches are in a good degree above their reach. One great advantage connected with pasturing over any other system is, that all the fallen fruit, during the whole season, is consumed by the animals, and with the fallen fruit the insects which are our great enemies in orchard culture.

I had an orchard of full size that had been plowed, cropped, manured and mowed—always carried through such a succession of crops. The trees were getting old and seemingly becoming valueless. About six years ago, I turned it out for a cow pasture, and my herd of cows preferred to lie there rather than in any other part of their range. The result has been marvellous. The trees have assumed a rich, healthy green, the foliage has come out luxuriantly and holds on well in the autumn, and the growth of fruit has been in every respect satisfactory. I pastured it until sometime in July, and then shut it up, as the weight of the fruit begins to bend down the branches, until the fruit is gathered in autumn. One of the difficulties connected with mowing an orchard, although you top dress it to restore what you take off, is that the sudden removal of a great growth of grass at that season of the year changes the condition of the roots so much and so suddenly, that it does not seem to be desirable for the growth of the tree.

In regard to the training of trees and shape of the top, in your selection avoid a tree that forks. As it grows up one side or the other will almost always get the advantage, and it will split down. Take a tree that branches out evenly from the head where you wish the branches to start. With regard to the height selected for branching, the variety will have much to do with that. Some trees that grow continuously upward may branch very low and still be always high enough. The Northern Spy is an eminent example of that kind,—the growth is continuously upward; while others, like the Greening and Baldwin, which spread widely, and droop in their branches, should have much more height of body before they are allowed to branch. The practice of allowing trees to branch out close to the ground has been advocated by some. The objection is, that the fruit on those lower branches never acquires the color that it does higher up. It is apt to be spotted and marked with gray mould and mildew, more than where there is a freer circulation of air about the tree.

There is one point which I omitted when speaking with regard to location and aspect, and that is shelter. If you can have a fairly ventilated location, with shelter, that is very desirable. You doubtless have your ice-storms here, and some protection against these is absolutely essential to success. If your trees after they get grown and begin to bear are crushed down by a weight of ice, it is very discouraging. A grove of evergreens, either growing naturally or planted artificially at the time your orchard is planted, and allowed to grow up with it, will do much to protect it from unfortunate effects of the season.

With regard to pruning, my advice is to prune little and often. That is, once a year the trees should be looked over; but excessive pruning should be avoided. If it is necessary that a limb should be removed, remove it at once; do not wait until it has grown to be large, but remove it while it is small, when you can do it with your knife, or when you can remove the shoot with your fingers, rather than let it grow and take it off ten years hence, when it becomes a serious operation to the tree to have its branches lopped in that manner.

With regard to the time of pruning, there has been some disagreement among pomologists, but it is pretty well settled that the mild days of winter will do very well for pruning, and that it is better to do it at that time. If we delay it until June, the pressing operations of the farm always exclude careful pruning. Prune with a clean, smooth cut, just close enough so that the wound may heal over—not too close, so as to leave a large scar upon the branches, as is sometimes done. Do not leave a stump sticking out to rot off, because when it is gone, you will find a hole rotted into the tree, just as surely as you do so. All "water sprouts," as they are called, suckers growing from the base of the tree, or growing from the limbs, should be carefully taken off at least once a year. Secure a well-balanced head. Some varieties have such a disposition to grow one-sided, that after planting properly, you must look after them carefully. You can do much by early pruning towards keeping a well-balanced head, sufficiently open to enable you to gather the fruit comfortably, and to allow a free circulation of air, that you may have perfect fruit. These are the objects to be secured in pruning.

Gathering the fruit. If for winter use, or for market, too much pains cannot be taken here. The practice of shaking upon the ground and gathering up the bruised, crushed and battered fruit, is simply a barbarous custom. The most delicate varieties of autumn fruit can be kept, if carefully gathered, even into midwinter. I have the *Fameuse,* or Snow Apple—*Pomme de niege*—some of you know it, undoubtedly—a famous apple, good in October. I have it now in my cellar. It has lost some of its flavor, to be sure, because it has been kept past its season, but by careful gathering it will keep, and so will other varieties keep. The Fameuse suffers more from careless gathering than almost any other variety. It is so tender and delicate when taken from the tree, that it readily bruises, which injures its quality very much. My practice is to gather in baskets and put directly into barrels in the field, transport them carefully to some out-building, where I can keep them cool and moderately ventilated, until it is time to put them in the cellar, and then remove them to the cellar. If they are to be sent to market, you know the rules of packing. The barrel must be full—it must be a little more than full, so that the head will press firmly upon the fruit, that there may be no jolting in transportation to market, and that they may arrive in the same order as they left your farm. But I refer especially to the preservation of fruit for your own use as farmers. You can just as well have your fruit keep if you will gather it carefully from the trees. You save the labor of sorting during the winter, by putting the picked fruit of one variety by itself in a barrel at the time you take it from the trees; it is all alike, fit for use at one time, and there will be little if any loss from decay.

With regard to the diseases and insects to which our fruit trees, especially apples, are exposed. The cold, wet soil, in which too many orchards have been planted is frequently the cause of the curling of the leaf and the decay of the outer branches, so that the tree very soon becomes, so far as the extreme branches are concerned, dead; and then it will be filled up with suckers and water shoots, that produce nothing. A healthy growth that will thoroughly mature the wood before winter is the great secret of hardiness in fruit trees. If by your culture—if by your system of manuring, you can insure that, you will insure your trees against winter killing in any form, and your culture should look towards that. Any system of culture which causes a vigorous growth towards autumn, is bad for the trees. Well ripened wood—and this is especially necessary in the pear—is of the utmost importance to the life and health of the tree.

With regard to enemies, we have the canker worm, we have the nesting caterpillar, we have the apple worm that bores into the apples, and last of all we have the apple maggot, which is perhaps unknown here, but which is a very serious drawback to the culture of the apple.

Question. Let me inquire if the apple maggot attacks the apple upon the tree, or after it is picked?

Mr. Gold. I have had no great experience with the apple maggot. I think its devastations are often not shown until after the apples are gathered, although they are found in the apples when lying upon the ground under the tree.

Mr. J. S. Gould. The eggs are always inserted when they are upon the tree.

Mr. Gold. It is a new pest. I do not know how far the canker worm is known in this State.

Mr. Perley. Not at all.

Mr. Gold. A very happy exemption. You probably have the apple borer which works at the root. Farmers look at their trees a few inches above the surface, and find some holes there. That is the first warning noticed, and they make an examination; they find nothing but a hole. It is where the borer came out. The borer is an insect that attacks the tree just at the surface of the ground. Two crops of eggs are laid, and they hatch at different seasons—a small white worm proceeds to bore his way into and beneath the bark, and into the wood, working onward and upward, and in the course of a year or two, makes its exit some inches from the surface of the ground; and when you see that little round hole, about the size of a goose-quill, you may know that he has gone. The only remedy, after he has once entered the tree, is to punch him out with a wire or cut him out with a knife or gouge, and it is not so damaging to the tree as you might expect The wound heals up readily. While the borer is at work, it is a growing sore, continually sapping the vitality of the tree; cut it out and it becomes a healthy wound, which will heal over and the tree will recover. But "an ounce of prevention is worth a pound of cure" here. Various applications are made to the tree to render it distasteful to the borer, and prevent the female from laying her eggs. Almost anything that will not injure the tree and that is noxious to insect tastes, will accomplish this. Washing with any one of the various offensive and tenacious liquids, which will hold on during the month of June, is very sure to accomplish it. Whale oil soap, and carbolic acid soap, have been recommended and used with success. The application of gas-tar in autumn has been recommended, and is claimed to be safe. I never have tried it. Whale oil soap, or anything of that sort, is very distasteful to insects, and the action of the mild alkali upon the bark is favorable to the growth of the tree. Nothing safer can be recommended than a wash of that kind.

Nothwithstanding all these insects that are ready to attack our trees, we have no reason to be discouraged. I think the success of fruit culture has been quite as good as we ought to expect, considering how much this department has been neglected. If we raise a crop of corn, we expect to manure it; if we raise a crop of apples, ought we not to provide food for the tree? Whether this is to be done by mulching the surface, so as to favor the decay of vegetable matter already in the soil, or by the direct application of manures to the tree, every one must decide for himself, as his own locality and circumstances may seem to demand; but it is evident to every one, that we ought not to expect to get something out of nothing; and is it not very much like this to plant an orchard and leave it neglected upon the barren hillside, and then complain because we get no fruit?

I will not take up your time with more extended remarks, as I did not design to exhaust the subject, but merely to present some general points in fruit culture.

Mr. Hersey. How far apart would you plant trees in an orchard?

Mr. Gold. I should give them considerable room—30 or 40 feet, at least—rather than the close planting I have sometimes seen practiced. Close planting does very well when the trees are young, but at full maturity, it is a great damage. The necessity that I have seen brought upon some orchardists of cutting down half of their trees, fifteen or twenty years after planting, has not seemed to be beneficial even to the trees that were left.

Mr. Lucas. How many would you ordinarily set upon an acre of ground?

Mr. Gold. About forty apple trees.

Mr. Lucas. A good orchard man in our county, Mr. ———, says seventy here in the State of Maine.

Mr. Gold. Mr. Stephen Hoyt of New Canaan, Conn., one of our best nurserymen, has many acres planted in orchards. He planted this large number to the acre, and he is now—the trees having been planted some fifteen or twenty years—obliged to cut down one-half of them. It is a very disagreeable necessity to be forced upon any one, and it does not seem to favor the trees that are left. I was through his orchards last fall, and he told me he had planted too thick.

Mr. Lucas. I have an acre and a half that has two hundred trees. The first of them were set out perhaps forty years since, and about half of them are alive; nearly half of them died in 1856 and 1857. Those trees were set out a rod apart. The proper distance is an important consideration.

Mr. Gold. Some seasons there seems to be an advantage derived from this natural shelter; other seasons it seems to operate disadvantageously; but I prefer to look forward to the full development of the tree, rather than to its partial development for the first few years.

Hon. S. F. Perley of Naples. I have been exceedingly interested in the remarks of our friend from Connecticut in regard to the manner of treating apple trees, in the first place, because

I know him to be good authority, and secondly, because I am much interested in that subject myself. We are always interested about that in which our profits lie. Mr. GOLD has endeavored to give us general principles rather than specific instructions. Very good; now if you will allow me a short time, I will confine myself more particularly to details. There is but very little new to be said. Nearly all that I propose to say may be found in many fruit books that have been published, but sometimes when we hear the experience of any one from living lips, it has more influence upon us, and does us more good than to read it in a book. I will speak more particularly of apples, because this, in my judgment, is an apple region. Pears need not be excluded; but the lands of Oxford, Franklin, northern Kennebec, and northern Cumberland, where I am best acquainted, are peculiarly adapted to the growth of apples. We often make a mistake in undertaking to raise that upon our land which the ground was never designed to produce. We may make that same mistake in planting orchards. The best judgment should be exercised in selecting the site. I will speak of Oxford county, because we are now upon its soil. It will be observed by all those acquainted with these ridges, that they gradually slope to the north and usually break down rather abruptly to the south.

Professor Agassiz gives us the reason why we find the soil on the northern trend of these hills deeper. Generally in selecting a site for an orchard in Oxford county, I would select a northern trend, first, because it has a better exposure, and next, because we get a greater depth of soil. The soil is almost invariably deeper upon the northern than upon the southern side, and in my observation, the best orchards are to be found upon the northern side. In regard to the adaptation of the soil to apple orchards, my observation is this: that the poorest soils that you can plant an orchard upon (trees will grow almost anywhere,) are sand, stiff clay and muck. The best soil upon which you can plant an orchard with a prospect of success is limestone or granite soil, where the granite is largely composed of feldspar.

Professor Emmons tells us that in one hundred parts of the ash of apple wood, (sap wood,) there are sixteen parts potash, eighteen parts lime, and seventeen parts phosphate of lime. In feldspar and granite we find a considerable per centage of potash; in limestone soils we certainly find lime. Now, if we would plant our apple trees in the right soil, we should take those which nature has most fully fitted to the growth of the apple. If our soil is lacking in any one of these constituents, we must supply it ourselves. So I say that a limestone or granite soil is better than any other, and here in Oxford county no one will deny that we have a granite soil; and from my observation of many localities, at least, in Oxford county, the granite is very largely composed of feldspar.

Our friend from Connecticut has spoken in regard to the protection of orchards. I simply wish to mention in that connection one very serious loss from lack of protection. You have better trees where they are not twisted and turned about by the winds and heavy gales that we have. We all know that our forest trees are what we call "shaky," the high winds blow them back and forth, and induce broken trunks at the butt. Apple trees are in a measure liable to the same injuries. If we get them out of the range of these strong winds, we have more healthy trees. But beyond that, when we come to harvest our apples, it is very unpleasant to find, after some northwest gale, twenty-five out of fifty barrels on the ground. I have seen one-half the crop on one hundred trees shaken off in fifteen minutes by a single gale. We want to place our trees where they shall not be exposed to these strong winds.

I agree most cordially with our friend in regard to the preparation of the soil. After having selected it, let it be thoroughly drained first, if necessary, and then thoroughly tilled. I would not plant an orchard upon a piece of ground without subsoiling it. You cannot do that well after you get your trees planted. You might do it, perhaps, within three or four years, but soon the roots run out so far that it is not possible. Then, when you come to dig the holes, don't talk about digging out great holes; if the whole field is what it should be, all the hole you want is sufficient room to spread out the roots. Then sift the finely pulverized earth among the roots, so that they will have a chance to grow. My experience in this is, that the roots of the tree should be placed so that they will form a support all round the tree, otherwise you will have to stake it, and I would not give a cent for a tree that needs to be staked. I would not have it in my orchard. When you have spread the roots properly, lay the earth upon those roots, gently pressing it down, so that there shall be no air spaces around or among the roots. Let the earth be brought *closely in contact* with every root, no two roots touching each other, and, if possible, no two roots crossing each other—but all spread about the tree so that where they take hold of the ground, you have a perfect support to your tree. I should hardly agree with him in regard to pouring water into the hole. I would select for setting out a tree a time when the ground is dry enough that you may handle it readily and intermix it thoroughly with the roots without any trouble. and trust to the next rain that comes to settle it down.

Now in regard to the choice of trees. As to their age, it depends upon how thrifty they were in the nursery. I should prefer pear trees not more than one or two years old. There is an old and trite saying, "As the twig is bent, the tree is inclined." We may train up a little tree just as we may train up a little child, and shape it about as we please. But take one that has grown up high and awkwardly, perhaps, in coming from the nursery, all the buds will be rubbed from one of the side limbs, (if they are not broken,) and it is difficult to make a good tree without cutting it close down again. I would say then, take small trees; I certainly would not have them more than three or four feet high, because small trees need no staking, their roots are more likely to be sufficient, and you need to cut them back but little.

I was glad to hear the question raised as to the distance that trees should be set apart. I see no greater error in connection with the cultivation of orchards than in the distance between the trees. Mr. Gold says, thirty or forty feet. In the main I agree with him. It depends much upon the variety. The Baldwin, the Greening, and several other large growing trees, should certainly have forty feet. I have in mind an orchard set out 24 feet one way, and 27 the other, making 25½ on an average, The trees have now grown to full size, and a man cannot handle a ladder properly among those trees. He must push it up among the branches to get at the apples. The branches interweave, and we know that the roots are interwoven more than the branches. The roots of apple trees frequently run off four or five rods from the trunk. Thirty or forty feet is little enough for the larger growing trees, and I am not sure but it is little enough for almost any. The last I set out, I put fifty feet apart. And here, upon our hillsides, where land bears only a moderate price, we ought certainly to give trees all the room they need; and for another reason, because they will be more profitable in the end. It requires a good deal of courage in a man to cut down trees that he planted ten or fifteen years before; very few will do it. Again, the ten or fifteen years' growth of those trees which you cut down is so much taken out of the soil, that ought to have gone into your standards. On my way to this place, I passed a row of trees set about twelve feet apart. Now I am quite certain that half of them would be worth more in ten years than all of them will be. Experience has convinced me that it is a serious error to set trees too close.

The time of planting in my judgment, is when the leaves are off and the ground dry. It is absolutely necessary to have a dry soil in order to set a tree well. If you plant in the fall, the sooner you do it after the leaves drop the better; and if in the spring, let it be as soon as the ground is sufficiently dry to do it properly.

In regard to the subsequent treatment of the orchard, I would say by all means keep it under cultivation until the trees are so strongly established that they can bear swarding over without serious check to growth. I agree too that it is desirable to plant low-growing crops, such as beans, tomatos, cucumbers, etc. Turnips and potatoes were mentioned; I would suggest to whoever may plant potatoes or turnips in their orchards, that they take care to manure liberally with unleached ashes. Potatoes and turnips are potash feeding plants, as well as the apple tree, so that if you take potash out of the ground in the form of potatoes or turnips, you must replenish the supply in the soil, or your apple trees will suffer. Ten years is the shortest period which an orchard should be planted out before it is swarded over.

In planting, let the utmost care be taken to set the rows perfectly straight—as straight as a line of soldiers, well drilled. It requires two or three men to do it well. There must be a man upon one side to set, and a man on the other side to set, and another to hold it. You cannot do this thing cheaply. It must be done well, and it must be done at some expense or it cannot be done well. It is economy to plant straight and well, and there is beauty in it, too. There is beauty in almost anything, if it is done well, but particularly in an orchard.

I was troubled when a boy, and I have been troubled even since, when plowing in an orchard with oxen, where the trees were not perfectly straight; the off ox always will have his head on the other side of the tree. It is a terrible annoyance. He will be sure to carry his head or horn round and break off some little limb which you set everything by. I never let an ox go into an orchard except to plow, and then only after having been through the orchard close to the trees with a plow drawn by a single horse. I take a horse and a straight whiffletree, and wrap that well around with cloth, so that it shall rub but little if it hits a tree, and put a trusty boy on the horse, and then I can get near the trees; after that, I put in oxen and plow between the rows. It is almost impossible to get men to plow without plowing out the roots. They are anxious to do the work thoroughly, and perhaps it's not their fault always, and perhaps it is; at any rate, the utmost care should be taken not to break the roots of the tree with the plow. If a root is broken, you ought to dig down and cut it off with a knife. I would say, that after the roots get spread, thorough cultivation, not deep, is what is wanted in a young orchard.

Those about to plant orchards of course will cast it over in their minds what should be the manure. I have found nothing better than a good compost made of manure and muck; old yard manure is good, ashes we know are good, lime is good, superphosphate is good, but avoid green stable manure.

I would say further, put your manure on in the fall, pile it a little cone about the tree, and in the spring spread it—the little pile will keep the mice away from the roots during the winter. Frequently we see orchards almost girdled by mice, and particularly those standing in grass.

Now, in regard to this matter of cultivation, some may be discouraged and say, "If we have to cultivate this ground ten years, the orchard will cost more than it will come to." You will pardon me for citing my own experience. I have a pear orchard of about three acres which has been under cultivation ten years. The crops I have taken from it have paid all the expenses of cultivation, the expense of buying and planting the trees, and I have those trees as they now stand over and above the expense. I do not know what they are worth, but no one could induce me to cut them down for ten nor twenty dollars apiece; so I say it is not all out-go. While you are cultivating your ground the ten years, you may have your pay as you go along.

After the trees get large enough to take care of themselves, it becomes a pretty serious question what we shall do. My judgment is,—subject to change when I see reason to change,—to run the orchard to grass, and pasture it with sheep. Other things will do; but calves are dangerous—hogs are dangerous. They bark the trees, and so will sheep sometimes, if you pasture too close; but take it all in all, I had rather have sheep in my orchard than any other stock; they manure it more evenly, they enrich it in a peculiar way. There is something in the old saying, that "sheep leave golden tracks." I know they manure a piece of ground better than any other stock. Allow me again to cite my own experience here. I have an orchard of a little over four acres, one which my father had plowed and planted, and mowed and hoed, as Mr. Gold treated one upon his farm. When I took the farm, the orchard was run out, and for ten years I hardly got ten dollars profit out of it. I undertook to cultivate it. In plowing, the roots would stick up all about. It was terribly discouraging. I manured it, but still the apples did not come. Going into that field one day when it was in potatoes, I made up my mind I would never put the plow into that orchard again, live as long as I might, and I left the potatoes in the hills. I never again put the plow in, but left it to grow up to grass, if it would; I did not care much whether it would or not. Little or nothing has been done to it since, except to pasture sheep. I turned in half a dozen at first, and in four or five years increased them to twenty or twenty-five. Now for the result. The sheep were turned on in 1856; no account was taken until 1860. Then I got 620 bushels of apples. There are 260 trees in the orchard. In eleven years, from 1860 to 1871, I harvested 6,417 bushels from those acres, which brought me $5,046.66, exclusive of some which I made into cider, leaving me a net profit, over and above expenses, of $4,598.79. I have charged the cost of fencing, the cost of the little manure I put upon it, and the cost of some underdraining that it needed; I have charged eight per cent. on the estimated value for rent and taxes, and over and beyond all these expenses, that piece of land has paid me $4,598.79; more than $100 a year profit per acre; and all I did was simply to turn it to pasture, putting in sheep. I do not think I put on $20 worth of any other kind of manure. The trees have averaged only $1.85 per year. That looks small, but when you take the aggregate, it foots up very satisfactorily. It is more profitable than any other farming I do. I will state that last year there were only sixty bushels of apples in that orchard, so that some other years yielded pretty heavily; one year, 1,002 bushels, another 1,025, and another 704 bushels. I have turned in young stock since, which have done very well, but the trees are now somewhat old, and the bark hard, so that calves have no inclination to gnaw them. I turn horses in sometimes, they are less injurious in an orchard than neat stock. They browse but little, and seldom pick off apples, confining themselves to what they can get upon the ground. The windfalls in almost every case contain at least one apple worm, so that we consider it an actual benefit to let them eat as many as they please, if it is a hundred bushels; we are glad to get rid of them, and it is much cheaper than to pick them up.

I have in my mind another treatment of an old orchard which I saw in New Gloucester. The soil was very similar to this—good orchard land. The owner had recently put in a team strong enough to carry the plow right through at considerable depth, and I never before saw so many roots sticking out. It was harsh treatment. I did not see it again for five or six years; but when I did, more than half the trees were dead and gone. It will not answer to plow an old orchard and break off the roots in any considerable quantity; they need their roots. The better mode is to improve the land by top dressing.

MR. PEIRCE. If he had cut off half the tops, would he not have saved them?

MR. PERLEY. He did prune severely. Perhaps the trees were too old—too far gone; there is a point beyond which it is impossible to revive an old orchard. The one I spoke of on my own farm was not more than sixty years old.

In regard to grafting, I prefer to take good thrifty seedlings from the nursery; plant them in the orchard, and when they are large enough, graft into the limbs from one inch to an inch and a half in diameter. There are some varieties that will not, in this climate, make good trees by being budded in the nursery; one such is the Baldwin, our most important apple. It is of no manner of use to purchase Baldwin trees budded in the nursery. They will not do anything. I have budded them in the nursery myself, and I have seen them purchased from good nurseries, grown by faithful, honorable men. It was not the fault of the nurseryman; the fault is in the tree itself. It must be grown, if grown at all in Maine, by planting strong, hardy seedlings in the orchard, and grafting in the limbs, when of suitable size.

A word here in regard to the position of grafts. We often see trees grafted where those who do it seem to be afraid to cut the best limbs; they graft into little stunted limbs and leave the best ones upon the tree. What is the result? The grafts never grow well and there they stand year after year. The proper way is to graft into the best limbs, and those in the best position to make a new top. You must consider that you are about to ruin the old top, for the sake of getting a new and better one. You can hardly pass through the country anywhere without seeing this mistake made in grafting.

To enter a little more into detail in regard to the borer. The hole which we see in the tree, from an inch to two feet from the ground, in the Spring, is that from which the bug—I will call him a bug, because we shall all understand that—comes out in the latter part of May or early in June. Within two or three weeks, the female lays her eggs and they hatch in July. The eggs are laid in two rows of four eggs each, and one at each end. They are always placed in that position. You seldom see the borer. The first year they simply bore through the bark. You will find at the foot of the tree the reddish castings which they throw out, and if you examine closely enough you have only to cut through with your jack-knife, without wounding the wood or the tree in the least, hardly cutting through the outer bark, and you may kill eight out of ten of the borers. They lodge themselves between the wood and the bark the next winter, and the following spring they commence their most destructive work. They set at work with their auger and bore upwards, and if they are not taken out as early as June or July, they will have got so far that it is of little use to follow them. Before that time, you may dig them out with your knife very easily. I sometimes use a wire and frequently a spear of grass will kill them, but after July you had better not undertake to cut them out; you will damage the tree more than the borer will. I prefer to fight this insect by extermination rather than by attempting to put on anything repulsive, for the reason that if he is once killed, he is gone, but if you drive him from one tree he goes to another. If he does not attack the apple-tree, he will attack your mountain ash or thorn tree. The second year, after having completed his growth, he bores up the trunk. There the chrysalis is formed and lies through the winter, and the next spring it comes out. The first year, and the early part of the second year, are the proper times to fight them. If any one understands the habits of the insect, it is easy to take care of it.

The most shameful sight I ever saw in an orchard was in Massachusetts. I counted twenty-five or thirty nests of the tent caterpillar in a single tree in the old State of Massachusetts, and every tree had more or less on it. Now it is one of the simplest things in the world to take care of the tent caterpillar; it only requires a little attention. We all know that the eggs of this caterpillar are laid, several hundred of them, in a little ring on the ends of the twigs. They hatch out just as the leaves are forming and grow two or three weeks before they become large enough to scatter about. While they are feeding upon the leaves their habits are very regular. Unless the weather is bad, they come out of their nests about eight or nine o'clock in the morning to feed; return in the heat of the day and lie idle; then in the afternoon they come out again. You can destroy them very easily when they are in their nests with your hand, or in many other ways.

The aphides or plant-lice are a very serious damage to young trees. Sometimes, when you think your trees are all nice and healthy, you will find the ends of the twigs covered with those little greenish lice, and wonder where so many came from. They live upon the juices of the tree, and unless removed, are very injurious. In regard to the rapidity with which they multiply, Reaumur says that six thousand millions may be produced in five days. They not only lay eggs, but as soon as they are hatched, he says they begin to produce without copulation. They are a most wonderful insect. They can be easily destroyed by dipping the twigs into whale oil soap, diluted, or anything that will destroy them and not destroy the foliage of the tree.

The bark lice are a serious injury under some circumstances. These can be best taken care of by washing; it requires sometimes pretty thorough scraping; you may even be obliged to put a little sand in. The curculio, which is so very destructive to the plum, is also an enemy to the apple. Our most tender skinned varieties, as for instance the Nodhead, are frequently stung by the curculio, and the value of the fruit very much diminished. But the worst enemy of the apple in the State of Maine is the codling moth, or apple worm. Dr. Trimble of New Jersey, has studied the habits of that insect and gives us his method of destroying it, which he thinks will prove effectual. It is to wind hay bands around the tree, and let the insect, when it comes to form the cocoon, make it in the hay and then take the band off and burn it. It is a good deal of work; but when we come to harvest our apples in the fall, and out of five barrels find three of them so wormy as to be unfit for market, we begin to see the necessity of spending a few minutes in taking care of that enemy.

I cannot help saying a word about harvesting. Two winters ago, in passing from my place to Portland, I was stopping at a tavern, and a man brought along some Porter apples, as he called them, to sell. The tavern keeper said he thought it was out of season, and asked me to see if they were Porters. I examined the apples, and they looked like Porters, they tasted like Porters, and they were Porters. I asked the man how he kept them so late, and he said simply by careful handling. He picked each one with his own hands, and they were not bruised in the least. One reason why Western fruit brought into this State usually brings a good price is careful handling, so that it is not bruised. Now, in order to pick apples without bruising, the basket should be lined. Take a half bushel basket, with a hook, so that you can hang it up in the tree within reach; instruct your men to lay the apples into the basket, not drop them an inch. Just as sure as an apple is dropped, if it is not more than one or two inches, it will be bruised. The bruise may be slight, but it is a bruise. Take the Yellow Bellflower, for instance; the skin is almost white, and a very little bruise will suffice to injure it. I never had a man yet who could bring in a half bushel of Bellflower apples without showing that he had dropped them. The utmost care is required in handling all the way through. My own practice is, to have them gathered into half bushel baskets, set in a wagon, and taken to the storing house, and there they are laid carefully into the barrel.

In regard to packing into barrels, we farmers of Cumberland and Oxford, and all about, are verily in fault. We send our apples to market in poor barrels. We would not buy a barrel of flour in such a package; you would say that the flour could not be good packed in such a miserable looking barrel. In the first place, you should have good barrels, and they ought to be uniform. If you can get flat-hooped barrels, let all the hoops be flat, and not part flat and part round. Let the outside of the barrel be clean, of course, but the inside *must* be thoroughly clean; thoroughly wash every barrel, and have them completely dry before the fruit is put in. We send too many poor apples to market—too many wormy apples—too many small apples; and we must expect the price to be low as long as we put up so poor fruit. Better fruit will command a better price; good fruit is always in demand. In filling a barrel, it should be frequently rocked, not violently, so as to bruise the fruit, but gently, so that every apple will take its place. Fill the barrel a little more than full, about up to the top of the chimb, place the head on and press it down with a lever or screw. You will spoil the upper layer, but you had far better spoil that the than have apples loose.

In regard to facing the fruit in the barrel; I do not believe in "deaconing" a barrel of apples—that is to say, putting good ones on top and anything that happens underneath; but I do believe in "facing." What is facing? I suppose you all know, it is simply taking some good, fair apples, and placing them on the bottom of your barrel, the stem end down. Then fill up your barrel, head it up, and turn it over, and mark the other end for the top end. When that barrel is opened you see a layer of very handsome apples. Now, the dealers to whom I sell my apples say, "We do not want you to 'deacon,' but we can sell your apples better if you will just face them." There is no cheating about it. It is understood that if you face a barrel of apples, it is simply for the beauty of the apples when the barrel is opened. That is a very simple thing, and inasmuch as it is not dishonest, I have begun to practice it. I must say, that when I go into Portland and see the Western apples opened there, every barrel faced, they look beautifully; and our apples will look just as well if we take the same care.

In regard to marketing, we must either market ouselves, or sell to agents. If we market ourselves, we must keep the run of the market, and know what apples are worth. If we market through an agent, we must take care that we have an honest man to sell for us.

I have already occupied too much time, but I cannot help urging the farmers of Cumberland and Oxford and all the country towns on these granite hills, to plant new orchards. Some of us have got pretty well along in life; I see many gray heads here. I did not begin to plant pears until I was past forty, but I am enjoying the fruits now. I thought then it was pretty late, but if a man is forty or fifty years old, it is not too late to plant an apple orchard. If he wants to leave a good farm to his children, a good orchard is the best thing he can leave, and he will know better how to take care of it than young people will. Let him start one, then. I intend to start one. I have seven acres which I intend to underdrain and put out apple trees. I may not see any fruit from it, but I intend the trees shall be there if I live two years. Certainly apples can be grown upon this soil better than any other crop. We must raise other things; there are farms which will raise other things better. Not every man has a farm adapted to fruit, but let those of us who have fruit farms see to it that those natural apple lands do not lie barren any longer.

Mr. Parris. What has been your experience in grafting old orchards?

Mr. Perley. If they are not too old, nor on too poor ground they may be grafted, and sufficient fruit taken off in five years to pay for grafting and all other expense you need to put upon them. If they die within six or seven years you have got your pay. In some instances I have known old orchards to be grafted and bear for many years. If the orchard is very old and badly run down, success is more doubtful. I have grafted some trees that have never paid me; I have grafted others that have paid a hundred fold and more.

Mr. Parris. Would you cut off the dead limbs and suckers and unnecessary limbs?

Mr. Perley. If I had an old orchard, I should begin by enriching the roots, then cut out all the bad and too big limbs and graft the best ones. You must cut severely; it will be a tremendous shock to the tree, but only by such an heroic method can you renovate it. You must throw vigor into it. A stunted tree almost always has not roots underneath in proportion to the top.

Mr. Parris. Do you practice mulching?

Mr. Perley. I have tried mulching, but it has not proved so satisfactory with me as has been represented by some. Spreading compost upon the surface has, in every instance within my observation, done better. I call to mind a young orchard near where I live, planted upon a rocky side-hill, so rocky that I hardly know how the man will get his apples. He planted in the grass of the pasture, dug holes, not very large, because he could not, and washed every sprig with soft soap, as far up as he could reach. I do not know a more promising young orchard than that.

Mr. Percival. What would you advise about planting young orchards where old ones have gone to decay?

Mr. Perley. I never would do it. The ground is already exhausted of the food peçuliarly adapted to apple trees. I did it once and know about it. I would as soon throw a tree away; it is labor lost.

Mr. Thing. You say you would never set a new tree in the place of an old one, because the ground is already exhausted.

Why would not the same treatment that would renovate an old orchard cause a young one to grow?

MR. PERLEY. It might, but I should rather take new land. If I had no other ground, I would let the trees that remained have the use of that ground until they were gone, and would then put in other crops before again planting trees. If you have only occasional vacant spaces, the roots of the trees that remain will run across the vacant spaces and interlock.

MR. GOULD. I freely admit, sir, that I have an axe to grind, and I may as well acknowledge it first as last. I have had an opportunity of acquiring information in all the States in New England except Maine, and many questions have been started here, and some which have not been started would be of great interest, not only to me, but I believe to the whole agricultural public. Taking the liberty to speak as an individual, and yet, believing that I speak the wishes of thousands besides myself, I say that I should be very glad if we could have the distinct experience of the farmers of Maine in relation to these controverted questions.

In the first place, I should like to hear the experience of the farmers of Maine with regard to aspect. What is the true aspect for an orchard, and if various aspects are desirable, the law which regulates results due to aspect in different parts of the country, in different soils, and in different climates? There was a time in my agricultural life, when, if I had been asked, I should have spoken in quite a dictatorial manner in regard to orchards. I had the conviction that one aspect was preferable to another; but within the last eight years I have been accustomed, with other gentlemen, to go to Pleasant Valley in New York State, the great seat of the vine culture, and there we have instituted a series of experiments with regard to vines which makes this matter of aspect far more interesting and intricate than I at first supposed. The object of the experiments at Pleasant Valley is to determine chemically the amount of acid and the amount of sugar in the grapes grown in each locality. They are sent there from an area of 300 miles in diameter, and all the various soils and climates are represented in this collection. Every gentleman who sends his box of grapes to be tested, with regard to acid and sugar, sends with it a statement of the aspect of the vineyard,—whether it slopes to the northeast, or northwest, to the southeast or southwest, east or west, north or south, as the case may be; so that when we have a determination of the amount of sugar in each particular box of grapes, we have a statement of the aspect under which it grew, what the average temperature for each month was of the vineyard where it grew, and also an accurate statement of the character of the soil. In that way we have all the elements of judgment. Now, it is an astonishing fact, that we have found the greatest amount of sugar, which is the great desideratum in the grape, in fruit coming from vineyards of all varieties of aspect. We have found vineyards having a northwest aspect, those facing the southeast, those facing the north and those facing the south producing the greatest amount of sugar. Now, the question is, what is the law that regulates the effects of aspect? I should be exceedingly glad to hear that question discussed by the gentlemen present. One has an orchard sloping to the northwest; his neighbor has one sloping to the southwest; he can testify as to his own orchard and as to his neighbor's orchard for a series of years, and that information would be of great value. It would enable us to determine with clearness what is right and what is wrong.

Now we are told by Mr. Perley, that a northern aspect is the one which, on the whole, is the most desirable in Maine for an apple orchard. I have no doubt that his testimony is correct in regard to Maine; but it is certainly not the case in New York. There, generally speaking, orchards facing towards the east do the best. In the counties of Orleans, Niagara and Wayne, the orchards generally slope towards the east. Now, if we can have this information clearly and distinctly stated from each neighborhood in Maine, it would be of great value.

Then again with regard to planting. Some gentlemen say here that seventy trees to the acre is the most desirable number in Maine; that certainly would not be true where I have had the most experience. I would never put more than forty to the acre. I have no doubt that these gentlemen have good sound reasons for the statement they make, and I should like to hear the testimony of gentlemen all around me on the question whether the planting of seventy trees to the acre has been best in their experience.

On the island of Rhode Island, where they have some of the finest orchards I ever saw, there are orchards which it is like going into a cavern to go into; there are large trees which have borne noble crops for 150 years. I have seen other places where the trees interlaced their branches, and roots also, and the result has been disastrous. I do not know why it is that on Rhode Island their experience should be so different; but I know that such is their experience. There are some places where orchards will grow better when the trees are interlaced, and there are others where they will grow better if the sunlight can bathe the whole tree. It would seem to be consonant with the laws of vegetable physiology that those trees would be the best which received the greatest amount of sunlight, for that is the great energizing and vitalizing agency for all sorts of plants; but there are cases where it seems not to be so. For my own part, I confess that I am ignorant with regard to this thing. If we could get the experience of these gentlemen upon the point, it would go a great ways towards settling these questions which it is of inestimable importance to every farmer to have settled on a solid and satisfactory basis.

Mr. Perley prefers sheep to hogs; my experience is reverse of his. I think the hog is the best animal we can put into an orchard. I would have it surrounded by a stone wall that was hog proof, and I would let them run and root just as much as they pleased. In orchards thus treated, so far as my experience goes, there has been little trouble from insects, which are the great enemies of our orchards. One great reason why our orchard fruits deteriorate is because of the millions of noxious insects which infest them. I do not doubt Mr. Perley's experience, that in Maine, or in some parts of Maine, sheep are better. I should like to get the experience of other gentlemen present as to which has proved the better.

Then there is another question. If you are going to cultivate a new orchard, what is the best crop to put in? I want to hear from the farmers of Maine whether they have found the same difficulty from sowing grain in an orchard that I have. I never in my life saw rye sowed in an orchard where the color of the trees was not injured. The beautiful, lively green which is the evidence of health, vigor and strength, in an orchard, has invariably been taken off, and has been succeeded by a sickly yellow. I should like to hear whether rye has the same injurious effect here.

There are various inquiries of this kind which it seems to me could be very easily settled, if gentlemen would tell their own experience, independent of all theory—we should all be the wiser for it.

Mr. Adams of Franklin. I have had some experience in fruit culture in Maine, and a fair share of success. My opinion is, that a slope to the south or east is the preferable one. We have in the State of Maine an abundance of good rich loamy soil, of granitic origin, which is well adapted to the culture of the apple, the pear, the plum, and all the small fruits. It is surprising, that with so great advantages, our farmers do not pay more attention to fruit culture; for there is no branch of farming which will yield so much pleasure and profit as a good orchard and fruit garden.

In order to manage successfully it is necessary in the first place to select a suitable soil, and I like best a rich, rocky loam, where the forest growth was maple, birch and other hard wood, with good natural drainage, or else made dry by artificial drainage; other soils can be made to succeed, but it is cheaper and better to take one naturally adapted to the purpose, and we have plenty of such as are well suited to fruit, and better for that use than for any other. The lot selected should be well fenced, not only to keep farm stock out, but also to keep pigs in, as I have found them very useful in a large orchard.

What kinds to plant depends on the object we have in view. If for family use only we should select such as yield a succession of fruit, from the earliest to the latest. If intended for the market we should select such as are productive and hardy, of handsome appearance rather than of very high quality, and will bear transportation well. For such as are near large markets, the earliest sorts are the most profitable. The best proved among these are the Early Harvest, the Red Astrachan, the High Top Sweeting, the Sweet Bough and Williams' Favorite. For house use and market, among fall fruits, the best are the Porter, Garden Royal, Fall Harvey, Dean or Nine-ounce and Gravenstein. The most profitable winter fruits are the Hubbardston Nonsuch, Baldwin, Rhode Island Greening, Roxbury Russet and Talman Sweet.

It is a great mistake to attempt to grow a large number of varieties for market purposes. There is far more profit in a small number if the best only are selected. Every orchardist should have his own nursery and raise his own trees. He can grow them cheaper than he can buy them, and a great deal better trees. Let him plant out seedlings of one or two years old, in rows six or seven feet apart, so as to give plenty of room for the trees to develop properly, and while they are small, he can grow a row of early potatoes or beans between the rows of trees. The soil for the nursery should be of the same sort as where they are to be finally planted out, and it should be well enriched and worked deep, and the nursery kept clean and free from weeds. Planting out is an important part of the work, and should never be left to boys and careless help. When I plant I take up a few trees carefully at a time, and see that they are properly set before more are taken up. It is very rare for me to lose one. Early spring is the best time for transplanting. Mulching is highly useful, for which purpose straw, swale hay or even brakes or potato tops will answer. The land intended for the orchard should be well prepared before planting by deep plowing, thorough pulverization of the soil, and a liberal addition of manures—planting crops for a year or two which require the use of the hoe. If any manure is applied when the trees are planted it should be well composed beforehand with a good share of muck. After culture must not be neglected. When the trees are of suitable size grafting should be done in the limbs. These should be from half an inch to an inch in diameter when the scions are inserted; three or four healthy limbs properly situated will form sufficient top; this should be open and well balanced. Pruning is best done in summer and fall, and if properly attended to when the trees are young, there will not often be need of removing large limbs afterwards.

After several years of cultivation the land may be seeded down to grass, but without grain; keep up fertility and a healthy growth by top dressing with compost and leached ashes. The less an orchard is plowed after the trees are well under way and in productive bearing, the better. Pigs serve a good purpose in orchards, keeping the land manured and eating all the wormy fruit. If the orchard is mowed, any lack of vigor in the trees should be promptly met by the application of manure.

Great loss is incurred by careless picking and handling; pick and handle with great care; pack close in clean barrels. Early sorts should be gathered before they soften, and should reach the dealer or consumer a little before they are in eating condition. It is found more profitable to sort carefully and make two grades. Those which are all fair and without fault will bring a much better price, and the second class will sell for nearly or quite as much as if not sorted at all.

In everything pertaining to the orchard and the care and treatment of trees and of fruit, whatever is worth being done at all is worth being done faithfully and well.

MR. R. DUNHAM of Woodstock. Considerable has been said about selecting trees that are well balanced. The question arises, how shall such trees be produced? I think it highly necessary, as we generally put the seed into the ground thick, that the trees should be transplanted when one or two years of age, and that is the time to prepare the tree so that it shall grow well balanced. Caution should be used in preparing the roots. If the tree has a tap-root that should be shortened and the top should be so trimmed as to be well balanced. Then the tree will grow into regular shape and be well balanced. Then if I were to transplant that tree before budding or grafting, I would take it up early in the fall, carry it to a dry piece of land and bury it, root and branch in the soil. Then early in the spring, I would take it up and transplant it. I have found this to be the most successful way of removing a tree from the nursery to the orchard. When taken out in the spring the sap seems to run freely into every part of the tree, and every bud ready to start. Trees thus treated seem to grow more vigorously than by any other method.

Muck has been spoken of as a bad soil to plant apples on. I once planted out a lot of nursery trees upon a piece of mucky land on which loam and gravel had been carted and they did well. It has also been said that the roots of trees should not be dried. I once had a bundle of trees which had been delayed until they were quite dry, roots and tops both. I soaked them in a pond two days and then planted them and saved the whole. Some were left and became good sized bearing trees, and bear well. They bear profusely in some years.

MR. GOLD. Does water ever stand about your trees which are planted on muck?

MR. DUNHAM. In the spring when the snow goes off, the water will come into my orchard perhaps a foot or more deep, but I have no doubt that a very coarse gravel underlies this muck-bed, for in a week's time the water all disappears. There is no water during the whole summer season, so that I think it is well under-drained, though I did not expend any labor to drain it.

QUESTION. Do you consider New York trees safe and desirable to plant?

MR. DUNHAM. I do not care much where a tree grows. If a tree could be well taken up in New York nursery and brought safely to Maine (though I would not recommend it to be done, because I believe we ought to raise our own trees) I should as lief have it as a tree from Norway or Rumford or Dixfield. New York trees have succeeded with me. I know there has been great complaint with regard to them. The great difficulty with New York trees is that men do not take care enough of them. Many of them are bruised when they come and many have frozen roots and frequently after planting they are not cultivated nor enriched properly. If we take a tree from rich soil and put it into poor soil without giving it proper care we ought not to expect it to grow.

QUESTION. Will New York trees bear as well as ours when they get to bearing?

MR. DUNHAM. I should say that no grafted tree will bear equal to a natural tree. So far as my experience goes, I think that natural fruit trees that come from the native seed are likely to produce more fruit than a grafted tree. The New York trees with me bear as well as any other grafted fruit. The Northern Spy bears profusely on my ground, though it was a good while coming to maturity.

MR. PIERCE. I have travelled through Maine considerably and I have noticed that the best orchards generally slope to the southeast. In Norway, Livermore and all through this region, that cant is the best. In North Norway there are orchards sixty years old that have done well; the southwest wind does not strike them. With us the southwest winds often kill orchards, if they blow two days. I have often noticed that orchards sheltered by pine trees on a side hill with a southwest cant will be killed. You will notice this fact, also, that the northeast side of a tree will bear apples when the northwest side will not have any fruit.

According to my experience, trees from New York will not do well in Maine; we should do well to bud them. You cannot get apples from a tree put into a little piece of root, however handsome they may look when they are brought to you.

SEC. GOODALE. In regard to the proper distance between trees in an orchard much depends on the variety. With strong growing sorts on good soils forty feet is none too much. But it should be borne in mind that some parts of Maine are in the northern limit of successful apple culture and that trees of some of the kinds which succeed in the northern part of the State do not grow nearly so large as the Baldwin, and others which succeed in this vicinity, for instance the Duchess of Oldenburg the most profitable apple in Aroostook county and the Fameuse, which is also sufficiently hardy to succeed there, do not require so great distance. Twenty-five to thirty feet for the Duchess gives as ample room for development as forty to fifty feet for a Baldwin in Oxford County.

With regard to aspect, I would recommend to one planting a new orchard to study carefully the facts presented by the orchards in his vicinity; just as I would recommend the same careful observation in relation to the varieties to be selected. Let him follow the indications thus found, both as to aspect and in relation to the kinds which have been proved by experience under similar conditions to be hardy and profitable. One aspect may be found better in one locality and another in another, and not very far off either. So with varieties. In some parts of Kennebec county the Roxbury Russet is the most profitable variety to cultivate by far, and the Baldwin is hardly worth growing. A very few miles distant the reverse will be found to be the case.

In my report for 1863 are some remarks on root-grafted trees, such as are known in common parlance as "New York trees," by no means recommending them for planting in Maine. I am happy to say that the general character of the nursery grown apple trees brought from New York into Maine has considerably improved since those remarks were written. A large proportion of them are grown on longer pieces of root and are of kinds better suited to our soil and climate; and with suitable care a tolerable proportion of them may eventually become productive trees. The mere fact that a tree is root-grafted need not necessarily condemn it. If it be grafted *at the crown*—i. e., *on the upper part of a vigorous seedling root,* (a *whole* root) and if it be grafted with a sort adapted to our soil and climate, and in addition to this, if it be of a kind adapted to this method of propagation, it may do well if brought hither uninjured, with good treatment afterwards, notwithstanding it be nursery grown in a soil and climate foreign to ours. It was the utter neglect of these necessary conditions which rendered the trees spoken of in that report worse than worthless. At the same time, nothing has transpired to occasion any change of view in regard to the expediency of growing our trees in Maine in preference to buying from abroad. The true policy for us is to grow them at home. In fact the only successful method with some of our leading sorts, such as the Baldwin, Roxbury Russet and others (with very rare exceptions) is to plant out healthy seedlings of home growth, and when of proper size *grafting the desired sorts into the limbs.* There are a few favored localities where nursery grafted trees even of Baldwin have succeeded in Maine, but so very rare as to be wholly exceptional. There are other kinds such as Red Astrachan, Northern Spy and a few others which succeed just as well when grafted or budded near the ground in the nursery as when grafted into limbs.

One of the most serious drawbacks to successful orcharding is the ravages of the Apple Worm or Codling moth, and it is a growing evil, and likely to increase until efforts are earnestly and persistently and extensively made to check it. Mr. Perley has alluded to the winding of hay or straw bands around the tree, in which the worm may find a lodgment, the bands to be afterwards taken off and burnt. These bands have undoubtedly served a good purpose, but not every one can so easily make and apply such bands as they can bands made of strips of cloth, and these are equally effectual, and need not be destroyed when removed for the destruction of the worms, but can be repeatedly used, and they are applied and fastened with more ease. They may be two or three inches wide, of stout cloth or canvass, long enough to encircle the tree or to wind spirally several times about it, and may be secured by a tack or two at each end. They should be applied the latter part of June, and should be removed, and the insects destroyed at least once a fortnight so long as any apples remain on the trees.

At the session of the American Pomological Society held at Richmond, Va., last September, there was shown an apple worm trap by Thomas Weir of Lacon, Illinois, which attracted much attention, and was received with great favor on account of its cheapness, simplicity, ease of application, and the evidence of effectiveness which accompanied it. It was examined by a committee consisting of Charles Downing, Esq., Mr. Quinn and other eminent horticulturists, and pronounced highly promising.

It is made of three pieces of thin board, 12 to 20 inches in length, and about 3 inches wide, varying a little in width, and fastened together with a screw in the middle by which the trap is secured to the tree. The narrowest board is placed next the tree and the widest outside. The boards are cut (semi-circularly) on each side of the screw, to facilitate turning them apart for the destruction of the insects. A few short pieces of straw are placed between the boards, which serve both to guide the worm and to keep the boards slightly apart. A knowledge of the habits of the moth carries conviction that the principle of the trap is a good one, and that, properly applied at the right time it must be as effectual as any device can be which does not encircle the tree. That they would seek shelter in it if they came near enough to observe it seems certain, but some might miss a single trap on a tree. A man with plenty of old shingles, (old would be better than new if these had any pitchy odor,) could make scores, perhaps hundreds in a day, and do it at leisure, in winter, and even affix them to the trees to save time at a busier season.

Mr. Weir has obtained a patent for this simple device, alleging his belief that through the efforts of agents it can thus be brought sooner into general use, and accomplish more good to the community. His charge for its use is moderate, I believe $2 for an orchard under five hundred trees, $3 for one under a thousand, about enough, as he thinks, to remunerate him for the trouble and expense of introducing it among orchardists.

Adjourned.

AFTERNOON SESSION.

The session was opened with a lecture by Hon. John Stanton Gould of Hudson, New York, on "The Management of Meadows and Pastures."

Management of Meadows and Pastures.

A merely cursory glance at the vegetable kingdom will convince us of the vast importance of The Grasses to the whole family of man; a more minute and careful survey of this great field of observation will make us wonder that the agricultural world has been content for so many generations to remain so ignorant of their nature and properties, as we know they have always been.

The latest and most certain conclusions of science coincide with the Apostle's statement, that "all flesh is grass." They demonstrate most conclusively that in thus saying, he yields to no mere poetic fancy, but gives utterance to a sober and unvarnished fact. The elegant contour of the human form, the ear that drinks in the melody of song, the tongue that communicates the utterances of the soul, the sparkling eye, the ruby lip, and every portion of our material frame, owes its origin, either mediately or immediately, to the grasses of the field. It is their appointed function to gather and combine the scattered elements of inorganic matter in such proportions and in such forms as are best calculated to build up all the tissues which are essential for the manifestations of animal life. They extract earthy and saline ingredients from the rocks, hydrogen and oxygen from the rains and dews, carbon and nitrogen from the soil and the atmosphere, and mingling these together by a subtle and mysterious vital chemistry which man can never imitate, they lay these treasures at his feet in a form exactly fitted for his purpose. Very precious, therefore, is this promise of the Almighty, "I will send grass into thy field for thy cattle that thou mayest eat and be full."

To treat in any fitting manner a subject so broad and vast in its various aspects, would require, at the least, a full course of lectures, rather than a single one. I propose, therefore, upon the present occasion simply to lay before you some of the considerations which should be taken into view in the sowing of artificial meadows; for which purpose I must assume that you are already familiar with the correct names and the leading qualities and characteristics of the meadow grasses; (using this term in the sense in which it is generally understood throughout the agricultural world, and not in the local and inaccurate sense in which I am told it is sometimes used in Maine, when applied to the aquatic grasses of natural wet meadows.)

A practical examination of these grasses will show that they vary much in their characters, their habits and their nutritive values; some of them flourish on sandy or rocky soils, while they speedily perish on wet ones; others flourish vigorously in wet soils while they speedily die in a dry one. Some will grow in alkaline soils, and of these a portion require a soil abounding in potash, another needs lime, and another can only grow in the presence of soda. Some of the grasses flourish most in the brightest sunlight, while others rejoice in the shade, some are best adapted for hay, others useless for hay are extremely valuable for pasture. Some lands are forced into great luxuriance by one kind of manure, which will operate almost like a poison upon other varieties. One kind abounds in that species of nutriment which strengthens the muscles, another, ill adapted and indeed quite inoperative for strengthening the muscular tissues, will lay on fat rapidly; another which is quite deficient in both these respects is rich in those elements which serve to support respiration and furnish the fuel from which animal heat is eliminated. A variety of grass possessing these qualities in a very slight degree may yet be very useful in combination with others if it assists to assimilate the nutriment contained in them with the tissues of the animal containing it, in other words it may act as a tonic, a dissolvent or an adjuvant.

In view of what has been said it will be clear that in the judicious selection of different varieties of grass to occupy different localities and to subserve different purposes, a wide field is afforded for the application of physiological, botanical, geological, meteorological and chemical knowledge. Every variety of grass was intended by the Creator to serve to some valuable purpose; it is the business of practical agriculture to find out what that purpose is and to place it in the locality and under the conditions best suited to its most profitable development.

I trust you will give earnest heed to the problems I have stated as on their solution the successful culture of grass must forever depend. Hundreds and thousands of acres of land are occupied by grass in this county yielding the most meagre returns, and scarcely paying for the labor of gathering because it has been seeded with a kind of grass ill-adapted to its capacity. If you only seed these lands with the proper kind of seed they will at once give remunerative crops. For example the *Danthornia subspicatum*, although not so valuable for fodder as some other kinds, yet will grow on clay grounds where Timothy will not flourish, and the same remark is true of the *Cynosurus cristatus* or crested dog's-tail. Surely it is better to sow such grasses as these which yield some profit than to leave the land naked, or to allow its occupation by noxious weeds. It is impossible in the present state of our knowledge to say with certainty what species of grass is exactly adapted to any given soil or situation. We cannot look upon this knoll or that intervale, or yonder plain and say this grass will grow better and prove more profitable if sown here than any other. But we can say without hazard of contradiction, that for every spot on earth there is a grass or a combination of grasses which is better adapted for profitable cultivation than any other although we cannot say exactly what they are. If farmers were more familiar with the several species they would recognize this truth more fully and thus be prepared to contribute original observations to the general stock of knowledge; if for several years in succession you carefully observe the soils and situations where each variety grows most spontaneously and with the greatest luxuriance, and furnish the result of your observations to some respectable agricultural journal, we shall soon have a mass of reliable and accurate facts in relation to this matter such as has never yet been brought together; practical men will then have some reliable guidance, and will not be obliged to grope in the dark about their grass culture as they have hitherto been compelled to do. You must remember however, that your statements if they are to be useful must distinguish the plants by their *botanical* names; there is so much confusion in the trivial names that their use will lead inevitably to the most serious errors in practice; thus some half dozen species are known in different localities by the single name of June grass, as many more are called blue grass, a number more are called spear grass, another number are called reed grass, &c., hence a man in one section of the country writing his experience of June grass or blue grass or spear grass will greviously mislead a farmer in another section who knows an entirely different plant, having different habits and requirements by that name.

I must again repeat that I know very little of those matters respecting grass culture which it is all important that you as farmers should understand, but the little that I have to tell you that is both reliable and useful I now proceed to unfold.

1st—*It appears that the grasses, which in the present state of our knowledge are the most useful and the most profitable, seem to flourish best when the opposite extremes of wetness and dryness are avoided.* Very careful counting in a great number of meadows give the following results. In *wet* meadows, out of thirty plants, four were useful and twenty-six were useless, that is, they were weeds. In *dry* meadows, out of thirty-eight plants, eight were useful and thirty were useless. In *moist* meadows out of forty-two plants, seventeen were useful and twenty-five useless.

2nd—In a rough classification of soils into *upland thin soils, poor clay, rich loams, flooded meadows,* and *irrigated meadows,* the following figures which give the average of a great number of careful observations will show the relative values of each kind of soil. The "upland thin soils" were in all cases the poorest grass lands, the "poor clays" gave 50 per cent., the "red loams" 150 per cent., the "flooded meadows" 250 per cent., and the "irrigated meadows" 400 per cent. more than the "upland thin soils."

3d—The soil which seems best adapted to the production of our best grasses is a *strong, deep calcareous soil resting on a clayey subsoil.* On such a soil, we may be sure of an abundant vegetation resisting drought and heat and making a fine desirable sod; but you must not forget that there is no soil which is incapable of bearing grass if we only select the variety best adapted to it, and bestow upon it the treatment most suitable to it. By effecting physical and chemical alterations in the soil, we may adapt it to the production of almost any kind of grass, but as this is an expensive and tedious process, most farmers will prefer, at least in the first instance, to suit their grasses to their soils rather than the soils to the grasses, but we should keep the amelioration of the soil steadily in view so as at length to fit it for the production of the most valuable kinds.

Let us now endeavor to digest the facts which we have been detailing into one view by deducing from them the principles which ought to guide us in laying down artificial meadows, and in doing so, I shall be very careful to teach no doctrine which has not been confirmed by the observations of sound, practical farmers.

1st—*We must sow a variety of seeds.* You may prepare your soil as thoroughly as you will, make it as rich as manure can make it and sow it so thickly with any one kind of grass seed that the seeds actually touch each other and you will find that after germination many of the young plants will die leaving certain interspaces of unoccupied soil between the plants which still live. If you fill these interspaces ever so often with fresh seeds, they will die out again and you will at length be fully convinced that it is impossible to fill them up with plants of the same species, and that the living plants will not tolerate any neighbors nearer than a fixed and determinate distance,—this distance is determined by the greater or lesser abundance of the specific food required by the particular species of grass cultivated. If with a given amount of this food, the plants will grow within three inches of each other, with a less amount they will be six inches apart—with a still less amount they will be nine inches asunder, and if the amount of food is still farther reduced, the space will be twelve inches, and so on. Each soil has therefore a capacity for bearing a certain maximum number of plants upon a square foot, which can under no circumstances be exceeded.

If now, you sow these unavoidable interspaces with the seeds of another species of grass, a certain number of them will grow, and as before a certain number of them will die after germination; the plants that grow will not interfere with those already growing, and the crop will be materially increased. Still there will be spaces of unoccupied soil, and the ground will not be thoroughly turfed over until you have from five to twenty varieties growing upon it. Experience has most conclusively shown that any soil will yield a larger and more nutritive crop when sown with from five to ten species of seeds than when only one or two species are growing. It has long been known to physiologists, that man absolutely requires a *mixed* diet; he cannot maintain the due exercise of all his faculties and functions if fed exclusively on a single article of diet, even if that article should be of the most nutritive character. It is the same with our domestic animals, they will not flourish as well on the most nutritive kind of hay of a single species as they will on a mixture, each individual of which may be inferior to the first. The animal tissues require numerous elements for their support, and these elements are furnished in greater abundance, and better adapted for assimilation by a mixture of dissimilar grasses than by any single one. Nature teaches this doctrine very clearly, independently of theoretical considerations. The horse when at liberty to choose will always leave the single one for the mixture. On a very rich old pasture which fattened one large ox and three sheep per acre, one thousand plants stood on one square foot of ground, of which nine hundred and forty were natural grasses, and sixty were creeping rooted clover and other plants; there were twenty distinct species of plants on this square foot of ground.

On a well managed water meadow, there were on a square foot, one thousand seven hundred and ninety-eight plants, embracing one thousand seven hundred and two plants of the natural grasses, and ninety-six of the clovers and other plants. Now compare this wonderful luxuriance with the produce of an equal space of land with a single species of grass. A single square foot where nothing but narrow leaved meadow grass *(Poa angustifolia,)* grew, contained one hundred and ninety-two plants—of meadow fox-tail *(Alopecurus pratensis,)* eighty-two plants—of rye grass *(Lolium perrene,)* seventy-five plants. Compare seventeen hundred and ninety-eight with seventy-five plants to a square foot and you will at once see how desirable and how profitable is the sowing a great variety of seeds. You will see how much is annually lost to the country for want of a greater variety of plants in our meadows and pastures, for the farmers in the United States who sow more than two kinds of seeds might be comfortably accommodated in a moderate sized church.

Let me advise you as one of the most important practical measures that you can adopt, to fill ten or twenty boxes with the soil which you intend to lay down to meadow, and sow each one with a different kind of grass seed. You will thus ascertain the adaptation of your land to different kinds of grass, and the number of plants each square foot of it is capable of maintaining.

2d—*We should only sow the seeds of those grasses which come into flower at the same period.* Chemical analysis and practical trials alike concur in showing that hay is most nutritive and most palatable when cut at the period of flowering; at this time it contains more sugar, starch, gum and albumin, than at any other; if suffered to stand after this these substances are converted into woody fibre and other compounds which cannot be acted on by the digestive organs, and is therefore valueless. It follows from this, that great loss is sustained by cutting together those grasses which flower at different periods. If cut when the earlier grasses are in good condition, the later ones are watery and innutritious. If cut when the later ones are ripe, the valuable constituents of the earlier ones have passed into woody fibre and other insoluable compounds. I have for many years been convinced of the wastefulness of mixing the grasses which flower at dissimilar periods in the same meadow; but I was never so thoroughly convinced of it as I have been during the last summer. In many meadows where one-half of the grass has consisted of meadow fescue and Kentucky blue grass, which flower in June, has been left absolutely to perish until the timothy had ripened; and in many cases even the timothy has been suffered to deteriorate seriously in order that the red-top, which is a fortnight later, might have time to ripen. Nothing more strongly marks the utter want of forethought and system in everything pertaining to grass culture, than the almost universal allowance of grasses in the same meadow which cannot be cut at any time without spoiling some of them.

I have heard some farmers complain that horses and working cattle are apt to scour when fed on hay cut while in blossom. I have never seen this result myself, and in one or two cases where the complaint has been made, I have satisfied myself that the difficulty has arisen from bad curing, and I have a strong suspicion that if every case could be examined thoroughly it would be found that the scouring was due to this cause rather than to cutting the grass in blossom.

3d—*The seeds sown should be exactly adapted to the soil and climate.* This rule is too obvious for argument. It is clear that if seeds which will only germinate and flourish in sandy soils are sown on wet clays they will be sickly and unprofitable; and so on the other hand, we cannot expect those that are adapted to soils where potash abounds to flourish in soils that are almost wholly calcareous. And yet, although this is so clear, and so fully commends itself to the approval of every man, yet no one thinks for a moment of practicing it. If a farmer wishes to lay down a meadow, no matter whether it is wet or dry, clayey or sandy, calcareous or peaty, the same uniform timothy and clover is universally applied and if these do not grow he is quite contented with a crop of weeds. As I have before remarked, there *is* some kind of grass just adapted to every soil under the sun, and the intelligent farmer in the "good time coming" will never rest until he finds from actual experiment, the exact species just calculated for his own land.

4th—*We must stock our meadows with the most nutritive grasses.* If you have looked at a table of grass analyses, and if you compared them, you must have been struck with the wide difference in nutritive value which exists among them. There have been two attempts at a chemical determination of these values on an extended scale; the first by Mr. Sinclair under the guidance of Sir Humphrey Davy, of 113 varieties; the second by Mr. Way, chemist to the Royal Agricultural Society, of 21 varieties; besides these, we are in possession of several analyses of separate grasses by other distinguished chemists.

Mr. Sinclair's method consisted in submitting the green or dry grasses to the action of *hot* water so long as it continued to take up any soluble matter; the solution being then evaporated to dryness the solid residuum was weighed, this was taken as representing the absolute weight of nutritive matter contained in the grass under examination. This process is now known to be inaccurate, as vegetable albumin which contains the greatest amount of the muscle forming elements is not taken up by boiling water and the presence of this substance was not therefore brought to light by Sinclair.

Indeed, Sir Humphrey Davy, who furnished the process, seems to have had much less confidence in its accuracy than Mr. Sinclair. Sir H. remarked, that the nutritive matter of grasses or soluble products, consists for the most part of five distinct vegetable substances, viz.—mucilaginous, saccharine, albuminous, bitter extractive and saline matter, and that "it is *probable* that the excellence of the different articles as food will be found in a *great measure* proportioned to the quantities of soluble or nutritive matters they afford; but still these quantities cannot be regarded as absolutely denoting their value,—albuminous or glutinous matters have the characters of animal substances; sugar is more nourishing, and extractive less nourishing, than any other principles composed of carbon, hydrogen and oxygen; certain combinations of these substances likewise may be more nourishing than others."

Mr. Way, guided by the more accurate knowledge which modern researches in chemistry have disclosed, has been enabled to give a more trustworthy exhibition of the real compositiou of the grasses than we have heretofore possessed, and has disclosed to us, as accurately as chemistry can do it, their relative values in the feeding of animals.

It is to be regretted, however, that he has omitted the analysis of several of the most important of our grasses, such as the redtop *(Agrostis vulgaris,)* blue grass *(Poa compressa,)* bastard fowl meadow *(Glyceria nervata,)* and fowl meadow *(Poa serotina.)* Still his experiments constitute one of the most valuable contributions which chemistry has ever made to agriculture.

These experiments show that 100 lbs. of quaking grass *(Briza media,)* will give 28½ lbs. more of dry hay than 100. lbs of vernal grass *(Anthoxanthum odoratum.)* That it will require 237 lbs. of vernal grass to supply an animal with as much of the muscle making elements as is afforded by 100 lbs. of timothy.

It will take 319 lbs. of soft brome grass to lay as much fat on an animal as 100 lbs. of timothy would; 100 lbs. of timothy, will support the respiratory process as long, and afford as much animal heat as 260 lbs. of vernal grass.

I think most of you will be surprised at the disparity of value among the grasses as disclosed by these numerical statements, and if they make a tolerable approximation to practical accuracy, you will be convinced that your interest as farmers demands that you should pay more attention to this subject than you have heretofore given it. I should, however, be untrue to my own convictions, if I did not warn you against too suddenly accepting the indications of pure chemistry as a conclusive guide in practice, for there is

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reason to fear that sometimes they may be misunderstood or misinterpreted, and thus lead to dangerous errors. Chemistry may show that there is a great amount of nourishing matter in a given species of grass, yet, it may not be available to the cattle consuming it, and if so, it will be almost worthless to the farmer. Thus, a grass may contain any amount of sugar, starch or albumin, stored up in its tissues and juices, but if its leaves are armed with sharp spines as the thistle, or with stinging hairs as the nettle, or if for any mechanical cause it is rejected by animals, it will avail nothing; or it may have some poisonous principle which is instinctively rejected, or some bitter or nauseous secretion mixed with its nutritive matter, or its oder may be repulsive so that cattle will not eat it. In either of these cases, it is of no use to the farmer, even though chemistry shows it to contain much which under other conditions would possess high value. There may be cases, too, where cattle will eat of a grass which contains injurious substances. Sorghum, according to the results of chemical analysis, is rich in nutriment; but on soils which abound in the soluble silicates, it becomes thickly coated with a substance like glass. While I am writing this, I read of the death of a number of cattle from eating sorghum, the sharp angles of the glassy coating having cut through the coats of their stomachs. While procuring my specimen of the *Phragmites communis* (reed grass,) I cut my fingers deeply in two or three places with its siliceous coating. Of course, this glass may be too thin to actually cut through the stomach, and yet thick enough to irritate the mucous surfaces to such a degree as to prevent them from gaining either strength or fat, in either of which cases the nourishment contained in the plant could not be converted into meat or milk.

These considerations show the necessity of verifying the chemical indications by actual trials at the manger, conducted with all possible care and precaution to guard against ambiguities and mistakes. I have searched in vain among the agricultural journals of both Europe and America, for the record of such experiments—if they exist I have been unable to find them. Nothing would tend more to the advancement of agricultural science and to the augmentation of agricultural profits, than a thorough settlement of the exact nutritive values of the different species of grass. To accomplish this result, it is necessary to take at least six milch cows, divided as nearly as may be into two equal lots of three each. Some species, as timothy for instance, should be selected as the standard of comparison. One of the lots should be fed on timothy for three weeks, the other on Kentucky grass—the weight of the milk of each cow and the richness of the cream, as indicated by a lactometer, should be carefully ascertained and recorded ; during the next period of three weeks the food of the lots should be reversed, the first lot being fed on Kentucky blue grass, and the second on timothy—the weight and richness of the milk being noted as before. During the third period of three weeks the food should be again reversed as in the first trial, and during the fourth period the food should be as in the second trial. The weight and richness of the milk yielded by each kind of hay would thus be indicated in terms which would be perfectly reliable, and the relative values of the two kinds could be accurately expressed in dollars and cents. In trying the values of the different grasses for fattening purposes, the same method should be adopted, except that the weight of the cattle should be taken at the commencement and at the end of each period of three weeks. Systematic attempts should forthwith be instituted to determine the question. If twenty farmers should each undertake to determine the comparative value of timothy and some other grasses, no one would be greatly burthened, and information of incalculable value to the whole agricultural community would be elicited.

5th—*The meadows on a farm should be so arranged as to come successively to maturity.* There is always a sudden augmentation of the demand for labor when the season of haying and harvesting comes on, without a corresponding augmentation of the supply. This state of things greatly enhances the cost of securing the crops, and causes much haste and carelessness which would not otherwise take place. The increased number of hands, greatly increases the labors of the farmer's wife and daughters, indeed, many a broken down female constitution traces its origin to the extra labor of haying and harvesting.

We have seen too that the grasses must be cut when in the flower if we would obtain their maximum value, every day that they are left standing after this, diminishes their nutritive matter. It follows from this that much of the grass on the meadows of large farmers who are restricted to one or two kinds, must suffer great loss from want of labor to cut it in its best condition.

To prevent these sources of waste and inconvenience, the grass lands on the farm should be divided, and stocked with grasses coming to maturity at different periods so as to diffuse the labor over a much longer period than at present, so that part may be cut in June, part in July and the remainder in August. Slight additions to the labor of the farm will thus enable us to secure all the hay at the best possible periods.

In the stocking of pasture grounds, a much greater variety of grasses is desirable than can be admitted into meadows; it is of little consequence in these at what time their flowering season occurs as none of the culms should ever be permitted to blossom. The great principle to be observed here, is to provide such grasses as will be in their highest vigor during every week from spring to autumn, the earliest and the latest should be mixed with those whose period of luxuriant growth is during the middle of summer. In meadows, those species are most desirable which send up the greatest amount of flowering culms; in pastures, on the contrary, culms are not desirable, but the radical leaves possess the greatest value. Hence timothy, so valuable in a meadow, is of little use in a pasture, being far inferior to Kentucky blue grass, and meadow fox-tail, which put forth radical leaves in abundance. With these two exceptions, the laying down of pastures is conducted on the same principle as meadows.

I trust the five principles which I have just laid down all commend themselves to your enlightened judgments. I do not believe there is one among you who will refuse his assent to any one of them. Yet there is not one of them which is not habitually neglected in the practice of most farmers. I have examined the statements of over 200 of them as recorded in the transactions of State Society of New York, and in the agricultural journals, and all, except about a dozen of them, sow no other seed than timothy and clover. Of the exceptional dozen, one sowed a small field with orchard grass, three of them mixed the seed of red-top with their timothy and clover and the remainder were accustomed to mix in the seed of the Kentucky blue-grass. Several of them are aware of the advantage of cutting while in flower and strongly commend the practice, but none of them advise the seeding of meadows with such plants as will enable them to accomplish the object, on the contrary, most of them sow clover and timothy together notwithstanding they vary so widely in the period of their efflorescence. None of them seem to be aware of the wide difference that exists among the different species with regard to their nutritive properties, nor is there any allusion to the necessity of diffusing the labors of hay-making over a longer period by stocking different meadows with varieties coming into flower at successive periods of time.

The arrangement and classification of the grasses with reference to the soils which are suited to them cannot be completed in the present state of our knowledge, but as a nucleus for experimental trials I venture to offer the following table which you can improve and enlarge as experience shall dictate from time to time:

For light, sandy land and mowing in June. Orchard grass, Red clover, Annual spear grass, Kentucky blue grass, and Meadow fox-tail.

For clayey or calcareous loams and mowing in July. Timothy, Red-top, Crested dog's-tail, Tall fescue, Italian rye grass, Perrennial rye grass.

For clayey lands and mowing in August. Wire grass, (Poa compressa,) and fowl meadow, (Poa serotina,) hairy brome grass.

For dry gravelly soils. Agrostis vulgaris, (red-top,) Arrhenatherum avenaceum, (tall oat grass,) Holcus mollis, (soft grass,) Poa pratensis, (Kentucky blue grass,) Festuca rubra, (red fescue.)

For blowing sands. Deposit turf at regular and short intervals and between them sow the seeds of Ammophila arundinacea and Elymus arenarius, by mixing them with clay attached to small pieces of straw rope and dibbling them into the sand; for which purpose from fifteen to twenty pounds per acre will be sufficient. To prevent the encroachments of sands, dibble in the plants of the ammophila at short intervals making a bed in front of the advancing sands from twenty to one hundred yards width according to the circumstances.

For marshy grounds and those occasionally overflowed. Agrostis stolonifera, Festuca elatior, F. loliacea, Glyceria aquatica, Glyceria fluitans, Phalaris arundinacea, Poa trivialis, Lotus major.

For pasture in orchards and other shady places. Anthoxanthum odoratum, (sweet vernal,) Dactylis glomerata, (orchard grass,) Festuca duriuncula, F. elatior, Lolium italicum, Lolium perrenne, (perrennial rye grass,) Milium effusam, Poa nemoralis, Poa trivialis, Trifolium pratense, T. repens.

For permanent pastures. A lopecurus pratensis, Dactylis glomerata, Festuca duriuscula, F. elatior, F. pratense, (meadow fescue,) F. rubra, Lolium italicum, Lolium perrenne, Phleum pratense, (timothy, herdsgrass,) Poa nemoralis, P. pratensis, (Kentucky blue grass,) P. trivialis, Agrostis vulgaris, (red-top,) Trifolium pratense, (common red clover,) T. repens, (white clover, creeping honey-suckle,) Anthoxanthum odoratum, (sweet vernal grass.)

Having now determined on our selection of seeds for the particular soil which we may desire to convert into meadow, the next most important question is, how shall we best insure the germination and growth?

I have no doubt that most of you can bear witness that this is a serious and important question. Unless you have been more fortunate than your brethren, you have been often obliged to seed your meadows several times before you could form a decent sod, and even then you have had to wait several years before the sod became thick and the meadow profitable. Many a farmer has bewailed the loss of interest on his land, the taxes and the wasted labor which unsuccessful grass seeding has imposed upon him.

To avoid this difficulty you must bring your soil as nearly as possible into the condition of our richest and best meadows. It is quite impossible to make plants as delicate as young grass grow in lands full of lumps of hard earth, stones and a tangled mass of weed roots and bushes such as we often see on lands which pretend to be prepared for meadows. A careful examination of our best meadows shows that the roots of the grass are surrounded by a fine dark mould, the fertility of the meadow being always proportional to its fineness, depth and darkness. This dark, fine mould is supposed by many farmers to arise from the gradual decay of the vegetation during a long succession of years; this doubtless is not without its effect but a little reflection will show that it is very trivial. Prof. Johnson estimates the weight of the stubble left in the ground at about one-fourth of the weight of the hay taken off; half a ton of these substances would therefore be a very large estimate for the substances left behind, this amount reduced to powder and spread over the surface would not, if it all remained, form a deposit of half an inch in a century, but when we reflect that much of the matter left by the roots and leaves is absorbed by the growing crops of subsequent years we shall see that the fine mould of our old meadows is not derived from this source, at least to any considerable extent.

This view is farther confirmed by the fact that this mould is uniformly laid on the top of the soil. When two fields adjoin each other, one being an old meadow, the other a ploughed field, the latter will be covered with stones, while none are visible in the meadow, the mould having been spread over the top. "A field which fifteen years since was waste land, was plowed and drained and then well covered with marl and cinders; it has not since been disturbed, and now supports a tolerably good pasture. Cutting down with the spade into this soil, the section presented the following appearance: Turf one-half inch,—mould two inches and one-half—a layer one and one-half inches thick of fragments of burned marl, (conspicuous by their bright red color,) of cinders and a few quartz pebbles mingled with earth; lastly, about four and one-half inches beneath the surface was the original black peaty soil." This state of things shows conclusively that this mould must have been, in some way, laid upon the surface of the soil over the first dressing of cinders and burned marl. The explanation of this covering of mould is simple. You have often seen a smoothly raked garden bed covered over in the morning with little hillocks of earth. These are caused by the common earth worms, which swallow the earth through which it moves, and after extracting whatever of nutriment is contained in it, throw out the remainder mixed with the mucus of its digestive organs on the surface of the ground. This is the origin of the little mounds upon the garden beds, and the annual accumulation of these mounds in the meadows forms the mould whose origin we are seeking for. This agency is more powerful than might be at first supposed. Mr. Johnson gives us the following illustration of the extent of this activity of the worms in grass lands: "A bowling green forty-five yards long by thirty-two yards wide, was watered by a solution of corrosive sublimate, after which 434 lbs. of dead worms were taken from it, which is at the rate 1,466 lbs. per acre." With this illustration of the immense number of worms at work, and remembering that they are casting up these mounds in the meadows every night during the summer, you will see that we are furnished with an adequate cause for the production of all the mould we find in them. Worms are not only useful in forming mould, but the subterranean galleries which they form in their ceaseless journeys through the soil and subsoil, admit the air, and thus set on foot that train of chemical transformations which are essential to the growth of the grass, and without their assistance could never be effected. From all this it is plain, that if we would succeed in our sowing, we must artificially prepare a seed bed as nearly resembling this worm-mould as possible, and we must encourage the continued travelling of worms through the soil.

To accomplish this, the ground must be deeply plowed, taking care that it is also pulverized; after the ground is dried it should be scarified with a cultivator, and this operation must be repeated three or four times, at intervals of a week, so as to destroy all the weeds as they start, and if the soil is tenacious, it should be rolled before using it; it should then be harrowed with a sharp, fine toothed harrow, until every portion of the surface is reduced to a fine powder; it must then be suffered to lie until the appearance of the sky pretty clearly indicates the approach of rain, when the mixture of seeds should be evenly sown and covered with a bush harrow, (not a tooth harrow.) The time of sowing should be as nearly as possible to the period when the seeds ripen.

A very good preliminary operation is, to plow the ground in the spring, and sow it with buckwheat, which is to be carefully turned under when in blossom. This keeps the weeds under, its fermentation pulverizes the soil, and the decay of its vegetable matter furnishes a rich pabulum for the young grass. It will be said that this preparation is troublesome and expensive, so it is, but you cannot make seed take, especially on stiff soils, without it. I have been told by farmers, that they have succeeded in making their new seeding look as green the first fall as an old meadow with one-tenth of the labor that I have prescribed. So they have; but when I have examined the plants that constituted that greenness, I have found from nine-tenths to three-fourths of it to consist of worthless weeds. The problem is not how to make the newly seeded land speedily green, but how to fill it speedily with useful grass.

Before the seeds have germinated, the ground should be covered with a thin coating of rotten manure, when in a short time the young grass will make its appearance. Before the frosts set in, the ground should be covered with straw, which will prevent the radiation of heat from the earth, and will prevent that tearing of the rootlets from the roots which ensues from the alternate freezing and thawing of the ground, and which is well known to be exceedingly destructive to our best grasses. Such being the effect of the straw covering, it will be found to repay with usurious interest the cost and trouble of laying on. There is another cause for the failure of grass seeds to germinate, which is not generally understood, and to which I ought to call your attention, and this is the burying of seeds too deeply in the earth. Carefully repeated experiments made with every precaution against errors, show that grass seeds should not be covered with more than an eighth of an inch of earth. A much smaller proportion of seeds germinate at a quarter of an inch deep, and they are nearly all destroyed at the depth of an inch. Mr. Sinclair, after recommending that the large seeds should be separated from the small ones of a mixture by a wire sieve, remarks as follows: "I have sown the seeds of the same grasses in every month of the year, January excepted, and though much depends on the weather and the state of the ground, the results were always in favor of the month of September and the beginning of August, and next to that the middle and latter end of May, according as the weather was dry. The seeds vegetated and grew with most vigor under the following circumstances: When the ground had been stirred, broken very fine, and made perfectly smooth and compact on the surface with a heavy roller previous to sowing the seeds,—the ground in a dry state at the time of sowing,—the seed sown on this fine, dry compact surface, the larger seeds not more than just covered by drawing a fine rake on the level surface, and afterwards sowing the small seeds and covering them no farther than what was effected by a repetition of the roller. The result further showed, that next to a coarse, unconsolidated or loose surface, the practice of deep sowing was in the second degree more injurious to the vegetation of the seeds and the first progress of the plants, than any other error that could be made in the *manual* part of the process of sowing the natural grasses on a soil of good quality." These facts show the impropriety of harrowing in grass seeds in the usual manner, since most of the seeds will in this way be buried beyond the possibility of germination.

Most farmers are accustomed to sow their grass seeds with some kind of grain, and many defend the practice on principle, but I think the preponderance of evidence is clearly and unequivocally on the side of those who advocate separate sowing. The practical results have almost invariably been in favor of this method when it has properly been done, and theoretical considerations would most certainly lead to this practice. The grain crop abstracts from the soil a large portion of the nutriment which is needed exclusively by the young grass. Every plant of grain occupies a place to the detriment of the expected sward, much injury is done by the lodging of the grain when beaten down by heavy rains. The young plants are repressed in the spring by the shade of the grain when they most need the genial influence of the sun, and then when the grain is cut it is exposed in its weakened state to its fiercest summer glare, at a period when it is more exposed to drought than at any other season of the year. This perfect coincidence between the teachings of science and the results of practical experience, fully justify me in the opinion I have just given, that grass seeds in most cases should be sown by themselves. Another cause of the failure of grass seeds to germinate, is the damaged condition in which they are received from the seedsman. It must be borne in mind that different species of grass vary greatly in their ability to form good seed, a large proportion of the most carefully secured crops proving abortive; thus, orchard grass is very apt to prove defective, perennial red clover has frequently abortive seeds, and the seed of the meadow fox-tail is, as a general rule, so bad that only one seed out of three will germinate. To guard against these unavoidable defects, as well as against the impositions sometimes practiced by unprincipled seedmen, they should be thoroughly tested before purchasing, in the following manner, for which I am indebted to Mr. Flint's valuable Work on Grasses, (p. 142.) "Take two pieces of thick cloth, moisten them with water, and place them one upon the other at the bottom of a saucer; place any number of seeds which it is designed to try upon the cloth, spreading so thin as not to allow them to cover or touch each other. Cover them over with a third piece of cloth, similar to the other, and moisten in the same manner. Then place the saucer in a moderately warm place. Sufficient water must be turned on from time to time to keep the three thicknesses of cloth moist; but great care must be taken not to use too much water, as this would destroy the seed. There should be only enough to moisten the cloths, and not enough to stand in the saucer. Danger from this source may be avoided in a great measure by tipping the saucer so as to permit any superfluous water in it to drain off. The cloth used for covering may be gently raised each day to watch the progress of the swelling or the moulding of the seed. The good seed will be found to swell gradually, while the old or poor seed which has lost its germinating power, will become mouldy in a very few days. In this way, also, any one can judge whether old is mixed with new seed, since the latter germinates much more quickly than the former. He can judge besides of the quantity he must sow, since he can tell whether one-half or three-fourths, or the whole, will be likely to germinate, and regulate his sowing accordingly. The seeds of clover, if new and fresh, will show their germs on the third or fourth day—other seeds will take a little longer, but till they become coated with mould, there is hope of their germination. As soon as the mould appears it is decisive, and the seed that moulds is worthless." This plan is so easy, and the injury arising from the sowing of defective seeds is so great, that it ought never to be omitted by any farmer who wishes to seed even a single acre of land.

Having now got our young grass successfully started, the next object is to provide for its future welfare, and our first inquiry with this view must be to ascertain whether there is any stagnant water in the soil. It is settled beyond all cavil by the united testimony of both science and experience that the true meadow grasses (such as are included in our fifth class) will not flourish in the presence of stagnant water. Sow as many seeds and put on as much manure as you will, they will all be lost. Nothing but the aquatic grasses will flourish on a soil where water stands. Wherever these aquatic grasses are seen there is but one thing to do and that is to underdrain. It is not necessary to drain meadows so thoroughly as plow lands, for nearly all the grasses require moist soils, but if you would have a profitable meadow or pasture you must free it from stagnant water. Good husbandry requires that grass should be well started, *and* that provision should be made for its future growth and increase; yet this necessity is overlooked by nineteen-twentieths of our farmers. There are hundreds of thousands of acres of meadows which have never had manure applied to them for a century nor have they been the subjects of any ameliorating process whatever; their annual burden of grass has been removed, and this is all the care their owners have bestowed upon them. This ought not so to be. Depend upon it there is a Nemesis that watches over agriculture as well as human conduct, and every fraud the farmer practices on his lands will assuredly be visited on his pocket. The necessity for the application of nourishing manures is clearly shown by the amount of matters removed from the soil by every successive crop. Each ton of hay of average quality removes 140 lbs. of mineral matter from the soil, and 26 lbs. of nitrogen equivalent to 31½ lbs. of ammonia. The mineral matter includes 34 lbs. of potash, 15 lbs. of lime, 8½ lbs. of phosphoric acid, besides other ingredients.

When we consider the immense loss of fertilizing materials which ensues from a removal of successive crops, and that the soil is not annually stirred up and brought into contact with the atmosphere, which is the main source of the supply of nitrogen, as is the case with grain lands, which are in additition receiving the manure of the farm ; every farmer ought to desist from the wasteful and heedless practice which they have hitherto followed, and adopt a system in the future more in accordance with the teachings of nature, as interpreted by science and confirmed by practice. They may do so with the full assurance that it will increase both the quantity and quality of their crops, and greatly augment their pecuniary returns. Grass lands laid down in the fall in the manner I have described will generally give a fair crop of hay the ensuing summer; but the season after this is the most trying year for the young meadow. Many of the young plants are found to have died out, and their places are supplied by noxious weeds, while the good plants that are alive look feeble and sickly. This is caused by the solid packing of the earth around the roots of the grass—they can hardly penetrate into the hard soil, nor can the air readily find access to them ; the worms have not yet been attracted in sufficient numbers to make a proper mould, or to fill the soil with air galleries, nor have successive crops yielded their debris to the soil. In this condition, the food which the plant cannot find below must be supplied to it from above. Early in the second spring, if we cannot obtain a supply of well rotted barn-yard manure, which after all, is the best thing, we may mix together two parts of Peruvian guano, one part of Plaster of Paris, and one part of wood ashes, and apply the mixture to the meadow at the rate of 400 lbs. to the acre, which will be found to invigorate the meadow and repress the growth of weeds ; and what is of almost equal importance, it will increase the activity of the worms. A very considerable difference of opinion exists amongst farmers with regard to the disposition of the first crop of grass from a newly seeded meadow. Some maintain that it should be pastured the first year by small stock, such as sheep and calves, in order that the land might obtain the benefit of their widely diffused droppings ; but so far as my own observation and experience go, I am decidedly of opinion that it should be mowed and not pastured, for the young grass has not yet become firmly rooted, and much of it will be torn out by the roots by the sheep and cattle, leaving vacancies for the weeds to find lodgment, while the uniform action of the scythe over the surface causes the grass to tiller, and the sward is invariably thicker and finer. You will always find in your pastures, that the cattle will manifest a preference for some spots, and for some kinds of grass over others, picking out these spots to the very surface of the soil, while they leave others untouched; the grasses thus left, will throw out flowering culms, which bear seed; it thus happens that the more undesirable kinds are increasing themselves by the self-sowing of their seeds. To prevent this, the scythe should be used. If the flowering culms are cut off before they mature their seed, their roots send up a rich aftermath, which in its fresh state, is greedily eaten, and thus the uniformity of the sward is maintained. It should be a settled rule never to allow grass or weeds to go to seed upon the pastures. Cutting off the roots of grasses is often resorted to successfully to increase the thickness of the sward in pastures; for this purpose, sword-shaped blades are inserted into a horizontal bar, about ten inches apart, which is drawn over the pasture, penetrating the soil to the depth of four or five inches; this is repeated once in five or six years, and in years when this is not practiced, much benefit will result to it from going over it in the spring with a sharp tined harrow.

It will be found advantageous to divide pastures into smaller lots than farmers usually do; the grass when it affords a good bite should first be fed off by milch cows and fattening beasts; when the first flush of the feed has been depastured they should be removed into a fresh lot and be followed by the young cattle and the store cattle. When the fattening beasts have had a good bite of the second lot, they should be removed into a third pasture; the store cattle from the first should follow them into the second lot and these should be succeeded into the first lot by sheep. The fatting should be turned into a fourth lot when they have taken off the best feed in the third and so followed by the store cattle and sheep in rotation, while the first lot is left vacant. When a good bite again springs up in this the fat cattle should go into it again, and the different classes should thus follow each other all the season, leaving one lot to recruit all the time. In this way all the feed is eaten off evenly and one lot is always recruiting and the sweetest grasses are not destroyed by overfeeding. This plan involves a large outlay for fencing materials but I am convinced it will prove the most profitable method. There is a method of laying down new meadows by transplantation somewhat in vogue in England which I have never seen practiced in this country. Strips of turf two and one-half inches thick and seven inches wide are pared off from alternate sections of an old pasture and removed to the field which it is intended to convert into meadow; it is here cut into pieces about three inches square at such distances, that the nine square inches of turf shall be surrounded by eighty-one inches of space and then pressed into the soil with the foot or with a wooden ramrod. If the transplanted sod is deficient in any of the valuable grasses they may be sowed on the vacant spaces in the field from which the sod has been taken as well as on the one which has been planted and both covered with a coating of manure. It is said that the vacant places left in both fields will soon be filled up with offshoots, and a well filled turf be obtained sooner than any other way,

Before closing my remarks, allow me to call your attention to an implement, a comparatively new one, and although, as I understand, introduced to some extent in this State, it is one which might be used to very great advantage by thousands of your farmers who probably have not yet so much as heard of it, I refer to Nishwitz's pulverizing harrow. It will be found a most efficacious implement in the restoration of grasses into many of your fields and pastures where the grasses have suffered severely by reason of drought and grasshoppers. It will effectually cut up the ground and render it fit for the reception of seed. I would apply fertilizers first, if possible, then go over it with this implement, at once incorporating the manure with the soil and pulverizing both together. If any grass roots remain, they will now start into more vigorous growth, and your seed will have the best chance for coming along also. In my opinion on all such lands which are adapted to its use, (it cannot be used to any advantage on rocky soils,) it will be found invaluable.

Mr. Thing. After you have used this Nishwitz harrow, and put on your fertilizers and sowed your seed, would you recommend rolling on dry ground?

Mr. Gould. I would, if there is a prospect of dry weather; but if rain comes soon after, there is no necessity for rolling. If it is sandy upland, I should roll it; there is too much air admitted within the interstices of the soil on loose land, and I would advise the use of the roller, whether rain is coming or not. But in ordinary cases, in dry soil, I think the roller is useless, except to give a smooth surface.

Col. Swett. How is it on granitic soil?

Mr. Gould. That varies very much. Some of it packs a great deal more than others; some is light and loose. On the loose kind I would use the roller; on the more compact kinds of soil, I would not, provided there is any prospect of rain coming on soon after.

QUESTION. In case you desire to change the grass on a meadow to timothy, will the Nishwitz harrow cut up the old turf sufficiently to give a catch of the new grass?

MR. GOULD. It will. You will need to put in a variety of manures; that is the great secret. *Feed your meadows well.* I endeavored to explain that point. I said that every kind of grass requires a different kind of specific food, and just in proportion as you combine the variety of food in the soil is the number of plants that will grow in a square foot. Put on manure of all kinds, and you will prepare the land for the production of all kinds of grasses.

QUESTION. On low meadow with a muck bottom where the moss is three or four inches deep, will that same process answer?

MR. GOULD. Yes, sir, provided you sow the seeds adapted to your soil, and otherwise do as I have described.

MR. ———. The greatest difficulty is to get rid of the moss.

MR. GOULD. The Nishwitz harrow will do it if you will use it in dry weather. I think that implement is the greatest contribution to the farmer that I have ever known. The miserable old-fashioned tooth harrow is the most wretched tool ever placed upon a farm. A good many farmers have an idea that the old tooth-harrow pulverized the soil; it does pulverize it a little on top, but you know how it is with your road makers. If they make a new road and want to settle it, what do they do? They do not take a roller; they take the old-fashioned tooth-harrow. So it is with your race-courses. If you will inquire of your horsemen, you will find that race-courses are always laid down with an old-fashioned harrow. That is the way they pack them. Now, the Nishwitz harrow instead of packing it, will make the soil loose, so that the air can penetrate into it. A new harrow has been lately invented by Mr. John J. Thomas, which for one purpose is the best that is made. There is no other implement which will smooth the surface like John J. Thomas' harrow. It is admirably adapted to land where you propose to use a mowing machine; and it is one of the best things ever invented for the corn crop. By going over just as soon as the blade makes its appearance above the ground, it will effectually destroy all weeds, and the corn will grow astonishingly. Even after the corn gets to be an inch high, going over it with the Thomas' harrow works admirably. It cuts up the weeds, and it so arranged that it never can clog. It leaves the ground perfectly smooth, and destroys all weeds without injury to the corn, and in a way that I have never seen done by anythiug else.

MR. POOR. As our grass has been almost destroyed by the grasshoppers and the drought, what would you recommend to bring the land into grass again?

MR. GOULD. I recommend this very process. I should rely a great deal upon top dressing. You have the old roots there, in a very weak condition. If they are nursed, they will come into vigorous growth; and the earlier you begin the better.

QUESTION. What kind of top dressing would you use?

MR. GOULD. That depends entirely upon the peculiarities of your soil. A man is simply a quack who stands up in a meeting of this kind, and pretends to say what is the best manure for any particular soil. The great principle to be observed in manuring is to restore to the soil the missing elements which were in it. If there is a deficiency of lime in the soil, then calcareous manures, chalk, lime and plaster, are the manures best adapted to restore it. If the deficiency is in phosphates, give phosphatic manures; give ground raw bone, give good superphosphate of lime; give it in any form that will restore phosphoric acid. If the deficiency is nitrogen, give sulphate of ammonia or nitrate of soda, or anything which contains it. First find out in what the soil deficient; chemistry will give you light, but if you want to learn in a practical way what mauure is best adapted to your soil, do as I recommended you to do to ascertain what kind of grass in best adapted to your land. Measure off eight or nine square rods of your meadow or pasture, and on one of them put phosphate, on another plaster, on another ashes, on another lime, on another nitrate of soda and so go on with the different kinds of manures the action of which you want to investigate on the grass, leaving one of the squares without any manure whatever. Mow off from each square rod on the same day the amount of grass that has grown upon it and weigh it in a green state. But do not decide yet; let all be converted into hay. Do it carefully; do it with your own hands, if necessary, only be sure that none of the hay from one of the squares is mixed with that of another square; then when your grasses are thoroughly dried, (let them all be equally dry,) weigh each portion, and the whole story is told you at once. If you find that one kind of manure gives you four pounds of hay more on your rod than that which was unmanured, then you know that four times 160 will be the amount of extra hay got from an acre by the use of that particular manure. You know what you can sell that extra hay for. Suppose 500 pounds is the result; you know what 500 pounds of English hay will bring; then calculate how much it will cost to put that manure on 160 square rods, and the measure of profit is given you, as it can be in no other way. It is a very easy thing to do, if you will only take the trouble. In that way you will learn precisely what kind of manure your soil requires, and you will also learn what you can afford to pay for any kind of manure whatever.

Mr. Paris. Will not plowing, in the mode you speak of to-day, and top-dressing the land, restore the ordinary grasses to an old field that is bound out, without the application of more seed?

Mr. Gould. In many cases it will, yet it is generally profitable to put on seed. I would always put on seed; it will almost always pay.

Mr. Paris. We find difficulty in getting different varieties of seed. There are very few kinds of seed preserved.

Mr. Gould. Only let the demand come, and there is no doubt whatever that there will be a supply. The reason you do not get them is because there is no demand. The reason I have spoken with what you will, perhaps, call an unwarrantable degree of energy, is because I want the farmers to rise to a nobler ether, to breathe a diviner air, than they have been accustomed to. I do not want to see farmers sitting quietly down without effort to improve. I want to see them day by day acquiring higher knowledge, and a more philosophical comprehension of all the principles underlying their business. That is why I speak so warmly.

Mr. Hersey. In your opinion, will the grasses of which you have spoken flourish in Maine as well as in New York?

Mr. Gould. Undoubtedly they will wherever the soil is suitable naturally, or is fitted to their wants by suitable culture and manures. You have, without doubt, all, or nearly all the varieties to which I have alluded, growing naturally in different parts of your State. The grasses are generally well diffused over large breadths, and although those which you sow intentionally are more common, there is no difficulty in growing many others.

Mr. Paris. The grass crop and the apple crop are of vital importance to us here in Maine, for they are about the only two that we really derive much profit from; therefore, we are deeply interested in the culture of the apple and grass. I offer that remark as an apology for the questions put to the gentleman.

MR. GOULD. I cannot tell with certainty, in winter, but as I rode along I saw some sod in several places which I thought was certainly Kentucky blue grass. It had the shape and form of leaf, and I took it for granted it was Kentucky blue grass—not the blue joint. Doesn't Kentucky blue grass grow in Maine?

MR. GOODALE. Yes sir. It is very common, but it does not attain such luxuriance as in Kentucky.

MR. GOULD. Certainly it does; and I have heard of a growth of the meadow foxtail here in Maine taller than I ever heard of elsewhere. If it is not diffused throughout the whole of Maine, I have no doubt it may be.

MR. GOODALE. I suppose the gentleman refers to a statement which I made to him some years ago, regarding an extraordinary growth of the *Alopecurus pratensis* which I once saw in this State. In 1861 I went along the seacoast of Maine from Kittery to Quoddy Head, for the purpose of investigating our resources in the matter of marine manures. Being on an island near Eastport, where herring were taken in large quantities, for the oil and manure which they yielded, I noticed near the oilworks a field of what appeared to be timothy, yet hardly had the usual appearance, and what struck me first as singular was that it had headed out so early, and in a locality where vegetation was later than in most parts of the State. So I walked toward it and found it, not timothy, but meadow foxtail; and much larger than I ever before saw this grass anywhere. Upon walking into it, I found the heads reached above my vest pocket, and upon measuring this height afterwards, I found it about four feet. I had reason to believe that the land where it grew had been manured with the liquid pressed out of the fish; but I was not then able to verify the supposition, the owner being absent. I noticed in the very valuable paper which Mr. Gould furnished for the Transactions of the New York State Agricultural Society for 1869, that he speaks of it as much esteemed in Maine as a meadow grass. I did not so intend to be understood, but rather that this case was an exceptional one. In no other case have I seen it much over two feet high, and oftener a foot and a half. It is not common in meadows, within my observation, but is occasionally seen by roadsides, in moist, rich places, and sometimes in pastures. The liquid which passes over with the oil when fish, after being cooked, is pressed, contains, besides nitrogenous matters, considerable phosphate of potash, and, as both the phosphoric acid and the potash are exceedingly valuable food constituents of the grasses, it is very probable that the extraordinary growth in this case was due to their presence in the soil in unusual amount.

If a grass so rare as this should come to occupy a field almost exclusively, and attain a degree of luxuriance elsewhere unknown, because of favorable conditions in relation to the food which it found on that spot, as seems highly probable, the fact is exceedingly suggestive regarding possibilities about other grasses, which at present are little cultivated. Who knows but that, with more knowledge about the requirements of the various grasses, and with improved ways and means of fertilization, we may be able some day to bring to great luxuriance varieties which are now among us, but so rare, or so diminutive in their growth as almost to escape notice?

I would be glad to learn if this grass is often seen in any of the fields or pastures of this State. It may be readily known by its general resemblance to timothy, the obvious difference being its smaller growth, and the head, which in timothy has a harsh feel when drawn through the fingers, feels soft, as a fox's tail—whence its name.

I may also mention that its seed is not common in seed stores, and bears a high price; besides which, it is more complained of for failing to germinate than almost any other.

It would be a very valuable pasture grass, could it be generally introduced and thrive well; not because of remarkable nutritive properties, but on account of its earliness. Although much inferior to timothy for meadows, it will bear cropping a great deal better, furnishes a good bite before almost any other grass, and throws up after shoots abundantly. As a pasture grass, it is highly prized in Europe, but not for meadows.

Adjourned.

EVENING SESSION.

The President stated that the general subject of grass culture would be resumed, and called upon the member from Kennebec County.

Mr. Horace Colbourn of Windsor. I am not in the habit of making apologies, neither am I in the habit of public speaking, and it seems like taking a step backward to call upon a common, plain farmer, who is obliged to work hard to get a living, to follow so able a speaker as has entertained and instructed us this afternoon, nor would it be possible for me to speak of scientific methods; yet such practical experience as I have had is at your service. It relates chiefly to reclaiming bog or swale lands.

It has been truly said, that whoever makes two spears of grass to grow where but one grew before, benefits mankind, and if the farmers of Maine had heeded that saying in past years, as they should have done, they would not be where they are now.

Wherever I have traveled in Maine, I see a great portion of the best grass lands covered with bushes and other obstructions to culture. Whoever has taken notice the last year, may have seen a good crop of grass on what we call reclaimed swamp lands, while you could count the gravel stones at a distance on the uplands, and, in some places, you could see countless grasshoppers also. Some farmers object to swamp lands beeause they say they cannot raise the better grasses on them, and that the varieties of swale grass are good for nothing. But the present year will be sufficient to convince them to the contrary. We find those who have those grasses have no difficulty in getting them all eaten up and to good advantage. In 1839, I purchased the farm, or a portion of it, on which I now live. The soil is mainly clay loam, through which runs a small stream that empties into the western branch of the Sheepscot River, on each side of which was a strip of interval, varying in width from two to twenty rods, and for that width it was covered with alders, elder bushes and with almost anything that could drift upon it. Wherever the bank comes down steeply towards the brook, the former occupants had hauled logs from the highlands and dumped them on to the interval, and it looked like a rather hard job to clear the piece. After I moved on to the farm, it began to be whispered around that I had bought Mr. such-a-one's bog, and much wonder was expressed that I had not bought more upland instead, so that I could raise more grass and corn.

It was a good hay season, and all the hay cut was judged to be twelve tons. I bought it at that estimate, but do not think there was so much.

When a suitable time came, I commenced at the lower end of the bushes, cut them out by the roots, cut and cleared off the logs, and, where it was not springy, I plowed and seeded to English grass; where it was, I let the water grasses remain. I have cut grass on some of it for more than twenty years, and it has averaged two tons to the acre. The hay cut now is finer than when I first mowed it, and by following up these places I have been able to increase the quantity of hay upon my farm from twelve to seventy or eighty tons, until within the last two years. But these intervals and swales have not fallen off in quantity in these years when the upland has not yielded a half crop. By clearing these waste places, I am enabled to keep up the fertility of the uplands. The sediment left after being overflowed, keeps them enriched sufficiently to produce an even crop of grass without any other dressing.

Give us plenty of grass, and we can have plenty of most other crops. I have failed to get as much benefit as some have from concentrated dressings. My experience with them is that they will start a plant early and hasten its ripening. Corn, for instance, may be pushed along earlier and be got out of the way of the frost sooner by using them, but for grass we must have dressing that has more body to it than superphosphate, guano, plaster, &c. From plaster there may be considerable benefit derived on certain kinds of soil, but when land that has been plastered for a number of years comes to be plowed, it needs more dressing of a bulky nature to bring it up than it would if it had never been plastered. My experience is that plaster does not do as much good on land that has been plowed a number of times, as it does on new land which has never been plowed. I cannot give the reason why it is so, but I know it to be so from experience.

The only way, according to my experience, to make a sure thing of fertilizing properly, is to carry back to the land all the dressing we can make out of that we take off of it. It will not do to sell hay. It will not do to raise too many potatoes nor oats. I am not satisfied that top dressing, in all instances, is the best method of applying manure. For instance, to top-dress the past fall cannot produce a great effect. We all know that the grass roots are nearly dead, and if so, top-dressing alone cannot do much good. My method has been, when the mowing gets run down, to turn it over about six or eight inches deep, in September or October, and the last part of October haul from twenty to twenty-five loads of dressing from the barn cellar to the acre and spread it broad-cast from the cart. In the spring, put on barley. By this method I never have failed of a good catch, and good crops afterwards. If any one, as he travels through the State, is careful to observe, he will see a large proportion of our best grass lands lying waste ; they neither produce a growth of wood nor a growth of grass, but merely serve as a range for cattle when there is a drouth. We must resort to these places, ditch them, haul what we take from the ditches to our barns and use it to help increase the amount of dressing.

If any one asks, What shall we sell, if neither hay, potatoes nor oats? I answer, sell butter, cheese, calves, beef, pork and pigs. Then the crops are all consumed upon the farm, everything is made to contribute to the supply of manure. After any farmer has tried dairying, he will be very loth to fall back upon the skinning process again. As farmers, *we must look to the condition of our farms, and see that the fertility is kept up.* If we do so, although our barns may be empty now, we shall see them well-filled again, and our stock again looking plump and sleek.

MR. SILVANUS POOR of Andover. My farm is what is called an interval farm, that is to say, most of the hay is cut on what is known with us as interval, or on swampy land, and contains one hundred and fifty acres.

When the town was lotted, nothing was called interval that was not dry enough to plow and cultivate, and was covered with hard wood, elm, maple, beech, birch, oak, &c., intermixed, in some cases, with spruce, pine and hemlock.

The upland, as a general thing, is from twenty to seventy-five feet higher than the interval, and in most places the banks are steep and curved, as though formed by the washing of the river. At the foot of these banks there is a belt of swampy land, from ten to fifty rods wide, generally composed of a deep black mud. This is kept very wet and soft by the water that makes out at the foot of the ridges, so much so that none of our domestic animals ever attempted to cross it. For many years such land was not considered worth clearing, and in many places they are not cleared yet. On my farm this swampy land had been cleared in a measure by taking off the wood to burn at the house, &c., and then suffered to grow up to bushes.

My farm contained a large amount of such swampy land. I had several acres in a body lying between my house and interval that I wanted to improve. After taking off the bushes, which cost seven dollars per acre, I dug a ditch through it in the best place to drain it, from three to four feet deep, and three feet wide at the top, at about right angles with the banks of the upland. This main ditch was left open until all the rest were finished. I then dug two others, one on each side of the main ditch, at about right angles with it and about the same size and depth, near the ridge, in the best place to receive the spring and surface water. In these, for want of draining tile, I used, for one side, small poles, (ash and cedar), beginning, in all cases, at the upper end to lay my drain, being careful to keep the water course clear. On the other side, I used brick and flat stones. After making them comparatively tight, I filled in with coarse sand or gravel to within eight or ten inches of the surface, so as not to disturb the sand with the plow when plowing. This method takes not only the spring, but the surface water readily. But this did not fully accomplish my object, for I found springy places on both sides of my side ditches; I then dug two other side ditches parallel with the first ones, and not finding much water, I filled them at once with coarse gravel from the bottom to near the surface, and found that they took the surface water readily, but did not drain my land sufficiently; I then dug smaller ditches (but about the same depth) from the side drains to wherever I found a spring on the ground. These I filled at once with coarse gravel, as before described, unless there was too great a flow of water—in that case, I laid underdrains, and filled as before. In this way my object was accomplished, and I can now raise on land that was worthless and barren for good crops—corn, potatoes, turnips, wheat, barley and oats, and the best of English hay, and get large crops. Since then, I have done more at improving the same kind of land on other parts of the farm, and have learned something from experience.

Now, I dig the main ditch in the best place to drain the land, and sometimes more than six feet deep,—it being very important to have the main ditch deep enough to thoroughly drain. I then make side ditches from my main ditch to wherever I find a spring or very wet place. These ditches I fill, as before described, using judgment as to whether an underdrain is required, or whether the coarse sand will answer alone. I prefer to use sand from a sand-beach at the river, as water passes through it readily. After draining such land, and it becomes settled and comparatively hard, I find it for my interest to plow and cultivate it, for the purpose of improving the *quality*, as well as the *quantity* of the hay. Farmers attempting such work must not be discouraged if it is expensive, nor if it takes several years to make it productive. It certainly *will* pay by and by. There is an acid, or something of the kind, in most of such cold, mucky land, that is injurious to vegetation; but exposure to the atmosphere will remove it, although sometimes it takes several years.

For instance,—I had a small piece of swampy land, lying at the foot of the bank, so wet and soft that I could run a small pole into it eight and ten feet very easily. After taking off the bushes, &c., and ditching near the ridge so as to take away the spring water, I sowed herdsgrass and fowl meadow seed, but it would not produce anything of value; I then top-dressed, and sowed on seed with the same result; the seed sprouted and came up, but it soon withered and died. This was the second year after ditching. I supposed I knew why the grass would not grow, and let the land lie. The fourth year fowl meadow began to grow, and the fifth year, I had a heavy crop of herdsgrass and fowl meadow, and the land has produced bountifully ever since, which is seven or eight years.

The same is true with some muck used as a fertilizer. Much depends upon the location and surroundings of a muck bed. For immediate use, as a fertilizer, muck taken from a bed or swamp mostly surrounded by black growth, and no stream running through it, is almost worthless, except as an absorbant, until it has had the action of the atmosphere and frost for a year or so after it is taken out. On the other hand, muck from a bed surrounded mostly with hard wood growth and near a stream, makes quite a good fertilizer for some land as soon as applied. But the best way to use muck, is to put it dry into the barn-yard, hog pen, &c., for an absorbant.

Much good is derived by mixing soils, if properly done. The most luxuriant growth of hay I ever saw was produced by mixing very fine sand and clay together in about equal parts, and spreading the mixture on coarse gravel underlaid by clay. Neither of the materials separately would have produced a single blade of grass. The same is true in regard to top-dressing, almost anything spread on grass land will improve the crop,—the better the material, the better the result; but one cannot raise a good quality of hay on a cold, wet soil, without first ditching and taking off the water. I find in ditching my mucky land, that the water does not mix with the muck. If water gets on a muck bed it remains a long time, unless taken away by ditching or evaporation. It will not readily soak through the mud; hence the necessity of keeping out spring water. I can dig muck in wet weather as well as in dry, if the surface water is kept out of the way. I also find all my muck beds underlaid with a very fine bluish compact sand, filled more or less with small particles of charcoal. This stratum of sand is from six to eighteen inches thick, and often so hard as to require a pick to remove it, and is almost impervious to water.

In some places, much of the time and labor expended in ditching, may be saved by digging through this stratum of find sand, and letting the water up that had to find vent in other places many rods away. I have a low, sunken swamp, on the upland near my buildings, of six or eight acres. A small brook ran into it, but there was no channel through, and it was always very wet. It was surrounded by a growth of evergreens. At the lower end I built a dam sufficiently high to flow the whole, and covered it with water, and kept it so five or six years, until all the growth was killed. After taking off the timber, wood, &c., (cutting close to the ice,) I drew off the water, and in a few years the bog cranberry came in and covered most of the swamp, producing abundantly. Water moss then came in and grew eight and ten inches high, and covered most of the swamp. I let it remain in that condition for several years. Then, wanting to get muck from the upper end, but being unable on account of its wetness, I dug a ditch through it lengthwise three feet deep, connecting it with the brook above, which thoroughly drained one-half of the swamp, (no springs coming in from that side.) The cranberries and moss soon died out on the dry side, and alders, willows, &c., began to come in, but grew slowly for three or four years. Then the foliage put on a new color, and wherever permitted to remain have grown very rapidly since. On the wet side of the ditch, which is quite springy, the cranberries and moss continue to grow, and bushes are working in slowly. I find the same acid to contend with as in the cold, wet land adjoining my interval.

I now have a very good and convenient muck bed on the dry side, and the muck is of good quality; where I take out the muck grass works in easily and grows well. I also find the same stratum of dark fine sand mixed with charcoal in the swamp on the upland as I did on the interval, and it produces well after plowing. Oats and barley grow well and yield bountifully, but the straw is weak and liable to lodge.

The average cost of ditching is about twenty-five cents per rod; for filling with sand alone the expense is about the same with me; much depends on the distance one has to draw the sand. Covered drains are more expensive—much depending on the material used for the drain.

HON. D. H. THING of Mt. Vernon, followed with an address on what he termed "Stick-to-it-iveness," graphically portraying the advantages of remaining by the old homestead in spite of discouraging seasons, and the rewards of perseverance in well-doing, which was received with great favor, and closed the exercises of the evening.

THIRD DAY.

THURSDAY, January 25, 1872.

The Board re-assembled at 10 o'clock, when an Address was delivered by T. S. GOLD, Esq., Secretary of the Connecticut State Board of Agriculture, on

THE PRODUCTION OF MILK.

MR. GOLD. *Mr. President and Gentlemen:*—The successful production of milk depends almost entirely upon the grass crop for its great foundation. There is no section of conntry where milk can be produced extensively and profitably except where grass thrives. We are obliged in some cases to obtain milk for a particular purpose where grass is not the natural product, but we do it under great difficulties. Where grass is the main dependence we are often obliged, by the particular character of the season or other circumstances, to call in other substances, but after all, grass must be the main dependence, either as green grass or after being dried. With either of these in abundance milk can be produced of the finest quality and in the greatest profusion. It is foreign to my purpose to expend very much time upon the subject of feeding as a means of producing milk, yet we are all aware of the fact, and I lay it down as an established principle, that the quantity and quality of the milk will depend very largely upon the character and the quantity of the food employed. Most conclusive experiments, conducted by Mr. Horsfall, in England, upon this subject, have recently been presented through the agricultural press. Mr. Horsfall's conclusions are, that with the proper food, proper conditions of temperature, and other circumstances being taken into account, as good butter, and as full returns can be secured in the winter as at any other season of the year.

In producing milk for different purposes, we must consult the different conditions required to be fulfilled. If we wish to make milk for cheese alone, it is our object to make milk when we can make it cheapest. In cheese dairies, beginning in the spring and running through to autumn, leaving the cows three or four months to recuperate, and to pass along without giving milk, is considered as the most economical system. If you make butter, you are encouraged to extend the time of milking by employing extra food, and to protract it even into the winter. As it is demanded for family use or for market, you are obliged to furnish a supply throughout the whole of the year, and an entirely different system of feeding, and a different class of animals, and another form of management, are required to accomplish this result. The subject came up with regard to close feeding of pastures yesterday, and changing stock from field to field.

There are some things to be said on both sides of that subject, but still I may present some facts upon it. For feeding beef cattle, high pastures seem to be desirable, and that the grass should get considerable growth; but for the production of milk, short pastures are considered to be desirable. Short, fresh, close grass will give you more milk than where you allow the clumps of grass to run up and obtain considerable firmness and size. And especially is this grass more productive in milk when it is fresh; when it is green, as was said here the other night, than when it is allowed to grow to considerable height, so that it is white or yellow below, and has become sour by reason of moist weather. Even with the most abundant pasture, I have noticed our cows fall off when there comes a warm, sultry, damp time, in which the grass in the pastures is growing most luxuriantly, and there is a great abundance of food, because it becomes soured by getting too rank; it gets ahead of the cows. That is by no means a desirable condition for dairy pastures.

With regard to the changing of stock, there are reasons why it is desirable to change. The manure is more evenly distributed upon your farm, and you can control the feeding of certain cold, wet lands more perfectly where you change your stock from one field to another. But the amount of milk produced as shown by the pail, and the amount of butter and cheese produced from the cows, is claimed, and I believe admitted, to be greater where they can have as nearly as possible the entire range which they are allowed to have during the whole season. Some of our best farmers adopt the system of two pastures, a night pasture, and a day pasture only. Now, the quiet condition that those animals assume is wonderful; they accept the condition of things; they go down into the low land or swamp, and fill up down there in part, and part of the time they graze upon the dry lands. They do it every day. They seek some of those coarse grasses; they seem to like to rasp their throats, as was said yesterday, with something coarse, while they are also partaking of the finer grasses. It seems, on the whole, I think, to be admitted, that you save fencing, you save in the quiet of the cows, and in the produce of the milk, by letting them have as large a range as you design for them, rather than to change them from one field to another. I started in my farming with the idea that I would do better than the old custom; I would change my dairy. My fields were well enclosed and provided with water, and I was enabled to do it. I turned my cows into a field of fine flush growth the first of June, and the first two or three days they ate too much; the next two or three days they were just right; gave a full flow of milk, and all comfortable. The next two days,—suppose a field lasting about a week,—they began to be uneasy; they were looking out for fresh pasturage. The result was, when they were turned into a new field they again ate too much. Seeing my neighbors pursuing a different course, although I did not believe was just right, I have been induced so far as possible to adopt it. I grant that the manure is not so well distributed; they will have favorite lying places, favorite places of resort, so that some of the pastures will be deprived of what should be dropped upon them to fertilize. We all notice a very great difference in the quality as well as the quantity of the milk produced when our cows are in one field, and when they are in another. No matter in what field our animals are kept, we cannot go back of this; there is something in the animals, feed them as we may, that tells in the milkpail, and in the churn; and here we come to a point which I propose particularly to call to your notice.

This difference in cows is found most commonly among what are called the native herds; that is, those that have been bred in this country from its earliest settlement, and mixed with the different animals that may have been introduced. You know there are no such animals as native cows; they were all introduced here from Europe; but what is called native stock was introduced so long ago that we have lost all knowledge of their history, and they have been mingled with every herd that has since been introduced, so that they present some of the best and some of the poorest and worst qualities possessed by any neat stock. We have a great many farmers who say, "I care nothing about your Shorthorns, or your Ayshires, or your Jerseys; just give me a good native cow, I can match her against anything anywhere; I know she will give more milk than anything you can produce." Well, the knowledge these men have of native stock has extended over thousands of native cows. To match that knowledge, they have known perhaps fifty or one hundred thoroughbred animals of some breed. They have had some acquaintance with these, and with this limited range of knowledge, they will insist that the natives are superior to any thoroughbred stock that was ever raised. I have explained why they have imbibed such an opinion.

Some of our native breed have sprung from as good animals, doubtless, as any of our thoroughbred stock, and we find everywhere the report of some native cow that is doing remarkably well; but even with the small number of thoroughbreds, those animals can be more than matched. You have cows that give very rich milk, and that make butter readily when the cream is churned; you have cows that give high colored milk; you have cows that give skim milk, as you call it, among your natives; and now a man attempts to breed from his native stock. He is confident that he may reject all your high-priced thoroughbreds; he will pay no such price for an Ayshire, or a Devon, or a Shorthorn; but he will breed from the native stock. He selects his herd of native cows, and with a native bull he makes the experiment. What is the result? It has been tried hundreds of times, over and over again, and the result is always a failure. Take the example of a herd of cows running back twenty-five years, bred up successively and uniformly; give them more time, if you please, fifty years, or any length of time that we are likely to pursue an agricultural enterprise in these days, and it has universally proved a failure. The strains of blood which have been united in producing these good native animals have been so intermingled with bad strains and conflicting strains of blood, that the result is always uncertain. A good native cow is a *chance production,* and the attempt to breed from that class of stock with any certainty, has always proved a failure. We have an old English adage which comes in here: "A good cow may have a bad calf." That is directly in contradiction to the adage that controls us in breeding, that "Like begets like."

Before speaking upon the different breeds of cattle particularly, I would allude to the different kinds of milk desirable for different purposes. There are four objects for which we make milk—for cheese, for butter, for market, and for family use; and all to a certain extent admit, and even demand, a different kind of animal, producing either a different quality of milk, or in some way producing it in a different manner; perhaps merely protracting the season of yielding milk. For market, we demand an abundant quantity of milk; we want good milk, but it is not desirable that the cream should separate readily, but otherwise; that the cream may remain suspended in the milk is the most desirable quality in market milk. To attain this object, we take pains in curing it for market. The milk is cooled and stirred immediately when it comes from the cow, for the express purpose of disseminating and retaining the cream through the whole substance of the milk; that is one of the objects of curing. Now, if we can find a kind of milk that answers that purpose more particularly, that does not as naturally separate into cream and skim milk, that kind is better for market purposes than such as separates more readily. It is also better for cheese. One of the great difficulties in the manufacture of cheese consists in the trouble experienced in disseminating the cream through the body of the milk. It has always been a contested point among cheese makers, whether, when cream was once separated, they could get it back again into the substance of the milk, and so into the cheese. They disagree about that continually and everywhere. It is not a settled question; some claim that they can. I think it is rather by a happy entanglement of the particles of the cream with the curd, than by the perfect dissemination of it through the milk that this is secured; and that if it has once been separated it never can be again so perfectly united in the curd; but by a happy process of manufacture, it may be entangled to a certain extent and retained. But you want milk that will not readily throw up its cream; that will hold it suspended through its body, both for market and for cheese making. For family use, you want a milk that is very rich in all the properties of milk, if you desire the best for your family; and there are scores of farmers who like to keep as good as they sell, though they are very often charged with selling everything they can and living on the rest; but really, we like to have as good as we sell to consume, and those who keep but a single cow or two are very anxious to get the best article of milk. I believe that here we find a very great difference in cows; some will give a milk that is rich in all its properties, where the cream is immediately separated from the milk, though the test of richness in our families, I would say, is more generally decided by the amount of cream and butter that the milk will make; they do not appreciate that there is any other richness in milk except the cream and butter; but there are other properties in milk that are as highly important and valuable perhaps for family use as the amount of butter that the milk will make; and therefore I say, that there are varieties of milk that are especially adapted to family use, that may not be in the highest degree adapted to the production of butter; milk that is rich in all its constituents, butter, caseine or curd, and sugar, and all those properties may be in some varieties in a higher degree than in others.

Then we come to the question of butter making; to the cow best adapted to the making of butter. Here we want a milk rich not only in butter, but one that will readily and easily throw up its cream; in which the separation is rapid, and from which the cream will readily form butter; and which in its color and flavor shall be just adapted to the demands of the market, I will not say in the highest degree the best, for there is a difference of opinion about that, but upon one point there is no difference of opinion; the highest price in the market settles the money value of certain breeds of stock as butter producers.

Now we come to a consideration of the different breeds of stock; for I claim that in these different breeds we have animals adapted to each of these wants in a very high degree, and they can be bred so that with a good degree of certainty their produce will answer our expectations. First, Shorthorns or Durhams. They are of fine size and symmetry of form, and always attract our admiration. It is claimed by their advocates that there are milking families of Shorthorns with strains of blood that produce large quantities of milk. It is doubtless true; I am willing to grant that; but generally they have been bred for the purposes of a beef producing animal. That is the main object, that is their history in a long succession of generations; and this has been, this is, their crowning excellence, and to hope to find among the Shorthorns, as a breed, animals that develop all the milking properties in the highest degree, is not to be expected. Their cream and butter, *as a rule,* are wanting in color; their milk, as a rule, does not compare in richness with that of some of the smaller breeds; and it is only in the most luxuriant pasturage, fine level lands, where they can fill themselves without the labor and difficulty of climbing hills, where they can lie quietly in most luxuriant pastures that the Shorthorn lays on flesh and thrives, and there, undoubtedly, especially if beef production is the object, and in some cases, I admit, as a butter animal, the Shorthorns and their grades are desirable. But in Connecticut, there are few sections adapted to this race, and I imagine that Maine has few sections in which this would be the most desirable animal for your farmers to breed.

The Devons come next on my list. The value of the Devons for working oxen is admitted everywhere. Their kindness, the ease with which they are broken to the yoke, their intelligence, the certainty with which you can breed them, so that they will be just alike, just like two peas from a pod, or more than two from a pod, if you have more Devons, is a great point in their favor among those who would breed steers. Their activity as workers is unsurpassed, and in breeding for this object, and for beef qualities, upon a somewhat thin soil, or hilly locations, they are unsurpassed, even by the Shorthorns. The milking properties of that breed have in a good degree been lost sight of, and it is an exception to find a family of Devons that are great milkers. Such exceptional cases are on record; and the quality of the Devon milk in all its properties, for butter, for the amount of casine or curd that it contains, and sugar of milk, is admitted, I believe, to be equal, if not superior, to that produced by any other breed. The color communicated to the milk by a large proportion of Devon animals is sufficient to give character to the milk of a certain locality. In my own neighborhood, from one station, we are sending milk to New York; we send, in the height of the season, about one hundred cans of forty quarts each a day from that station, and it is reported that our milk is of a better color than that from any other station on the Housatonic railroad. We have more Devon stock, more Devon blood mingled with our herds of cows there, than at any other place with which I am acquainted on that road; and I attribute that quality to the mixture of the Devon blood, rather than to the character of our pasturage, though I think a good deal of the pasturage of those hills, as having something to do with the results. I would remark here, that there are no Jersey animals, to my knowledge, in any of the herds that send milk to New York. The Devons would have to yield the palm for color when the Jersey comes on the ground; but among other breeds of cattle, we claim fine color and fine body for the Devon milk, and the quality of the butter is not a whit inferior to that made from the finest Jersey, although that bears such a price as throws Devon butter into the shade. But that is another question; the intrinsic value of the product I am now speaking of in the Devons. With regard to the milking qualities of the Devons, all the females are not to be classed among "tea-cup cows," as they have been sometimes. Lieut. Governor Hyde, who is an extensive breeder of Devons, recently informed me that at the Massachusetts Agricultural College, they are now testing the four leading breeds, Shorthorns, Devons, Ayshires, and Jerseys, as milk producers. He had sent some of his stock there, and they had informed him that at present the Devons are leading as milk producers. As to the richness of Devon milk, the stories connected with milk in many respects have somewhat of a fishy odor, as it is said. We have a record of the amount of butter produced from a given quantity of Devon milk, and although we receive it from unquestioned authority, still it is rather incredible. I will give my authority. Mr. J. N. Blakeslee of Watertown, Conn., who is a breeder of Devons, states that in the autumn, his son, after feeding a Devon cow upon pumpkins freely, took her milk and set it by itself, carefully saved the cream and churned the butter, and the product was one pound of butter to 3.66 quarts of milk. Probably they were milk quarts, because this experiment was conducted some years ago, when milk quarts were more in fashion than they are now.

Mr. Parris. How do you compare the Devon oxen with the Durham in point of strength and work?

Mr. Gold. You cannot get as much weight in a pair of Devons, on a given surface of space, as you can in a pair of Durhams. In our quarries in Middle Haddam, Conn., where they use over one hundred yoke of oxen all the time, feeding them on grain, they want high grade Durhams; they want the heaviest cattle they can get, so that they can bring great weight in a limited space, and put that weight right on to a rock and go along; that is what they use them for. They do not want Devons there. Their cattle are all of this heaviest class. But for our country farm work in Connecticut, we want the Devons. They will travel further, they will plow more, they will draw a cart anywhere with a load as big as ought to be put on a cart, they will climb our hills, and they will do any amount of farm work. A pair of Devons will do more than a pair of Shorthorns that will weigh a thousand pounds more, and we think it does not cost so much to keep them. Certainly they will go round and gather up their living and be fat upon rocky fields, where the Shorthorns will not. But when they want cattle to put into these quarries, and give them all the grain they can eat every day for a year, so that when they stop working them they go at once to the shambles, they want a different class of stock. High grade Shorthorns are bred expressly, in the valley of the Connecticut, to supply those quarries.

I have been repeatedly called upon by friends in cities to furnish them with a cow that would give good milk for family use. They were not particular about the quantity, but they wanted good milk. I have met that demand satisfactorily by going to a neighbor and getting a high grade Devon. The problem has been satisfactorily solved; they have always been satisfied with the milk produced by such an animal.

We next come to the Ayrshires. These have been bred for a long period in Scotland upon hard hill pastures, for the express purpose of producing milk for the making of cheese. They are not a large breed; they are hardy, but the quality of their milk, when tested for butter making, does not compare favorably with that of the Jerseys. The cream does not so readily separate from the milk as in the Jersey, but the richness exists in the milk. It is rich in all the constituents of milk, and they seem particularly adapted to the production of milk for cheese and for market. Few owners of Ayrshires claim excellence for them as butter makers, though there are some cases on record which show a good yield in that direction; but their record as milk producers is perfectly astonishing. I have in memory one cow which appears in the last Ayrshire herd-book—"Red Rose"—I forget her owner and her number,—she was a small cow, (the Ayrshires are all small,) that gave 84 pounds of milk in a single day, and her average for some two months was 67 pounds a day. Eighty-four pounds is as near forty-two quarts, wine quarts, as you can make it. Milk is now measured by wine quarts.

There are other examples given of Ayrshire cows. At the first exhibition of the New England Agricultural Society, there were some Ayrshires exhibited from Maine whose record was very remarkable indeed, considering the size of the animal. You have a small animal; about eight hundred pounds live weight gives you a pretty respectable Ayrshire cow; and it is claimed, and I believe undisputed, that for the amount of food consumed, the Ayrshire will give more milk than any other breed of cattle.

I will now pass to the fourth class—the Jerseys. The Jerseys are a breed long established in the Channel Islands, lying between England and France. They are sometimes called "Aldernays," but the proper name is Jerseys, and that embraces all those animals which are brought from those islands. There is another little island, Guernsey, which differs a little in the character of its animals, but they have one general class of characteristics. They are a small, fine-boned, fine-limbed, and rather nervous and excitable breed of animals, but their leading characteristic is the exceeding richness, most people say, of their milk; but I say, the richness of *the color* of their milk. It has been laid down as a rule by some writers, that the Jersey milk, although its richness was claimed to be so great, was no richer actually than the Ayrshire or the Devon. I would hardly assert that, but I do assert that a large part of its apparent richness is due to the exceeding richness of color and the fact that the cream so readily and perfectly separates from the milk. Jersey skim milk is almost always of poor quality; it is the poorest kind of skim milk; while the Devon skim milk is claimed to be as good as the new milk of other breeds for ordinary household purposes. I have spoken of the price obtained for Jersey butter as a fancy one. I believe it is on record, and not to be disputed, that Mr. Sargent of Brookline, Massachusetts, sold his whole product of butter the past year to a dealer in Boston at $1.15 a pound, and that he sells it to his customers at $1.25; and they are satisfied and glad to get it at that. Other Jersey breeders have to be satisfied with 75 cents per pound, and so on until you come down to the common price which farmers get, twenty-five to thirty or forty cents a pound, just as the quality or the reputation of the dairy may be.

Now, setting aside this fancy value, the Jerseys, for the high color which they impart to their milk, seem to be worthy of introduction, in part, at least, into every herd where butter-making is followed, to give, at least, *color* to the butter. This is the universal advice, I believe, upon that subject. While they lack somewhat in hardiness, while their extreme nervousness and somewhat fidgety nature makes them not the most pleasant animals to herd with others, a high grade Jersey will so improve the richness of the color of your butter, that they should have a place in every herd designed for its manufacture. As a butter cow, in the vicinity of cities, where they can have nice care, and as a pretty object to be petted, they are in great favor, and pay their breeders high prices for raising them; but as farm stock, except for the purpose of giving color to the butter, they can hardly be commended, or for the especial purpose of butter-making, to meet this fancy demand.

I have gone over the ground now with regard to the merits of these different breeds, and every farmer must choose for himself, for his own wants, for his own neighborhood, his own soils, which class of these animals it is most desirable for him to obtain. And here comes up another point, which is the power of transmission of the qualities which any animal may possess to its progeny. I have said, with regard to the natives, that this power of transmitting their properties, with any tolerable degree of uniformity or certainty, was not possessed by them; but there are breeds of animals, there are families of animals, that possess the power of transmitting their qualities to their progeny in a very high degree and with great uniformity and certainty; and that is true of every one of those classes of which I have spoken. They have been bred for centuries with one single object in view in each case, and that has been kept uppermost all the time, until it has become an established habit with them. You may have accidentally an Ayrshire that is not famous for milk, or you may have a Jersey that is wanting in the peculiar characteristics of that breed, but they are very rare exceptions indeed. They breed like their dams, like their sires, with a good degree of certainty, and it is only by breeding from such stock that you can hope to secure a superior herd of animals. The best farmers in the world, those who pursue a system of "stick-to-it-iveness" far surpassing anything ever adopted in this country, have been sticking to these breeds for more than a hundred years, or back to the earliest records, right along; they have stuck close to one object, until they have secured the power in their animals of transmitting their good qualities to their progeny. Now, the value of an animal for breeding purposes does not depend so much upon the actual merits of that animal, as it does upon his power of transmitting his good qualities to his progeny. It is true, his bad qualities are also transmissible, but an animal that belongs to one of these thoroughbred classes has greater power, although he may be a failure in some respects, of transmitting the good qualities of that breed in a high degree to his progeny, than even a superior animal that may have some taint of inferior blood in his ancestry. Hence, in building up a herd of animals, it is now announced as an established fact in breeding, one that you cannot gainsay, nor get around, that if you wish to improve your herds in any particular, you must obtain a thoroughbred bull of that class of animals that possesses those qualities which you desire in the highest degree, and continue to breed from that stock. That rule is laid down without any fear of contradiction. Now, if you want to build up a breed for butter-making, you will introduce the Jerseys. If you want milk for cheese or for sending to market, you cannot do better than to take the Ayrshires. If you want to breed oxen for farm use, and cows that will produce an excellent quality of milk for all purposes, you cannot do better than to take the Devons. And if beef is your object, early maturity, fine growth, a class of animals that will make the most pounds of flesh on what they consume, the habit of the Shorthorn is such that you cannot do better than to take the Shorthorn, if you have plenty of feed for them.

There is one other consideration in regard to the Shorthorn as a dairy animal, that I would call to your notice. The grade calves from Shorthorns are almost universally large. If you want to make veal, that is an object. For early sale to the butcher it is very important that calves when they are dropped should weigh something like 100 pounds. It is a good start to get an animal of that size, and they will grow right along. But if your object is merely milk and you purpose to dispose of most of your calves as they do in most dairy districts by the process called "deaconing" you want to rear a calf that will make the least drain upon the system of the cow, that is, require the least draught to support it; and with the Ayrshires, the Jerseys or the Devons, you will secure such an animal. Not only are the thoroughbred calves of these breeds small, but they are so small that your farm help will often tell you that they are not worth raising. I have been met a great many times with such a statement as this: "That little Devon calf you have got there will never amount to any thing, it is of no use to keep him." I am told the same thing with regard to the Ayrshire calves. The grade calves are larger than the pure bloods, but all the grades of these crosses are small in comparison with the grade Shorthorns. If you want to make as light a drain as possible upon your herds in that direction, it is certainly a very great saving to adopt such animals, rather than the common run of native stock, of which you never know what the produce will be.

I have little further to say, except to insist once and again upon this power of transmission of their good qualities in thoroughbred animals as stronger than the power of transmitting their bad qualities. If they have any faults, they are not as sure to be transmitted as their good qualities. Take these principles to guide you, and you can build up a herd that will be continually improving in the desired direction.

MR. HERSEY of Lincoln. There have been some Dutch cattle imported into this State this year, and I am aware that Mr. Chenery of Massachusetts, has been importing Dutch cattle into that State for several years. They have not been extensively used yet. I see by the record of the New England Fair this year that there were some full-blooded Dutch cattle sold by Mr. Chenery at that Fair at a very high price—a great deal higher than any others that were sold at auction. I would like to ask if the gentleman has any information in regard to that breed.

MR. GOLD. My knowledge is confined entirely to seeing those animals on exhibition, and from what I see in the reports that are circulated in regard to them. They are doubtless, some of them, enormous milkers, but they must be also enormous consumers of food. They are very large, and generally rather coarse in their forms, indicating not the finest organization, nor well adapted to give the highest returns for the amount of food consumed. The quality of the milk of the larger animals is considered to be inferior to that of the smaller ones, and Mr. Flint goes so far as to say that there is a regular gradation in the quality of the milk and when you get down to the Brittanys, which he has inported (those little animals three feet high; "cowlets," some call them, not cows) the milk is as much superior in richness to the milk of the Jerseys as the Brittanys are smaller than the Jerseys; that the size of a breed indicates in a good degree the richness of the milk. Taking that view, the Dutch cattle would stand at one end of the scale, and the Brittanys at the other.

MR. PARRIS. There is one breed of cattle that I should be very glad to hear the gentleman's opinion about, if he has had any experience with them; I mean the Herefords, which are regarded in some parts of our State as being the first breed of cattle.

MR. GOLD. I have had no personal experience with the Herefords. In my remarks I have confined myself almost entirely to my own personal experience. I have bred Shorthorns, Devons and Ayrshires, and their grades; I have not bred Jerseys. As for the Herefords, they are celebrated as beef-producing animals rather than as milkers.

I would remark, that in the valley of the Connecticut, there has long been bred a family as it was supposed of Shorthorns, grade Durhams, in fact, that were famous milkers. They were admitted into the first edition of the old Shorthorn herdbook as thoroughbred Shorthorns. I owned one of these cows. She gave, before I owned her, thirty-six quarts of milk a day, and made eighteen pounds of butter a week. More recent discoveries have proved that on one side that class of animals were descended from the Ayrshires, and they have been excluded from the Shorthorn herdbook. Still, they did more to establish the milking quality of the Shorthorns and their reputation in the valley of the Connecticut, probably, than anything else.

MR. PEIRCE. Is the Ayrshire cow better adapted to wettish pastures, of which we have a great deal in Maine, than other cattle?

MR. GOLD. It is claimed and admitted, that the Ayrshire is one of the most hardy breeds of cattle that exist; they will bear as much neglect, ill-treatment and abuse as the native stock, although they thrive better if they have good keeping. You can only expect the highest result from any breed when you place them in the most favorable conditions. But still if you have a place where you want hardy animals the Ayrshires are as well adapted to it as any other.

MR. GOODALE. I would inquire of Mr. Gold if, in his description of Shorthorns as a milking breed, he based his remarks, as I supposed he did, on their general character throughout the country, or whether he took into consideration anything exceptional with regard to the history of the breed in this State?

MR. GOLD. I based my remarks solely upon the general history and reputation of the breed throughout the country. I remarked that we had some families of Shorthorns that were claimed to be good milkers that have been bred with this object, and with a good degree of success. But in many cases the calf has been worth more than the milk, and therefore it has been the object to get as many calves in a period of years as they could from an animal, and the milking properties have been in such cases thrown out of sight. Dry up your cow and have another calf; twelve calves in ten years; of course you will breed out the milking properties of your herd in that way if you follow it up.

SEC. GOODALE. Mr. Gold's statement regarding the milking properties of the Shorthorns, *as a breed,* is undoubtedly quite correct. Yet there is ground for the belief that milking properties attach to the animals of that breed, generally, in Maine, to a degree considerably beyond what holds true in many other sections. I am satisfied of the fact from personal observation, nor is it difficult to account for it. The very first thoroughbred Durham, as they were formerly called, brought into this State was "Young Denton," a bull imported by Mr. Williams of Northboro', Mass., in 1817, more than half a century ago, and before milking properties had been "bred out" from the breed. This animal was bred by Mr. Wetherell of Leicestershire, and was sired by "Denton," he by "Comet," Comet by the famous "Favorite," and so back to "Hubback," familiarly known as the father of Shorthorns. His stock proved remarkable milkers. After some years service in Massachusetts, he was presented by Mr. Williams to the late Dr. E. Holmes, and was kept, first in Gardiner, then in Livermore and afterwards in Somerset county, where he died of old age in 1830. The next full blood was "Jupiter" which was introduced not much later by Mr. Davis of Augusta, together with two full blood cows, which were sired by the famous "Cœlebs," the same with which Col. Jacques began his "Creampot" breed. Jupiter's stock were also excellent milkers. Subsequently, Col. Greene, Sanford Howard and others, brought in milking strains of the same breed, and from that day to this I believe that special care has been almost uniformly exercised by breeders to retain as far as possible, in the animals brought hither, the milking characters which all acknowledge to have been possessed by this breed, in olden time as a common inheritance. It is very natural and proper that this should have been done, for we cannot compete with some other sections in the growth of animals for beef alone, while we have grazing lands from which we can profitably produce milk and butter and cheese in connexion with meat.

MR. GOULD. The very best herd of milkers I have ever seen is one kept at the Lunatic Asylum at Brattleboro', Vt. The dams of the present race of cows kept there were carefully selected by Gov. Holbrook, who is one of the best and most intelligent farmers I ever met, from what is termed, erroneously, native stock. He had been familiar with the cattle of that region, had kept the track of the best milkers, and selected none but those that were both the daughters and grand-daughters of superior milkers. With these, he selected a bull from Mr. Thorne's herd, containing strong strains of the "Princess" blood. He has bred from those cows, and they are the largest milkers I have ever seen among grade cows.

MR. GOODALE. My impression is that if you seek for cows giving the greatest amount of milk, you will still find them among large sized grade Shorthorns, and yet Ayrshires have done very well indeed. I had an Ayrshire which weighed, within a few days of the time of trial, as she came in from pasture towards night, (which was the only time I ever weighed her) 815 lbs.; that cow gave me 49 lbs. of milk daily for a while, or at the rate of her live weight in milk in seventeen days. She afterwards went to Massachusetts and may be one to which reference has been made. Her only fault was, and it is one that I have found occasionally among Ayrshires, that she was a hard milker.

The gentleman spoke of the Jerseys as being nervous. I have never noticed that peculiarity with our Jerseys, except among the males, which are very apt to become vicious at an earlier age than other bulls. The cows are usually very gentle. Some trouble in respect to nervousness has been observed among our Ayrshires. Wherever they receive such treatment as cows should have, they are perfectly gentle, and there need be no difficulty; but if they are treated as too many milch cows are, they develop a degree of nervousness and it is nothing to be wondered at.

MR. PERCIVAL of Kennebec. I have listened with a great deal of pleasure to the remarks of Mr. Gold and others, and they only confirm me in the opinion that different people in different localities want different things, and that people in different localities come to different conclusions. I agree with Mr. Gold in the main, but I should take some exceptions to his statements, perhaps on account of my limited knowledge.

Every man should possess intelligence enough, in making his selection of animals, to know what he wants; what animal is adapted to his locality; what he wants to produce, (I think that is the first requisite), and then, whether he can produce it in his locality. This gentleman has ranked the several herds of cattle as he has gone along. I felt, while he was speaking of the butter qualities of the Shorthorns, that he might find men in Maine, who would take exceptions, from the fact that breeders here have bred for different purposes, made their selections when they started for different objects. They have bred, perhaps, in a different direction from the men in Connecticut, and of course the results would be different. Mr. Gold would not recommend the Shorthorns as butter stock, while the gentleman from New York regarded them in a different light.

I regard an animal as a machine, possessing certain qualifications. If you want to manufacture cotton goods, you will not attempt to do it from wool; and you must apply the material which you manufacture to such machinery as will manufacture what you want to produce. If you want milk, you must put food into a machine that will produce milk mainly. If you want to produce beef, put it into a machine that will produce beef mainly. Now, if it is possible to get a machine that will produce a number of articles from the same materials, it may be very desirable to do so. For instance, you want to produce beef, working oxen, and milk; and a certain proportion of each. Then you want to select a machine that will convert the material with which you furnish it into what you want. The main question is, what breed of cattle will produce just what the farmers of Maine want? If you want a little of several things, that is one thing; if you want only one product, that is another.

The exception which some might take would be here: that some animals will live and thrive where others will not succeed. It is a law of nature, that animals require food according to their size, although there are exceptions to this as there are to all general rules. No man supposes that a pasture upon which a nice little Jersey could gather her fill in a few hours, and lie down and be secreting rich milk, would carry a Shorthorn, girthing seven or eight feet. Now, let an animal of any of these larger breeds get food according to its size, and be as happy and contented and lie down as quietly as the Jersey, the question is, whether that large animal will not do as well, thrive as well, and pay the owner as well, or better, for the amount of food consumed, as the smaller animal.

Mr. Gould. There are one or two points connected with this discussion to which I should like to call the attention of farmers present. Mr. Gold has stated a fact which I never heard before, and I am unable to bring forward any facts either to controvert or support it. It is a new proposition to me, that it is an advantage to have milk the cream of which is a long time in rising. If any person had asked my opinion in regard to it, I should have told him I was not bound to give my opinion. If he still pressed me I should have said that Mr Gold's statement was the reverse of what I should guess. It is certainly a very important question in connection with the dairy husbandry of the country.

Now in regard to one or two points which have not been suggested here. My own experience with regard to cows is, that the soundest mode of judging is by the form of the cow. The form of the animal which is best adapted for the rapid production of beef is not the one best adapted for the most rapid production of milk. So far as my experience has gone, the cow that is best adapted to the production of milk is the largest behind. The normal form of the Ayrshire cow is near that of a carpenter's hand-saw; small in front, growing broader behind. That seems to be the law. In judging of the capacity for milk production, one of the most important signs is the development of the vascular system. I look to that more than to anything else. If I can see the veins sticking out superficially, and especially if I can see huge milk veins below, I think it is the best sign that can be had. For an animal to produce beef, I should not look for such a development of the vascular system. The first point I should look at would be, to find that animal which attains the greatest weight in the smallest relative compass. I believe that law to be universal, and one which will never fail to guide in the selection of the best animal—the greatest weight in the smallest relative compass. It will be found that animals of this kind are the best machines for converting what is to be eaten,—grass, hay, turnips, meal, or anything else,—into meat. Then, in selecting animals for beef, choose such as have this general characteristic, that expand the most broadly, where the ribs stick out the most nearly square from the backbone. That gives a large lung, and the larger the lung the greater is the capacity for the assimilation of food.

Another thing is often overlooked. Sometimes these marks will be found to be illusory. In that case, you will always find a want of co adaptation of the four stomachs to each other. Every one knows that a cow has four distinct stomachs. The first is the paunch or rumen, which has no chemical influence upon the digestion. It is simply a macerating paunch; there is no secretion from its surface. The paunch of the animal must therefore be adapted to the size which will macerate the food to be digested in the most perfect manner. After maceration, the cow transfers from the paunch all the sufficiently macerated matter into the second stomach, which is known as the "honey comb," or *reticulum*. In that, the macerated food is moulded into small pellets. After those pellets are thus moulded, the cow has the faculty of regurgitating, that is, throwing these pellets upwards and then chewing them as a cud. After the cud is swallowed, the animal at will directs it into the third stomach, which butchers know as "the book" or "many folds," and by anatomists as the *omasum*.*

It is globular in form, and consists of leaves, which you may turn over like the leaves of a book. If you examine these leaves, you will find that the exterior portions of them are formed of minute hooks, something like an old-fashioned card, and as you go upward, the sharpness of those claws diminishes, until you have finally a mere flat, hard surface, where the food is rubbed, and as it passes onward the cud is pulled apart, entirely disintegrated. It then passes from this stomach into the truly digestive or fourth stomach, known as the *abomasum*. In this stomach, the gastric juice is found. Now, when the surface of this fourth stomach is precisely adapted to the capacity of the three preceding stomachs, you have, on the hypothesis that all the stomachs

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* In alluding to different views held in relation to the manner in which rumination is effected, Dr. J. B. Simonds, professor of Cattle Pathology at the Royal Veterinary College, London, says, "*We are of opinion that the food in its second descent goes into the rumen, and also that it is propelled directly by this viscus into the gullet to be remasticated* The situation of the second stomach must interfere with its supposed property of propelling upwards the pellet, for it is placed nearly at a right angle with the course of that tube. This objection does not apply to the anterior division of the rumen which we believe to be the part from whence the food is ejected. The muscular coat is thicker here than elsewhere and its fibres are continuous, as before remarked, with those of the lower part of the œsophagus; besides which we find them implanted into a strong fleshy band which crosses the viscus in such a direction that it serves as a fulcrum from which they can act. Thus we see that even upon mechanical principles the rumen is adapted for this special purpose. If the *remasticated food* descended directly into the third stomach, we should expect to find that organ of a proportionate size to contain as much as would undergo the process, during at least one rumination; for all authors agree that the food is detained for some time in the omasum, and it is well known that an ox will continue to ruminate for upwards of an hour. The omasum, however, in the animal is far too small for such a purpose and in the sheep it is relatively smaller. If also it be true that such aliment does not pass into the rumen 'because it is less irritating to the

are in a high state of health, a perfect digestion, and you have an animal which is capable of converting the greatest amount of assimilable matter, matter which is calculated to make beef or to make milk—that that animal possibly can so convert. But in many exceptional cases (to come back to the point where I went off,) you will find that in consequence of a fever or preceding gastritis, there are patches of that fourth or digestive stomach which are incapable of pouring out gastric juice, and therefore incapable of using up and forming into assimilable matter those portions of food which have gone through the three preceding stomachs. Here is a difficulty, and is the main reason why the marks which I have formerly described are not in all cases absolute guides. I have dissected many females where this difficulty has occurred, in which cases, notwithstanding the presence of those exterior marks which indicate admirable qualities as milkers and beef makers, they have failed to milk and to lay on flesh according to the family or strain of blood they belonged to and as their form and external marks would have led a person to believe that they would. It was due to the fact of inflammation in the fourth stomach, or the failure of the third stomach, or book, to perform its function; for it is in vain that the fourth stomach performs its digestive function if the book, or grinding-mill, fails to perform its duty of disintegrating the matters which the cow has taken into her. It is very often the case that an examination of the leaves of the book will show that, instead of having the moist condition which belongs to them, one or more are dry.

pillars of the canal' then *prepared* food, as soft mashes, &c., ought when *first* swallowed to enter the omasum, and fluids would also take the same course, whereas, we have many proofs, afforded by experiments, that these find their way into the first and second stomachs. Besides which, the pillars do not form 'the *floor* of the œsophageal canal' as stated by Mr. Youatt and others, but *the side* of the channel; and *if they are placed in contact, then there is no passage or duct behind them*; in short, the errors of description have arisen from studying these structures on the dissecting table alone and not in their natural situation. Our opinion of rumination receives further confirmation from the fact that many ruminants, of which the camel is an example, do not possess a reticulum; therefore in such animals the rumen must propel the ingesta upwards. We could advance many other facts to negative the general belief, but it is unnecessary to do so on this occasion. It may be asked, What function we ascribe to the reticulum? We answer, that it supplies the third stomach with aliment suited for digestion; this it receives from the rumen by the ordinary peristaltic action that is continually going on in that viscus, and passes it at intervals through the aperture situated at the inferior part of the œsophageal canal. And we are further of opinion that the before-mentioned pillars perform an office analagous to a sphincter, by drawing the opening which communicates with the omasum towards the œsophagus, and thus close it against any coarse or indigestible matter that is presented by the reticulum." S. L. G.

They become, therefore, incapable of grinding down and disintegrating the material, so that the fourth stomach can operate. One of these causes will be found, in all cases, to account for the failure of an animal having the marks described to secrete milk and make beef in a normal manner.

Now, in regard to the escutcheon as a guide in reference to the production of milk. I am inclined to believe that the escutcheon is an admirable guide, taken in connection with the other guides to which I have referred, in reference to the capacity for the secretion of milk. The length of time during which milk will be secreted, and the amount, are generally indicated by the escutcheon. But if the escutcheon is taken as the sole guide, without regard to the other marks I have described, it will be frequently found illusive.

With regard to another point, my own experience has not corresponded with that of Mr. Gold in regard to the milk-producing qualities of Durham cows. I know Mr. Blakeslee very well; I believe him to be perfectly truthful, and his statement may be accurate that a pound of butter was made from 3.66 quarts of milk. I can only say that no other such instance is on record, within my knowledge. I have never met with a case where a cow has given a pound of butter from less than four quarts of milk. I have repeatedly known Jersey cows to produce a pound of butter from four quarts; I never knew it to be done by any other breed. The very best Durham cow I ever knew produced a pound of butter from 14 quarts of milk. I never knew one to produce a pound of butter from any less quantity than that. The ordinary production of butter from the milk of our native cows is a pound to about 20 quarts. The milk of the Ayrshires will average about a pound of butter to 14 quarts. I have known a herd of fifty Jersey cattle that would produce a pound of butter from six quarts of milk, on the average, right straight through.

Nor do I think the richness of that milk is entirely in the color; I think it has an absolute richness. A Jersey cow certainly will not be, ordinarily, the most profitable farmer's cow. It is the gentleman's cow; I mean, it is the cow adapted to men who live on their incomes, and who desire to promote their own personal comfort, without special reference to the cost. There is no cow on the face of the earth which gives such rich, delicious milk as a Jersey, for it has a taste that is unmistakable, and exceedingly delicious. The best physicians select the milk of a Jersey cow where children are to be brought up by hand. I think that is tolerably good evidence of its richness, independent of color. They have found it to be the best milk for children who are to be brought up by hand.

I would be glad to learn the opinion of gentlemen present who have experience as to the intrinsic richness of Jersey and Ayrshire milk. If Mr. Gold's statement is sustained by experience, it is a very important fact and should be generally known.

Mr. Gold. Allow me to add one word. From my experience, conversation with breeders, and general observation, I had established that opinion in my own mind, in regard to milk throwing up its cream. I announced it in my remarks at the Dairyman's Association in Vermont last week. I was followed by Mr. Hyde of Lee, Mass., who delivered a course of lectures at the Lowell Institute, in Boston, last year, and who is well known in agricultural circles for his care and accuracy. He read a carefully prepared paper upon the subject of milk, giving analyses and careful reports. He announced the same fact with regard to the quality of the milk of the Ayrshire and the Jersey, especially with regard to the rapidity with which the cream separated from the milk, and he went further than I did then, or have to-day. We were sustained by Mr. Flint, who also spoke upon the subject of breeds and breeding cattle. Mr. Hyde, without any qualification, announced that the Ayrshire milk, taking into account all its properties, was as rich as the Jersey milk, and Mr. Flint particularly dwelt upon the point, that the reputation of Jersey milk was due in large part to its color, not that it was actually any richer than the milk of other breeds; that while it was admitted to produce this large amount of butter, the other properties communicated to it by the Ayrshires and Devons had been ordinarily left out of sight. But, as I have said, I announced these propositions before that large collection of dairymen, and they were undisputed. That is my authority.

Mr. Thing. Living as I do on the line of the Maine Central Railroad, between Winthrop and Waterville, I should feel it my duty to sustain the Jerseys, under ordinary circumstances; but after the statement that has been made by the distinguished gentleman from New York, I feel it my duty to offer a single word of caution. A lady in Winthrop told me (she seemed to be in earnest but she might not have been, I can't say,) that it was not safe to feed children upon Jersey milk, because, if she did, she could not trot her baby on her knee without churning the butter!

Adjourned.

AFTERNOON SESSION.

The Board re-assembled at two o'clock, and the proceedings were continued by the reading of a paper on

FARM LABOR,

BY HON. SETH SCAMMAN.

Man was created for action—mental, moral and physical. It was never designed that he should be a drone, a mere hanger on upon society. He has a higher and nobler mission to perform. Made but a little lower than the angels, endowed with powers of mind capable of investigating the laws of nature that surround him on every side, and in connection with his physical ability bringing those laws under control, and subservient to his welfare, he has such a field for thought, for study, for action and for good that he has no time, nor has he any right to let those powers remain dormant and lost to the world. The position assigned him in the creation, "to have dominion over the beasts of the field, the fowls of the air, the fish of the sea, and over every living thing," and when placed in the garden and commanded "to dress and to keep it," must or ought to have impressed him with the magnitude of the labor assigned to him by the Creator, and the importance attached to the proper and faithful performance of that labor. It is commonly understood that before the transgression Adam had nothing to do but enjoy life, and regale himself on his surroundings. But this is a great mistake; for the fact that it was said after every other living thing was made, "that there was not a man to *till* the ground," and also that he was required "to give names to every living thing," implied thought, study, investigation and *labor*; and that too before the fall. How much more then are his duties, cares and labors enhanced since he has disregarded his high prerogative, by disobeying his Maker.

We accept then the proposition that labor is one of the conditions of life essential to our happiness, our usefulness and the welfare of society. The subject of labor is now largely occupying the public mind. It is made the theme for discussion in public conventions, and public prints, and is legislated upon in deliberate assemblies. We have our labor reform associations, and our union labor societies, and our ten and eight hour systems of labor; all very well so far as they have a tendency to elevate man, and to make labor more effective for good. Yet all this bustle, hue and cry about being the laboring man's friends, should be accepted with a very wide margin of allowance, as being more the work of demagogues and designing politicians, as a means of foisting themselves into place and power, rather than as indicating a sincere desire to make labor honorable and to contribute to the real welfare of the laborer.

Early in the history of the world agricultural labor was the only occupation of man; and from that period to the present it has been the most important of all industries. Not antagonistic to any other honest employment that has grown out of the world's progress and development, but stretching out its arms to cherish and foster all, as a faithful parent does his children. Yet agricultural *labor* has not and does not to-day, command that respect and remuneration when compared with other kinds of labor, that its importance demands. This may be owing in part to the wide-spread ignorance prevailing in the farming community, to the old fogyism that holds on with a death grasp to the old ideas, ways and measures of our fathers, grandfathers and great grandfathers, not considering that progress is a law of nature, and that something new in the condition of things is constantly developing which demands a corresponding change of action to reach the end in view; or it may be owing in a great measure to the false estimates of character made by men in other occupations of life. Young men are oftentimes noticed while pursuing their studies, but if force of circumstances compel them to lay aside their books for manual labor they are passed by unnoticed. Well do I remember when a young man and attending the academy, a certain legal gentleman who was considered a model of good citizenship, took special pains to give me a friendly shake of the hand and otherwise encourage my efforts to acquire some knowledge beyond that imparted by the district school. But after school books were exchanged for the goad-stick I was no longer recognized by that gentleman. You can judge of my surprise better than I can describe it. Being young and knowing little of life I wondered what I had done to forfeit his good will. I thought of his cordial greeting while a student, and could it be possible that he would thus treat me because I was at work? Too much of this feeling is manifested in action if not in words, and young men are quick to observe it. Their pride of character is touched. They discover at once that it is the occupation they follow for which they are thus treated. They reason that if farmers' boys are not to be admitted into circles of society sometimes looked upon as higher they will not be farmers; they will seek some other occupation; will choose some other position in life. If a boy has any pluck at all he means to be respected by respectable people, and will make choice of his occupation accordingly. These with other reasons that might be named, turn the mind away from farm life, and induces the constant migration of young men and women to the city or wherever else they hope to better themselves.

How long and to what extent this state of things is to exist it is difficult to foresee. It is certainly time that the public mind was awake to the matter, and if any remedies can be applied they should be speedily. One way is to elevate labor and make it honorable. Much has been done in this direction by diffusing useful knowledge. Men of science and of large and expanded views have thrown themselves into the work of investigating the laws and principles of agriculture, and have given the results of their investigations to the world. The knowledge thus obtained has shown us that the study and *practice* of agriculture in its true and successful, legitimate issue is yet but in its infancy; that to succeed it is necessary to understand the principles that lie at the foundation of success. As well might the engineer attempt to run his locomotive with speed and safety without understanding the first principles of his machine, as for the farmer to expend his time and labor successfully without some adequate knowledge of agricultural science. Happily a spirit of inquiry and research has arisen among many practical men, which augers great and beneficial results to agricultural labor. Books and agricultural papers are sought after, and read with avidity. Agricultural societies and farmers clubs have been formed; boards of agriculture and agricultural schools and colleges have been established. Many of our young men are now in a course of training preparatory to farming. Men of intelligence and culture are reducing the principles they understand to practice. This is a very important point gained. It is one thing to understand a principle, it is a very different thing to apply that principle to practice so as to secure all the benefits which may follow its proper application and use.

What we now most need is men of this character who have the ability, will and opportunity to illustrate science in practice. It is said we have men of science enough, but they are men of science only. They can tell us what to do, but do not do it themselves. Such men are beginning to see that to make agricultural labor successful, intellectual and manual labor must be combined. The great trouble has been that the theory has been in one man's head, the practice in another man's hands. Now combine these two in one person and you elevate both. Intelligent labor will create a revolution in agriculture. We look with much hope to the Agricultural College to see this accomplished. The young men there are obtaining the rudiments, the first principles of science, while they are at the same time practicing in manual labor; learning to use their hands as well as the head; combining intellectual with physical effort; disciplining body and mind—not to the injury of either, but to the benefit of both. A reasonable amount of manual labor is both compatible with, and necessary to the growth of mind. Experience has shown that active physical labor imparts vigor to the system, and that bodily vigor imparts activity to the brain. In fact, no education is complete that does not develop the body in connection with the mind. One or the other or both will otherwise be dwarfed. This is the way in which every child should be educated. On this principle we may account for the fact that boys in the country with very much less schooling will compare favorably in intellectual knowledge at sixteen, with city boys. The active labors of the farm have imparted vigor to the brain so that they are able to learn from books and teachers in less time than those do that have not this active labor. And it is on this same principle that we account for the fact that the men who spent their early days in active labor on the farm in connection with mental discipline in the country schoolhouse, are among our most active and successful business men of the cities—who fill the professions with so much credit—and are among our most eminent legislators and statesmen.

Now what an argument is this in favor of agricultural labor. With such examples and facts as these before her, what mother would not prefer that son or daughter should have their lot upon the farm rather than in the city? be trained in early life to habits of industry and application, rather than be left to idleness and the temptations of city life? Mothers have a mighty influence in moulding the characters and shaping the destinies of their sons and daughters. One unguarded complaint about the drudgery o farm labor, one complaint that there are so few privileges in the country; one glowing description of the beauties and privileges of city life, have been ripe seeds planted in the mind of many a boy that have sprung up and made him restless on the farm, and carried him to the city to be *worthless* there. Then let mothers be careful how they speak disparagingly of that occupation that has furnished many, yea, most of the brightest examples of manhood: an occupation that affords the widest field of research for knowledge among nature's choicest gems. Oh, the depths of knowledge yet to be unlocked in agricultural science! Oh, the beauties of nature yet to be developed by research into the principles and laws that govern the mineral, the vegetable and animal kingdoms!

Another benefit of farm labor above most others is the great variety of manual labors to be performed. The position of the body being so often changed, and a different set of muscles brought into exercise, that relief is afforded to all, while all are brought into exercise.

A knowledge and use of the best agricultural machinery is another means of keeping boys on the farm as well as carrying on the farm with the least expenditure of manual labor. The impression, whether true or false, is current that farm labor is the hardest as well as the lowest of all occupations. Now, very much of the heaviest labor on the farm may be performed by the improved machinery of the present day, and boys take pleasure and pride in working that machinery. It also enables the farmer to do up his work more promptly in the season of it, and raise better crops and secure them in better condition.

A little time spent in setting out ornamental and shade trees—tastefully arranging and embellishing farm buildings—encouraging boys to cultivate a plot of ground as their own in their own way, and the girls to have their plots of flowers will serve very essentially to make home and its farm-house the most desirable place on earth, and labor becomes a pleasant duty rather than an irksome task.

Another and most important consideration in favor of farm labor is to be found in the health and prolonged life of those engaged therein. The pure air and out-door exercise of the farm tend greatly to preserve health and render the constitution vigorous. It has been found by careful observation for a long term of years, that the average age of farmers in a given locality is about sixteen per cent. greater than in other occupations, that of mechanics standing next, a consideration which should have its due weight with every person in choosing his pursuit for life.

Mr. L. L. Lucas then read the following paper on

COMMON ERRORS IN REARING AND FEEDING FARM STOCK.

The farmers of Maine are at fault in so many different ways, that no one man can expect, or even hope, through his best exertions, with all the talents he can bring to bear, to correct many of them, or to create any rapid change among the masses. Farmers as a mass don't respect their occupation, and the small pay they get accounts for it to a very great extent, since it is the dollars and cents growing out of any business or profession that renders it popular, especially if physical labor is necessary to its prosecution. Farmers ought to look upon their occupation as a profession superior to Divinity, Law or Medicine. He can live without them, but they cannot live without him. It requires as much ability to become a successful farmer, as it does to become a successful lawyer, doctor or minister, and as thorough education would help him very materially.

Farmers have made their occupation to be what it is, and it is in their power to change it and make it not only different, but decidedly better and more remunerative. They ought to know from the experience of the last ten years what crops are most profitable to cultivate in their particular locality; also what kinds of stock, including horses, sheep and swine, are most profitable. Since the stock from Maine has been shipped to market over the railroads, many farmers have had an opportunity to go to the markets that perhaps otherwise might never have gone, and it would seem that with ordinary powers of observation they could not well help knowing what kinds of stock sell best and are most popular in the market, hence what kinds are most profitable to raise, and how to breed and raise them; but their march has been slow, only small progress has been generally made, and the present year cleans them out so effectually that when they start again, they can go in any direction they choose. They can pack up and go to the woods, though I have never advised that course, but I have advised them to try and get out of the woods. I stated before the Board of Agriculture in September last, that stock could not be raised in Maine exclusively for beef purposes except at a loss. I reiterate it now. It can be grown and fed elsewhere cheaper. We cannot compete with western farmers in growing stock and making beef; but we can raise our own oxen, cows and horses, and we can raise better than we have done in the past, and so many as we do raise must be better or we must expect to raise them at a loss. It will not do to sell them at one or two years old, unless they go at the price of Shorthorns.

We must breed only from pure blood males, and raise only the best calves at that. A nice bang-up cow will bring $100, while a common one will bring only $25, and there is not that difference in the cost of raising. And the same rule applies to oxen and sometimes to two and three years old steers; the best ones fetch a great deal the most. Now in order to get good ones we must have a good, pure blood bull, and the best cows we can get, then select the best calves, as many as we propose to raise, give them all the milk until three or four months old, then provender enough to keep them growing, and *always keep them growing until disposed of,* never allow them stand still a day. When they cease to grow unless they are at work or giving milk, they are kept at a loss. We cannot afford in the State of Maine to raise ordinary horses; they are never worth enough and will never bring enough to half pay the cost of raising. Reference must be had to either size or speed in rearing horses if adequate compensation is expected for the trouble and expense.

Farmers of Maine have been and are still in the habit of overstocking their pastures, (especially when pasturing stock for other people,) so that, so much labor has had to be done by stock to get a living, that no growth has been had where there might and would have been good growth with a plenty of feed. The result has been poor cattle, and when put into the market, (like the negro's preaching,) poor price, and all for the want of better feed and more of it. When not designed for the market their cattle from overstocked pastures, come to the barn in the fall poor, or poorish, and are then put through the winter upon straw, meadow and swale hay, corn stalks, &c., late cut, with no provender, and often in barns as cold as an orchard. I have heard such farmers complain, that from some mysterious cause, their cattle were thin, they had not done well. Now is it really anything mysterious that cattle don't grow under such treatment? If they should grow and look sleek and fat, would not there be great mystery about it; would any good feeder of Shorthorns be able to account for the fact in any possible way?

One of the greatest mistakes among farmers is in keeping their stock in cold stables. There is not one in ten among them that realize how much they pay annually for exercising the right to keep their stock in cold, open stables. I have made an estimate and have come to the conclusion that the extra expense of keeping ten head of grown cattle sixty days in extreme cold weather, will finish up a stable that is roomy enough to accommodate them, and make it as warm and as comfortable as a common sitting-room in our houses without a fire. And here allow me to explain one of the ways in which it may be done; first, nail the boards upon the outside so that they are solid, and close to the timbers, then cover the cracks between the boards either with shingles or with narrow boards say three or four inches wide, then put furring upon the inside about four inches from the outside boards, and board upon the inside and fill up the space with saw-dust or tan as may be most convenient; board and shingle in front, leaving a space sufficient to feed through that can be shut comparatively tight after feeding, then have the doors and windows shut tight and a scaffold of hay overhead and the whole thing is done if the floor is tight. Any mechanic that can saw a board and drive a nail can do such work, and the expense is very trifling compared with the benefits to be derived from it; and I may add here that barn cellars ought to be so finished that they can be shut up as tight as the barn over them. Few farmers are aware how inhuman is the treatment of stock kept in cold stables; if they were, they would begin at once and make them warm and comfortable. The expense is sure to be saved in fodder every winter; it is saved again in the labor of cleaning out the stables, in the difierence between shoveling out manure that is frozen solid to the floor and such as is not frozen at all; and it is paid again in the improvement of the stock, and again in the consolation from knowing that the stock is all warm and comfortable, whether they have anything to eat or not.

Another popular error is in the feeding of rough fodder, such as dry corn-stalks, straw and swale hay, late cut. The large bulk of such fodder is fed just as it comes from the mow, and nothing but extreme hunger and cold will induce cattle to eat it, and then only in quantities sufficient to keep them from actual starvation; whereas if it could be cut fine, wet with warm water, or even with cold water in moderate weather, and a small quantity of Indian meal, shorts or fine feed mixed with it, it would be very much improved, and would be eaten with nearly as much avidity as common English hay, and furnish about as much nourishment. By such a course all the refuse fodder is converted into good feed, which is no small item when fodder is as scarce as at the present time; hay thirty dollars per ton; enough to buy a ton of straw and fifteen bushels of corn. It is generally conceded that fifteen bushels of corn is worth as much as a ton of English hay—hence the conclusion that a ton of straw and fifteen bushels of meal, properly mixed, will furnish equally good and much more feed than a ton of hay.

Another fault (and one for which there is no excuse) is, in not cutting hay and grain including corn, early enough by ten days. The crops are allowed to stand so long that the straw and stalks become dry and woody, and almost worthless as fodder; and the grain, although it may measure rather more bushels, is worth much less to feed to man or beast. Grain is good in proportion as the straw is green and good. Farmers, however, generally understand that late cut, *ripe, woody* hay will winter more stock than if cut early, when green, juicy and good, but I will risk the opinion that if they will feed the early cut hay in no greater quantity than to keep the cattle in just the same condition that they keep them on late cut hay, (with barely the breath of life in them,) that the early cut will winter the most stock. Certainly if fed liberally with it they will grow and fatten, while with the late cut they would become poor. They will not eat enough of such feed to keep them in a growing condition—they can't do it. In the first place they have not the appetite for it, and secondly they cannot hold enough of such feed as would be necessary, and lastly, they are not able to do the work of eating it. The difference in the quality and price of flour that we find in the market is more attributable to the time of harvesting and the treatment of the wheat from which it is made, than to all other causes combined. Wheat must be cut at the proper time, otherwise it is a failure, the same as with hay. I speak from experience in this, for I have been in the habit of raising wheat and have learned what is necessary to get good flour after the wheat grows, and I adopt the same rule with oats and corn. Always cut corn and shook as soon it is fairly turned yellow, and let it ripen off and dry in the shook; perhaps it don't shell off from the cob quite as easily as if riper, but in every other respect it is much better, and on the whole a great gain.

Another fault among farmers is, in the making and care of manure, and its application to the soil. In the first place on the average they do not make more than half the quantity they might with the means they have, then a very large per cent. of it goes to waste for the want of a cellar or shed to protect it from the storms and from being washed away. Then what is left is usually put upon double the land it should be, and often ploughed under so deep as to be entirely lost, or so that it is worth but a mere trifle to future crops. Again, it is put upon wet land, or ground that is full of water, which in my judgment, is making a very poor use of it; it is not worth anything like as much on such land as upon dry land; or as upon the same land after it has been under-drained and thereby put in condition for crop. Manure costs enough and there is necessity enough for it, not to throw it away, or to make any other than the best possible use of it. In the use of our manures we pursue too much the same course as we do with our fodder, give just enough so that everything we feed barely lives. If our farmers could be made to believe that they can raise as much corn, as much wheat, and as much hay upon one acre as they now do upon two, very likely more of them would try the experiment. I have no doubt that by putting the same amount of barn manure and the same amount of commercial fertilizers now used by farmers in the State of Maine, upon one acre that is ordinarily put upon two, that more than double the crop would be raised, and with great saving of labor, and it would hold out to grass much longer. My method is, to haul out the manure in the spring and put it upon the surface of plowed ground and harrow it thoroughly, so as to incorporate it with the surface soil; it is not exposed to the sun by itself, but is subject to the heat of the sun and to the influence of rains the same as the soil, and although it may not be worth as much for the immediate crop as old pulverised manure, yet for a succession of crops I am of the opinion that it is worth more than in any other way. It is all there, and by thorough working of the soil it becomes a part of it. There is no loss nor way of escape if the land is dry and fit to cultivate.

Underdraining. I remarked at our meeting at Lincoln that the necessity for underdraining was conceded by everybody, or to such an extent that it was not worth our time to discuss its need after an able paper upon the subject had been read. Others thought differently in relation to public opinion upon the subject, but conceded its necessity and then explained how it might be done in a cheap and substantial manner. There was another who admitted the necessity but doubted the expediency of draining. There may be farms which require underdraining to such an extent as that it might cost more than the farm would sell for or be worth after it is done. My advice in such a case would be to abandon such a farm at once if it will not admit of proper and necessary improvements, either from its location or from any other cause; the sooner that farm is abandoned the better, for nothing is worth keeping that is not worth keeping well.

The more I have reflected upon the subject of underdraining, the more I am convinced of its necessity and of its expediency. The cost is not great; on our rocky farms there is material enough on the ground to make as many drains as are wanted, and all the expense there is about it, is in digging the ditch, the rest of the cost is cancelled in saving the distance we should have to haul the stone to get them off of the land; and as many farmers are constantly in the habit of breaking and working their land when wet which land would be dry enough if properly drained, the necessity for draining cannot be urged too strongly, for nothing injures land more than working it when wet; it ought never to be done, it destroys all profit from working it at all, if cropping it be the object, for certainly not more than half a crop can be raised upon such land, and as I said before, manure is not worth more than half price upon such land.

Another error of farmers is feeding fields in the summer and fall after haying, or in fact, at any other time. One acre of fodder corn will supply as much feed as will ordinarily grow upon two common farms after haying—and the present year it has supplied more feed than all the hay that grew on many farms before haying, and the sooner we adopt the rule not to allow stock in our fields at any time except when at work, the better it will be for us all. It costs us very much more to recover to fertility the fields so fed than to furnish the same amount of feed in almost any other way. One of the greatest objections to keeping large flocks of sheep on our farms is, that it is so difficult to keep them off from mowing fields in spring and fall—they rather prefer to take care of themselves at all times when the snow is off the ground, and as they bite close, they must at times do immense damage to fields if admitted to graze them. My opinion is that on the whole sheep benefit the farm but little. I hear the contrary opinion expressed but have never found satisfactory evidence of it. That they will enrich some portions of a pasture more than other stock, I have no doubt, but that they will enrich the whole of a pasture sufficiently large to feed them properly through the season, I have very serious doubts. Only small portions of our pastures ever get fertile enough through such agencies to produce better than the average of our fields that we cultivate after they cease to produce a satisfactory crop of grass.

Another popular error, as I believe, is in cultivating too much surface. The crops as a whole pay little more than the expense of raising, and as large portions of land are cultivated to oats and no returns made in the way of fertilizers, I ask how is it possible with such treatment that land can otherwise than deteriorate? Always dipping out of the meal tub and never putting any in, one will soon come to the bottom. Our boast is too much in large farms and large areas in crops; I have lately examined the agricultural statistics of France and find that she has an area smaller than the State of Texas, with a population of about thirty-eight millions, or three and one-half acres to an inhabitant, while in this country we have fifty acres to each inhabitant; and while our farms range from 100 to 150 acres, theirs' range from 10 to 15, and after supporting their own population, their exports are greater than ours. In 1868, there were produced in the United States 240 millions of bushels of wheat, and the same year France produced 350 millions of bushels; and while we exported nine millions of dollars worth to England, they exported eleven millions of dollars worth of butter, and their exports exceeded ours in almost every product of agriculture save cotton and tobacco. Now with farms only one-tenth as large as ours in the State of Maine, and about the same ratio to the rest of New England, and a population to feed equal to that of the United States all told, one of two inferences must be drawn—either they produce very much more in proportion to the area cultivated, or subsist upon very much less than is supposed to be necessary in this country. Be that as it may, it would seem that we ought to learn and profit by their example. Our boast ought not to be how large area we cultivate, but how much we produce from what we do cultivate. Not how early we get up in the morning, but how well we do after we do get up. It requires a demonstration upon such subjects to produce the desired effect; facts and figures are what are needed. In all our agricultural writings, this most important feature is too much ignored. A reasonable certainty of better results will divert us from old channels and draw us out of old ruts; it requires no argument to produce a change when you have demonstrated its utility.

Having touched briefly upon what I conceive to be the more general errors of farmers,—avoiding details as much as possible, one other idea occurs to me at this point in regard to keeping cattle, and I propose to present a problem for the consideration of those present. A and B have each a pair of four years old oxen, equal in form, symmetry and aptitude to take on flesh and fat, and girt 6 feet and 6 inches and weigh 2700 lbs. on the first day of November, 1871; each has the same amount of work to do during the winter, simply haul their fire wood. A feeds his in such a manner as to keep them in the same condition as to flesh and of the same size and weight on the first day of May following. B feeds his in such a manner as to grow them to 7 feet and 2 inches in girt and to weigh 3400 lbs. A's cattle at 40 per cent. shrinkage weigh 1620, and at 8 cents per lb. bring $129.60; B's cattle at 35 per cent. shrinkage weigh 2210 lbs. and bring 10 cents per lb., $221.00—B's $91.40 more than A's. The question is, which course had better be pursued by farmers in Maine?

There are other obstacles in the way of the farmer, and what retards farming more than almost anything else is, that the farmer feels himself in some measure degraded, he feels that he is ranked below the mechanic and far below the professional man. The farmer's boys feel it, and their chief aim is to obtain an education so to be prepared to do other business, other than manual labor on the farm. Why is this so? Is the cultivation of the soil more degrading than other kinds of labor? Is not physical labor substantially the same, whether it be tilling the soil, tending a saw mill or working in a blacksmith's shop? Is not the well-to-do, independent farmer, from the very nature of his business, the richest and happiest man in the world? I do not mean that he has the most money, but he has a competence, and with no disturbing troubles. No honest pursuit of life degrades a man. It is degrading to be without useful occupation. Among the Romans it was the man who honored the house, not the house the man.

I hold that the man who cultivates the soil stands on an equality with the man engaged in any other honorable pursuit; all pursuits are equally necessary, and all are dependent upon each other. It is a wise provision of Providence that men should be endowed with a variety of gifts. Were it not so, the world would not be worth living in. No common man can attend to several different pursuits to advantage, any more than he can ride two or three horses without being in danger of coming to the ground. No man can excel in any art or science unless he gives it his undivided attention. I ask again, why has farm labor been degraded, why, when we all know that literary and scientific men would soon die out were it not for the farmer and mechanic? Why then have any ever been so unwise as to demean the laboring classes? It arose chiefly from the meanness of the ambitious few, and partly from the force of circumstances in early periods. It is plain to see that ambitions, artful, designing pagan priests had much to do in moulding society. Nearly all the learning of that period centered in them. They were at once priests, astronomers and physicians. The masses of ignorant people believed them to be the vicegerents of God. It was then that in Asia and a part of Africa caste arose, and it has proved one of the great curses of the world. It still remains, but is steadily growing less.

It has been comparatively but a short time since schools have been free to everybody; and in the days of our fathers the chances of getting much of an education were open only to a few, nor was it supposed at that time that any necessity existed for educating a boy to become a farmer any farther than to teach him to read and write and cypher through the four first rules of arithmetic. Although the course of studies was short, it is patent that very many only took a partial course at that; and it is no uncommon thing nowadays to hear the remark that such a one has learning enough for a farmer. Hence it is not so much labor of one kind, or another, that shut them out from society, as the fact that they are not educated, hence are not intelligent and interesting, and are entirely unprepared to mingle with intelligence and refinement. Ignorance and rusticity, intelligence and refinement cannot mingle together, they have no natural affinity for each other. Now this state of things need not exist, and there has been an improvement in the right direction growing mainly out of the influence of the Board of Agriculture, agricultural societies and agricultural newspapers.

Our constitution forbids titles of nobility, yet we always had and still have a species of aristocracy. This ought not to be. It seems to have been the natural tendency among all people from time immemorial to exalt the few at the expense of the many.

Some are naturally timid and passive, others are naturally arrogant and ambitious. Hence in early periods when men were both ignorant and superstitious, it was easy to bring about this state of society. Now, I say to the farmer if you wish not to feel degraded—if you wish to associate freely with the statesman, the lawyer, the doctor and the minister, you have but to will it. You have ample time and opportunity to educate yourselves and become intelligent, and put yourselves on an equality with professional men. Your opportunity is equal with theirs; there is no necessity for distinction in society beyond what arises from merit and demerit. If a man is virtuous, industrious and seeks every opportunity to improve the talents given him, he may be the peer of any man.

And now, brother farmers, in order to make the cultivation of the soil more pleasant and more profitable, we must learn to do it scientifically. The farmer must be a scientific man, he must understand first principles, he must understand the nature and properties of different soils and of what they are composed, so also, of all the fertilizers we use—and must constantly experiment. He should have a knowledge of chemistry and geology, and understand the terms made use of in treating them; we should read, study, reflect, and keep a daily record of all business connected with our operations on the farm, as well as off the farm; take an agricultural newspaper *any how*, and as many others as you please, *and read them*, take an active part in the business of the town and parish; apply the best talents and energy to your business, and you can then say to yourselves that you have done the best and all that can be done.

God never made an indpendent man,
It would destroy the order of his general plan.

Let us live together—and help one another.

THE PRESIDENT. It appears to the chair that enough salient points have been presented to elicit an animated discussion, and it is hoped gentlemen will give free expression to their views.

COL. SWETT. The statement was made that fifteen bushels of Indian corn are generally considered to be equal to a ton of good hay. I suppose that such is the common impression among farmers. I formerly thought so myself, but some of us in Oxford County have found out that it is a mistake; I will call on Mr. Thayer of South Paris, to state his experience.

MR. THAYER. I was brought up on a farm where it was not so easy to raise corn as in some other places, and we naturally came to set a high value on it, and it was used very sparingly. There are now ten bushels used where there was a peck then. Of late years I have kept some cows for the sale of milk. I wanted to know what it would cost to keep them. By careful experiment and actual weighing, I found that twenty pounds of good hay would keep a cow better than they are usually kept. For winter milk it is necessary that some provender should be given in addition to hay, and I began with the impression that ten bushels of corn was as good as a ton of hay, and fed accordingly. I soon found out my mistake, and lately when hay was scarce I wanted to get along with as little as would answer, and make up the necessary food with meal. So I went on the supposition that twenty bushels of meal were equal to twenty hundred pounds of hay, but I found out that that was not enough in my experience. Then I hunted up what the books had to say about it, and I found it stated that it required sixty-four pounds of corn to be equal to a hundred pounds of good hay. That just about agreed with my experience, and after finding myself backed up by so good authorities quoted in the Reports, I expressed my views pretty fully at the club and with neighbors, but nobody agreed with me at first. We had some pretty lively discussions about it. Finally I weighed out ten pounds and twenty pounds of hay, and meal equal to ten pounds of hay, reckoning ten bushels and fifteen bushels and twenty bushels equal to a ton of hay, and set them before them. When they came to see the different messes as actually weighed out they all came over to my way of thinking.

Mr. Percival. Did you feed the meal wet or dry?

Mr. Thayer. Usually dry. I tried both ways and found no difference. If my cows could not get all the water they need, easily, I would feed wet.

Mr. Percival. Did you cut the hay?

Mr. Thayer. I fed it just as it came from the mow.

Mr. Percival. Did you give the cows all they would eat of hay and meal?

Mr. Thayer. Not all the meal they would eat, because a coming-in cow will eat more than is for her good.

Mr. Percival. Do you believe it expedient to give a cow all she will eat to make her thrive and do well?

Mr. Thayer. There you touch a point where I differ from a majority of farmers. It is thought among us, that if you give an animal half or two-thirds what it will eat, it will do just as well or better than if you give all it will eat. I don't believe in stuffing an animal's crib from morning to night; but my experience is, that the best plan is to feed three times a day, regularly, all they will eat, right straight along; that is the way I feed; and if there is a better way, I should like to know it. If I can keep three cows on what two will eat, I should like to know how to do it.

MR. DOE. I would like to hear from Mr. Lawrence in regard to feeding hay and meal.

MR. JAMES A. LAWRENCE of Bucksport. I have been very much gratified by what I have heard and learned at this session, and am well repaid for coming 150 miles to attend, although I am seventy-two years old and was not bred a farmer. Yet, for a few years past I have taken quite an interest in the subject, and have exerted what little influence I could to raise the standard of farming. This year, in common with other farmers in Maine, I am very short of hay, and am driven to my wit's ends to get my stock through the Winter with the least possible expense, and bring them out in good health and condition in Spring. I have adopted this rule: I have a horse weighing about 1200 pounds, I give him twelve pounds of hay and two quarts of scalded meal in the morning, a quart of oats at noon, and at night two quarts more of scalded meal So far, this allowance has kept my horse in good condition, sleek, smooth and bright. My cows are half Durham and half Ayrshire. To my older animals, I give twelve pounds of hay per day, two quarts of scalded meal in the morning, and two quarts of scalded meal at night; and my cows in milk never have given more in winter than they do this winter. My younger stock, three years old, two years old, yearlings and calves, I feed about in that ratio. I have two or three full-blooded Ayrshire calves, which will be a year old next Spring. I am giving them five pounds of hay per day and one pint of oats, and they are sleek and handsome. I wish you to understand that my hay is good hay; there is no clover in it, nor any weeds. I didn't raise ten pounds of clover on my farm the past season. The hay is chiefly timothy and red top, and was cut before it came into the second blossom (if there is any such thing) and cured in the best possible manner, bright, handsome and aromatic. I had not a drop of rain on a single load of hay put into my barn this year. I ought to add that my barn is warm and comfortable, the frost rarely or never entering it.

I have also a colt that will be a year old in April, that is fed three times in the course of the day, and eats six pounds of hay and one quart of oats; he has a good, sleek coat.

THE PRESIDENT. I would like to ask the exact weight of the cows and of the calves, or their probable weight, or girth.

MR. LAWRENCE. I suppose that my cows would girth from five to five and one-half feet; they are not large, being half Durham and half Ayrshire. The calves I spoke of are full-blood Ayrshires; of course they are not as large as Durhams.

QUESTION. How often do you feed your horses and other animals?

MR. LAWRENCE. Three times a day.

MR. WALKER. Do you give the hay cut?

MR. LAWRENCE. I do sir, unless the hay is very fine. If it is timothy, which grew large and rank, I cut it, but if redtop, I do not cut that.

MR. PARKHURST. Do you wet your meal and mix it with the hay?

MR. LAWRENCE. I usually wet the hay a little, and the meal I give out of a trough made for that purpose; always scalded meal.

QUESTION. Do you think that meal thoroughly cooked is better for stock than meal scalded?

Mr. LAWRENCE. I am perfectly satisfied of it; and if I am prospered, I mean to obtain a cooking apparatus, so that I can cook both the hay and meal, and give them in that form.

MR. HERSEY. Do you weigh all your feed?

MR. LAWRENCE. My cattle have eaten nothing this year that has not been weighed. If I live until spring, I mean to know just what it cost me to carry them through. When I begin a thing I go through with it. I was taught when an apprentice and learned to push the fore-plane, that anything worth doing was worth doing well. When I get through the winter, I want to know exactly the facts, so that if I am called upon I can show the figures. If I find my cattle falling away, I shall increase the quantity; if not, perhaps I may in some cases, diminish it.

MR. GOULD. I have been deeply interested this afternoon, and especially in the paper of Mr. Lucas. I have a rule, perhaps not always safe in its results, but exceedingly convenient and self-satisfactory in its application; it is this: when any gentleman agrees with me I always think he is perfectly accurate in his opinions. Applying that rule I find this gentleman to be exceedingly sound in all matters. Being much interested in the subject matter of his discourse, I want to say a word or two by way of illustration in relation to one point which he made. But before doing so, allow me to make a little contribution to the subject which has been just discussed. I have found great difference of opinion with regard to feeding, and the amount of food necessary for keeping animals, and I resolved to go to headquarters. I spent considerable time in the city of New York visiting the horse railroad stables in that city and in Brooklyn, and the omnibus horse stables, in order to learn their experience. I found those in charge very courteous; they opened their books and gave me every information desired. To sum up the results, looking over the record of their experience for several years, I found that they had all settled down, each company for itself, as the result of careful and repeated experiments, the details of which I was privileged to observe, upon one uniform rule for horse-railroad horses, and that was, twelve pounds of hay and sixteen pounds of Indian meal per day. In that way a railroad horse was kept up to his highest condition, and they were enabled to do their work more satisfactorily than under any other system that had been tried. Oats had been repeatedly used as an article of food, and their cost was carefully compared with that of Indian meal. It was feared at one time, that during the hot weather, the feeding of this amount of Indian meal would be found injurious, but the result of their experience was, that Indian meal, on the whole, for a railroad or omnibus horse was the true thing. But they have one very curious practice, the reason of which I am unable to fathom, which I ought to state in connection with this, as possibly bearing upon the subject under discussion. They invariably water all their horses at one o'clock at night. They have an idea, how true it is I do not know, that watering their horses at night adds greatly to their power of digesting the food, and prevents injurious consequences. And yet there is one respect in which an omnibus horse might perhaps furnish an insufficient guide to farmers. I found on comparison of the railroad horses with the omnibus horses of New York, that while the railroad horses on the average lasted four years, an omnibus horse lasted eight years, or just double. For example, the Third Avenue Railroad Company, which has 1,200 horses in their stables, purchases 300 horses every year. It is their regular rule to turn off 300 horses every year which are worn out. They have, to be sure, many horses which have been in their service for ten or twelve years, but I speak of the average. Now, the distinction between the railroad horse and the omnibus horse is, that the latter rests the whole Sunday, while the railroad horse works every day of the week. Many persons suppose that this rest accounts in a great measure for the difference in the lives of the two classes of animals. I do not think it does altogether, for it is notorious to those familiar with the railroad labor of New York, that there are certain times in the day, at morning and at night, when the mechanics are rushing to their work and returning to their homes on the outskirts of the city, when the railroad horses are overloaded to an extent to which the omnibus horses are never subjected. I think this overloading has a good deal to do with shortening their lives, as well as not being allowed any period of rest. There is another thing; the veterinary surgeon is called to attend to ten times as many omnibus horses on Monday as on any other day in the week. It is found that this day of rest (perhaps because connected with full feeding) tends to produce colic. Out of 1,200 horses, there may be twelve who will be suffering from colic on Monday morning.

I mention these circumstances to enable you to see that there are important differences; but the main fact remains, and I think it is one upon which you can rely as truly as upon any demonstration in mathematics, that it has been established on satisfactory testimony, that twelve pounds of hay and sixteen pounds of meal is the best food for a hard working horse. They get nothing besides this, except once in a while a few carrots. Formerly they were accustomed to give carrots, or some other roots, once a day, for the purpose of keeping them in health, but careful experiments have satisfied them that a feed of carrots once a week, is sufficient.

Now, in relation to the remark that twenty pounds of hay is sufficient for a cow; I weigh my hay every day and if there is any left over at night, I weigh that and deduct it from the amount given, and my twelve cows have consumed during the winter twenty-four pounds of hay each a day. At the same time I should remark, that last season I was unable to procure the help needed to cut my hay in time, and the consequence was, that a considerable portion was cut after it was in the best condition. It is probable that may account for the fact that my cows needed four pounds more.

With regard to the comparative value of corn and hay, I do not feel as sure as some gentlemen, that we can ascertain accurately their relative value, for the fact is, that if corn is fed exclusively to animals, they will not and cannot digest and assimilate to their own substance the full amount of nutritive matters contained in it. The construction of the stomach of the cow is such, that it is absolutely necessary that something shall be given for the distention of the stomach. It is impossible for the stomach to act as it was made to do unless its walls are distended with something; so that even wood shavings given with the meal may add to its digestibility. There should be a proper proportion of distending matter mixed with it. If you feed a cow exclusively upon Indian meal, you feed her under such conditions that it is impossible to ascertain the value of the nutritive matter contained in the corn.

With regard to the feeding of the colt and other animals by the gentleman from Bucksport, and its results as related by him, I am sure that his ability to use successfully so small a quantity reflects the highest credit on him as a farmer, for it shows that his hay must abound in nutritive properties to a far greater extent than the average of hay in this country, and that the oats which he raises must also contain nutritive matter much above the maximum quality of the oats raised in the State of New York. In regard to making the warmth of the stable a means of economizing food, I wish to endorse fully what the speaker has said, and I wish to impress upon the minds of the farmers of Maine what a wonderful source of economy is open to them in this alone.

There is a farm in the State of Illinois, of which many of you have heard, magnificent and princely in its proportions. I recollect being on that farm and seeing the system of operations there. The plowman went out in the morning, after breakfast, and plowed one straight furrow, without turning right or left, until it was time to eat his dinner, when he put his nose-bags upon his mules, sat down upon his plow, ate his own dinner, and then turned round and plowed a straight furrow back, and his day's work was completed. There were seventy-two of those plows in operation upon that field. You may judge something from this fact of the extent of the farming operations. The owner of this farm had over ten thousand cattle upon it; and when Rosencrans broke down so many horses, almost destroying them, at the battle of Chattanooga, the government requested this man to take in some twelve thousand horses thus broken down, and he took them to board, and hardly made any fuss about this addition to his usual stock. On this enormous farm, and raising corn to the extent which you may judge it was raised from the fact just stated with regard to the day's work of plowing, you will be surprised to learn that it takes a hundred bushels of corn to keep an animal from the day the grass ceases to grow in the fall until it begins to grow again in the spring, and that the animal has not gained one single pound. I do not mean to be understood that each animal actually eats six thousand pounds of corn, but a hundred bushels were put before each animal, and either eaten or wasted. There was no such an institution as a barn on that farm, and the animals were exposed to all the snows, and winds, and rains of heaven; and the consequence was, that the corn was wasted in furnishing energy for the mechanical labor of grinding up the corn and in supplying the heat that was necessary to keep them alive. Here is a practical exemplification of the amount of food that is required in order to obtain the animal heat which is necessary under such conditions.

When your rooms are cold, and the winds of winter are howling around, your method of preserving warmth is to put wood into the stove, where it inflames and burns up, and the result is, that heat is poured out and the room is kept warm. Stated chemically, in this process, the oxygen of the air combines with the carbon of the wood, and in the act of combination, heat is given out. Now, the same chemical statement which gives the cause of the heat which comes from your stove to warm your rooms, may with equal accuracy explain the source of animal heat. The animal eats a certain amount of food containing carbon, and that carbon combines with oxygen, and gives out heat which is diffused through the system, what we call animal heat. The oxidation of the carbon in the form of corn is precisely and identically the same with the combination of carbon in the form of wood in the stove, except that the latter is more rapid and accompanied with flame. Inasmuch as it is necessary for you to burn more wood in your stove if you leave the window open, so it is necessary, in order to supply the requisite amount of heat for an animal, that he should consume a greater amount of corn, if he is left exposed, in order to furnish the carbon which is necessary to supply animal heat to preserve life. For the heat of the body must be maintained at a nearly uniform temperature if you wish to preserve your life. It requires a variation of only a few degrees, (I think only eight,) either higher or lower than the normal temperature, to destroy life in a human being; and it is precisely so with the ox; eight degrees up or down is the boundary of the range in which the life of the ox is possible. Now, then, if he is to live in cold and discomfort, he must eat an increased quantity. If he appropriates the carbon of his food for the production of heat, so much is deducted from the amount of carbon he would lay on his ribs in the form of fat. Every degree of temperature that he has to keep up by means of food is just so many pounds or ounces subtracted from the amount of fat which he would otherwise lay on.

This matter is of vast practical importance. I may venture the statement, that if the barns of Maine were made as they ought to be, and as humane men ought to make them, the *pecuniary saving* to the farmers of Maine would be, not thousands of dollars, but millions; and if this gentleman does no other good work for his brother farmers, than to impress this great fact thoroughly and completely as the foundation of real practical work, if he can induce them to make their barns as he has described, he will entitle himself to the epithet of a noble public benefactor.

Mr. Thing. I want to say a single word upon a single point in justice to the farmers of Maine. We have heard much said about the dignity of labor; about farmers not respecting their calling; about labor not being respectable. I have no sort of sympathy with such talk. The farmers of Maine have no sympathy with it. In this blessed day of grace in which we live, the labor of the farm, the field, the shop, the sitting-room, the kitchen, the laundry, is not only just as respectable, but it is looked upon by the people generally as quite as respectable as any other calling. If we desire to occupy a higher plane, *we must fit ourselves for it*; we are not to dignify labor, but dignify ourselves.

A few years ago, in a certain court in this State, a foolish fellow was tried for a crime which he had committed through the instigation of another. He was defended by a lawyer who pleaded in extenuation that the fellow was *non compos*, and therefore not responsible. Nevertheless, he was convicted. The foreman of the jury, wishing to keep upon good terms with the lawyer, came to him, and undertook to explain the thing. Said Mr. Libbey, "I have no fault to find; he has been tried by a jury of his peers." Now, as I said before, let us fit ourselves for the place we wish to occupy, and then we shall stand there.

Adjourned.

EVENING SESSION.

The meeting was called to order at 7½ o'clock, the President in the Chair. The first paper read was an essay on

"OUR INFLUENCES FROM AN AGRICULTURAL STANDPOINT."

BY HON. WARREN PERCIVAL.

When the Board of Agriculture was first organized I had the honor and pleasure of being a member during several years. I felt a deep interest in its labors and discussions. Those associations had a salutary influence, inciting me to reduce to practice, views and theories advanced by practical, intelligent agriculturists. I have lost no interest during the intervening years; and now, when again I find myself a member, I am prompted to assist in some way, but there has been such a change in its practical workings that I hardly know my latitude, or what to do or say; but as every man exerts an influence for good or ill, even though his knowledge is limited and his sphere of action humble, I propose to offer some remarks upon OUR INFLUENCE. Very many regard agricultural pursuits as humiliating in the extreme. I am happy to know that a radical change is taking place in public sentiment, and more happy to perceive that the intelligent, practical agriculturist ranks first in many of the business relations of life Therefore I shall attempt to illustrate my ideas by two extremes, principally from an agricaltural stand-point.

Mr. A has fair natural ability, but from the force of early education, is traditionary in agricultural operations. He inherited his farm and fixtures from his father; the homestead for generations. The buildings are dilapidated; orchard (if he has any) is unpruned, ungrafted, dying and barren; fences decaying; stone-walls prostrated; bars broken; gates ajar and unhung; mowing fields rough and barren, interspersed with large clusters of bushes and thistles surrounding numerous rock-piles, infested by destructive vermin; pastures exhausted, covered with moss, hard-hack and sweet fern; swamps unreclaimed, overrun with alders, willows, water-grass and brakes; wood-lots neglected, trees upturned and decaying; his garden producing an abundant crop of weeds. Poultry house in the top of his trees or where he stores his carriages; the piggery is a yard on some northern slope to secure a supply of fresh air. His tool-house is his entire farm; his farm implements are no modern humbugs, but have descended to him with all his other traditions and are retained with equal tenacity. His horses poor, lame and lazy; his cattle pure native, true types of Jacob's cattle; his sheep are wild, small and poor, bearing light and poor fleeces; his swine small, poor and pointed at both ends, pastured perhaps in the garden, front-yard or in the highway, an annoyance to his neighbor day and night; while his scanty crops stored in their well ventilated receptacles (being dirty and rickety, infested by rats and mice) all bespeak his ideas of scientific farming, blood stock, tight barns and rat proof granaries.

His literary department lacks modern books, as well as paper and stationery, but is very likely furnished with pipes, tobacco, a pack of cards and perhaps a bottle of whiskey. His children being surrounded by such influences grow up ignorant, awkward, impudent, dissipated and dishonest specimens of humanity. They are strangers to art and science; they discover no beauty in the works of nature; they have no love for the useful and beautiful in flower gardens, field crops, or in flocks and herds. Their leisure hours (which are many) are devoted to gossip, vulgarity and croaking, contaminating the whole sphere of their influence.

We will now turn to Mr. B who is Mr. A's neighbor. He began life with scanty patrimony, save good religious, moral, and intellectual and agricultural training. His farm buildings are new, or old ones modernized, with all the convenient fixtures; his orchards are pruned, grafted, vigorous and bearing bountifully; fences and stone walls indicate taste and thrift; bars and gates in place and shape. Fields smooth and verdant, covered with luxuriant crops of all kinds. All destructive vermin soon come to grief if they dare to intrude. Pastures producing abundant forage, free from bushes and noxious weeds. Swamps reclaimed and underdrained, yielding splendid crops of grass, grain, fruits and vegetables. Wood-lots cleared of fallen and decaying trees and receiving constant, watchful care to protect the young and tender growth. His tool-house is a tight, dry, commodious structure, easy of access; his farm implements are of the most approved kinds, carefully stored when not in use. His horses fat, sound and spirited. His cattle (some improved breed) are smooth, fat, symmetrical and beautiful of their kind, quietly ruminating either in the comfortable barn, or rich pastures. His sheep docile, large and fat, bearing heavy fleeces of lustrous wool; their flesh tempting to an epicure. His swine beautiful types of some of the improved breeds, in a convenient piggery, either converting grain and vegetables into sweet, tender pork, or rearing young, and with a little labor and skill on the part of their owner, manufacturing a huge pile of valuable fertilizers from muck, weeds, straw, turf from the roadside, with the aid of the wash from the laundry, ashes and plaster to retain ammonia and assist in decomposition. His abundant crops of all kinds are carefully harvested, and securely protected from vermin in their respective places, illustrate fully and forcibly to every observer, the influence of early and correct agricultural discipline. His literary department would interest intelligent minds, being largely supplied with scientific productions of eminent agriculturists, illustrating the goodness, wisdom and power of nature's God, in the production from the germ to maturity, everything upon which we and ours subsist from infancy to age. Here we find the choice literature of present and past ages; the relics of dissipation, ignorance and profanity being discarded. His children (being his pupils) here find recreation and spend their leisure hours with profit; they are familiar with art and science; they admire the works of nature; they love the beautiful and rare flowering plants and shrubs that surround their home. They combine theory and practice in the cultivation of all farm crops; they understand the nature and varying character of their soils, and the requisite quantity and quality of needful fertilizers. They are familiar with the origin, descent and characteristics of their domestic animals, whether natives, grades or thoroughbred. They have moral courage to advocate truth against falsehood. In short, they love that quiet home, made cheerful and happy by early, continued and practical education in the right direction and are choice specimens of agricultural production, possessing such religious, moral, agricultural and political qualifications that when circumstances call them to leave the home of their childhood, we find them master-mechanics, engineers, navigating the ocean, consul or minister to foreign countries, religious missionaries at home or abroad, at the head of or in some of the national departments, in legislative or congressional halls, president, professor or student in some agricultural college, or *last* though not *least*, members of the board of agriculture, devoting their best energies to promote the interests of agriculture. Some may say that this picture is over-drawn; that that such men as Mr. A are not to be found, and that such models as Mr. B are rarely found.

I appeal to you, gentlemen. Do you not find Mr. A very often in your intercourse with mankind? Do you not frequently meet him in your legislative halls, denouncing all agricultural associations, all scientific farming, all Boards of Agriculture, all Agricultural Colleges; and contending with pent up vengeance against all appropriations for such objects, until, like the maniac, they regard everybody as insane but themselves?

I also ask you, do you not often meet Mr. B, his whole soul in the work of elevating his brother man to a higher life in all his pursuits? He regards the human family as susceptible of improvement and believes that what has been done by man, can by man again be done; yea, even more than this, he is determined to excel. I could name such, but they are so numerous that I desist.

I have considered the subject mainly from an agricultural standpoint. I have done this because I believe agriculture to be *Alpha and Omega.* The first man was very soon (after his creation) initiated in the first principles of agriculture, and I am inclined to think the first woman very early in life had some practical knowledge of the duties of her sphere as a farmer's wife. I make the assertion broadly, that agriculture underlies and is the foundation of all our *institutions,* and all other departments of industry are successful in proportion as agriculture succeeds. If this be the fact, should not every man ask himself, what am I doing in this great work? How many could respond, *I am fully doing my duty?*

Hon. J. Stanton Gould of New York, followed with an interesting lecture on "The Relations of Railroads and Transportation to Agriculture."

Mr. Thing then introduced the following resolutions, which were seconded by Mr. Simpson and unanimously adopted, the large audience all rising:

Resolved, That the thanks of this Convention are hereby tendered to Hon. John Stanton Gould of New York, and to Hon. Theodore S. Gold of Connecticut, for their very acceptable, interesting and instructive contributions to the usefulness of this session, and that the vote be taken by rising.

Resolved, That the above resolution be entered in the Records of the Secretary of the Board.

Adjourned.

FOURTH DAY.

FRIDAY, January 26, 1872.

The Board assembled at 10 o'clock, Mr. Scamman of Cumberland in the Chair.

The day was chiefly occupied with reports from delegates from Farmers' Clubs. To give these in full would occupy large space and involve a repetition of much which has been presented in former volumes. From their general tenor abundant evidence appeared regarding the exceeding usefulness of these institutions, and abundant encouragement for their promotion. Plentiful testimony was also given showing the need of them, the uses which they subserve, and that a large amount of indifference and *vis inertia* exists among many, perhaps among the majority of farmers, which needs to be overcome, and which demands persistent, earnest labor on the part of those who realize the need of elevating agriculture to the position it should rightfully occupy, and the consequent need of a general diffusion of both practical and scientific knowledge among farmers.

What Farmers' Clubs have already accomplished in these directions in many neighborhoods, as testified to by many of the speakers, gives the highest encouragement for continued efforts where they have been in operation, and for their formation in other neighborhoods. It also appeared that for successful working there must be some who are willing to devote much more than their proportionate share of time and labor to the work; and who will work on steadily after the attraction of novelty has worn off,—and who by their well directed enthusiasm may leaven the duller ones with progressive ideas.

No other calling suffers so much for lack of contributions to the common stock of knowledge by means of what each other has gathered from experience, as agriculture. Farmers are not brought together so much as mechanics and many other classes; they have less opportunity to inspect each other's work and to criticise and profit by one another's operations. Whatever contributes to this end serves an exceedingly useful purpose, whether it be the Town Fair, the County or State Exhibition, a printed Book, the Newspaper, the Club, or whatever else. In many cases Town Exhibitions have been got up by Clubs, and have brought their benefits as it were to the doors of all. These in their turn contribute greatly to the success of County Exhibitions, and these again to that of the State. What the primary assemblage—the "Town meeting" has done for us as a nation,—educating all in the fundamental principles and practices of free government—*true* Republicanism—*genuine* Democracy—elevating each to a consciousness of being one of the sovereign people, and to a sense of responsibility as the source from which power flows and laws arise, such may the farmers' club be in regard to that most important industry which feeds all the industries of the world—and without which society must retrograde into barbarism and go hungry, or starve at that.

Among the points most clearly shown by the statements of the delegates were the following: That it is expedient to have the meetings partake of a social character, thus insuring the attendance of wives and daughters, young men and maidens. That it is best to have the discussions opened by the reading of a paper previously prepared by some member, to be followed by extemporaneous discussion; that it is well occasionally to obtain a speaker from abroad, but that the main dependence should be on home resources; that a good library is a great help; that the benefits are not confined to the members alone, nor shown only in increased activity of thought, greater facility in expressing ideas and views, ease in presiding gracefully and effectively, &c., but that many who do not attend the meetings get much good at second hand, they hear something of the discussions, and see something of the improvements as put into practice, which were mooted at the club, and are led to better practice on their own farms. It was also stated that substantial improvements thus originated had effected so material an increase of value in farms and farm property that it was visible in the valuation made by the town assessors.

The reports of delegates being concluded, on motion of Mr. Lang, the following resolution was adopted unanimously.

Resolved, That the thanks of the Maine Board of Agriculture be and are hereby tendered to the citizens of Paris, for the ample and convenient accommodation provided for its deliberations; for the cordiality with which it members have been received, and for the uniform kindness and courtesy extended to them.

Mr. Shaw of Paris, responded to the resolution in highly appropriate terms; and the Board finally adjourned.

Books for Farmers.—Not unfrequently inquiries are made regarding the best books on agriculture for public or private libraries, Farmers' Clubs, &c. It is usually no easy task to select those which, in character, numbers and price will best answer the varied requirements which are thus sought to be supplied.

But there are some which can be recommended without hesitation. Among these is a work on Practical Dairy Husbandry, by X. A. Willard, A. M., of Herkimer County, New York. It treats very fully of Dairy Farms and Farming, Dairy Stock and its Feeding and Treatment, Management and Manufacture of Milk into Butter and Cheese by the most improved methods of the present day, giving also the history and mode of organizing Butter and Cheese Factories, together with much else of interest on related matters. Mr. Willard gave an address at the session of the Board at Farmington in January 1871, which was published in the report of last year. Those who heard him on that occasion, or who have read the address can readily judge of his fitness for such a task. Suffice it to say that having had practical experience in his own dairy for upwards of twenty years and having enjoyed rare opportunities for studying and observing all which pertains to to the Dairy, no man is better qualified for the authorship of such a treatise than Mr. Willard. Octavo, 546 pages. Published by D. D. T. Moore, New York. Price, $3.

To those who believe that a right understanding of fundamental principles is the surest guide to successful practice, and therefore desire to study the scientific truths which bear upon agriculture, are most heartily commended two works by Prof. S. W. Johnson, of the Sheffield Scientific School of Yale College; the one entitled "How Crops Grow," being a treatise on the chemical composition, structure and life of the plant; and the other, "How Crops Feed," a treatise on the Atmosphere and the Soil as related to the Nutrition of agricultural plants; designed to be a companion to, and the complement of the other.

The results of the more recent investigations of German and French botanists, chemists and agriculturists have been, for the most part, presented in journals or other publications which are quite out of the reach of the general student. These results, together with the remarkable studies of English experimenters, comprise nearly all which is positively known with reference to the life and growth of agricultural plants. This widely scattered mass of facts embraces, however, just what every progressive farmer wants to know; while not one in a million has the time, the means and the ability to obtain, translate, digest and arrange them for himself. It is in the highest degree creditable that one of our Professors should undertake and satisfactorily accomplish the formidable task of bringing order out of such a chaos.

In the above named volumes Prof. Johnson has presented in a convenient form, the established facts of Physiological Botany, so far as they relate to the cultivation of crops, and he has stated in clear language the cardinal principles upon which successful agriculture must depend. The following is from the Preface to How Crops Grow:

"For the last twelve years it has been the duty of the writer to pronounce a course of lectures annually upon Agricultural Chemistry and Physiology to a class in the Scientific School of Yale College. This volume is a result of studies undertaken in preparing these lectures. It is intended to be one of a series that shall cover the whole subject of the applications of Chemical and Physiological Science to Agriculture, and is offered to the public in the hope that it will supply a deficiency that has long existed in English literature.

"The progress of these branches of science during recent years has been very great. Thanks to the activity of numerous English, French, and especially German investigators, Agricultural Chemistry has ceased to be the monopoly of speculative minds, and is well based on a foundation of hard work in the study of facts and first principles. Vegetable Physiology has likewise made remarkable advances, has disencumbered itself of many useless accumulations, and has achieved much that is of direct bearing on the art of cultivation.

"The author has endeavored in this work to lay out a groundwork of facts sufficiently complete to reflect a true and well-proportioned image of the nature and needs of the plant, and to serve the student of agriculture for thoroughly preparing himself to comprehend the whole subject of vegetable nutrition, and to estimate accurately how and to what extent the crop depends upon the atmosphere on the one hand, and the soil on the other, for the elements of its growth.

"It has been sought to present the subject inductively, to collate and compare, as far as possible, *all* the facts, and so to describe and discuss the methods of investigation that the conclusions given shall not rest on any individual authority, but that the student may be able to judge himself of their validity and importance. In many cases fulness of detail has been employed, from a conviction that an acquaintance with the sources of information, and with the processes by which a problem is attacked and truth arrived at, is a necessary part of the education of those who are hereafter to be of service in the advancement of agriculture. The Agricultural Schools that are coming into operation should do more than instruct in the general results of Agricultural Science. They should teach the subject so thoroughly that the learner may comprehend at once the deficiencies and the possibilities of our knowledge. Thus we may hope that a company of capable investigators may be raised up, from whose efforts the science and the art may receive new and continual impulses.

"In preparing the ensuing pages the writer has kept his eye steadily fixed upon the practical aspects of the subject. A multitude of interesting details have been omitted for the sake of comprising within a reasonable space that information which may most immediately serve the agriculturist. It must not, however, be forgotten, that a valuable principle is often arrived at from the study of facts, which, considered singly, have no visible connection with a practical result. Statements are made which may appear far more curious than useful, and that have, at present, a simply speculative interest, no mode being apparent by which the farmer can increase his crops or diminish his labors by help of his acquaintance with them. Such facts are not, however, for this reason to be ignored or refused a place in our treatise, nor do they render our book less practical or less valuable. It is just such curious and seemingly useless facts that are often the seeds of vast advances in industry and arts.

"For those who have not enjoyed the advantages of the schools, the author has sought to unfold his subjects by such regular and simple steps, that any one may easily master them. It has also been attempted to adapt the work in form and contents to the wants of the class-room by a strictly systematic arrangement of topics, and by division of the matter into convenient paragraphs.

"To aid the student who has access to a chemical laboratory and desires to make himself practically familiar with the elements and compounds that exist in plants, a number of simple experiments are described somewhat in detail. The repetition of these will be found extremely useful by giving the learner an opportunity of sharpening his perceptive powers, as well as of deepening the impressions of study.

"The author has endeavored to make this volume complete in itself, and for that purpose has introduced a short section on the The Food of the Plant. In the succeeding volume, which is nearly ready for the printer, to be entitled 'How Crops Feed,' this subject will be amplified in all its details, and the atmosphere and the soil will be fully discussed in their manifold Relations to the Plant. A third volume, it is hoped, will be prepared at an early day upon Cultivation; or, the Improvement of the Soil and the Crop by Tillage and Manures. Lastly, if time and strength do not fail, a fourth work on Stock Feeding and Dairy Produce, considered from the point of view of chemical and physiological science may finish the series."

How successful Prof. Johnson was in his endeavors, as above set forth, is shown by the reception which his books have met, both in this country and in Europe; having been republished in England under the joint editorship of Profs. Church and Dyer of the Agricultural College at Cirencester, and in Germany, a translation, instigated by Baron Liebig, has been published.

It is safe to say that these volumes may be accepted as an authoritative exposition of the scientific agriculture of the present day, in those branches of which they treat. It is equally safe to say, that they are books not well adapted for light reading. They deserve to be carefully studied, as well as read, and will be of little use unless they are. Two duodecimo volumes, of rather less than 400 pages each, containing all the facts gathered during a series of years by scores of laborious investigators, together with the interpretation of these facts, or, in other phrase, their testimony regarding agricultural practice, could not fail to be full to the brim of concentrated mental food. Their contents, amplified with swelling words, extended with a customary amount of blunders, and diluted with twaddle to the consistence of the thin broths supplied to the press by some agricultural writers, would furnish materials enough for a library of great magnitude. As the case stands, either can be had* for two dollars, or both for four, and a world of house room saved, with a corresponding economy of time.

It is well to have some such books. The digestive powers of intelligent farmers are not so weak that they need, either physically or mentally, to be fed solely upon slops, or even on milk; and the farmer who has taken a slice of solid intellectual food such as these furnish, has a cud for profitable rumination while his hands are busy with daily routine work. In one respect these volumes are open to less favorable criticism. Those who buy them will do so for the sake of availing themselves of the author's share in the work, and not because of less attractions contributed by the publisher; the paper, binding and general mechanical execution being suggestive of a poverty in marked contrast with the solid wealth within.

To serve the double purpose of more fully introducing Prof. Johnson to the farmers of Maine, and to furnish valuable informa-

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* Sold by booksellers generally, or sent postpaid on receipt of price by the publishers, Orange Judd & Co., 245 Broadway, New York.

tion regarding a subject of great practical importance, I am happy in being able, through the courtesy of Secretary Gold, to present here two lectures delivered before the Connecticut Board of Agriculture at their last session.

Soil Exhaustion and Rotation of Crops.

BY PROF. S. W. JOHNSON.

Mr. Chairman and Gentlemen: Sometime since, I received from Mr. Gold, a letter asking me to address the Board of Agriculture and the gentlemen assembled on this occasion, on Exhaustion of Soils and Rotation of Crops. In that letter Mr. Gold says:

"We want to go further than the common theory of rotation leads us, and to inquire why some crops may be grown for several years in succession, as onions and buckwheat, why corn does not succeed after turnips, why does land become clover-sick.

"Why does the culture of certain crops tend to make the farm richer, while other crops only make it poorer, and in both cases, the gross amount of minerals and ammonia contained in the crops may be the same, or even greater in the enriching crops?

"Are there certain periods of plant growth which may be called the enriching period, and others, as the fruit season, the exhausting?

"Is not wheat, the prince of cereals, the greatest exhauster of the soil for the product taken from a given area?

"Tobacco should not be a very exhausting crop; yet from the fact, that for the particular purpose for which we cultivate it, a very luxuriant growth is required, do we not need to furnish more plant food than can be assimilated, much of which is lost in the air, and washes away?

"The physical condition of the soil as it is left by different crops is worthy of notice.

"Wheat grows well after peas and clover, also after tobacco; but is not this last owing to the manure left over by the tobacco and the good preparatory culture?

"Corn does not do well after buckwheat, but potatoes do well.

"Perhaps my facts may not be *facts*, but they are believed by a great many farmers, and we want the whole subject overhauled and explained."

After getting here on the ground, and looking over the material which ought to be considered in connection with these questions, Mr. Gold has promised me that I shall have another hour to-morrow, and I will occupy this morning with a part of the subject.

I cannot promise, however, to answer all the questions which Mr. Gold has proposed. Our knowledge is not sufficient for that. Mr. Gold's admission that some of his "facts may not be *facts*," shows that investigation is needed to establish fully what *is*, and to distinguish that from what *appears to be*, before we can reasonably expect to give explanations. But the very investigations which shall serve in any given case to identify the *fact* will also assist in understanding the reason of it, and in seeing clearly its bearings upon the other facts which we properly regard as settled. I shall endeavor then, as far as the time admits, to put before you some of those considerations which seem adapted to furnish guiding ideas in respect to my subject.

By Exhaustion of Soil is properly understood, not a complete deprivation of producing power, but simply a reduction of this power below a profitable point. This is indeed a somewhat indefinite definition, because the point of profit is not easy to decide upon, but it is sufficient for our purpose.

What does exhaustion consist in? It consists either in the removal of certain materials from the soil, materials which serve to feed the crop and become a part of it, and which, by continually taking off harvest after harvest, become diminished in quantity; so that after a certain time there is not enough left in the soil to produce a fair crop, or else it means that the materials which may still exist in the soil no longer occur in that condition in which the crop can make use of them. We may have a soil containing potash in large quantities, many hundred pounds, or tons even, in an acre, taken to the depth of two or three feet; but if this potash exist there exclusively as an ingredient of some mineral which is acted upon so slowly by the natural process of solution that there is no available potash, as we say, nothing which the crop can get hold of, such a soil would be unproductive. Again, we may have a soil which contains but a thousandth part as much potash, but which is fertile from the simple fact that the alkali occurs there in such a state as to become available as rapidly as the crop requires it.

To cure exhaustion, we must either restore the nutritive matters which have been removed from the soil, or we must change the state of those which still exist there so that they may become available.

Chemical science has established the fact that every crop requires a variety of materials to support it. I have here a number of printed sheets, containing a table of the average quantities of the chief ingredients of our ordinary cultivated crops, of which I would like every gentleman present to have a copy.

Average Quantity of Water, Nitrogen, total Ash and Ash-elements in 1000 lbs. of fresh or Air-dry Vegetable Matter.

By Prof. Wolff, of the Agricultural Academy, at Hohenheim.

	Water.	Nitrogen.	Total ash.	Potash.	Soda.	Magnesia.	Lime.	Phosphoric acid.	Sulphuric acid.
Wheat, grain	143	20.8	17.1	5.5	0 6	2.2	0.6	8 2	0.4
Wheat, straw	141	3.2	42.6	4.9	1.2	1.1	2.7	2.3	1 2
Rye, grain	149	17.6	17.3	5.4	0.3	1.9	0.5	8 2	0.4
Rye, straw	154	2.4	40.7	7.6	1.3	1.3	3.1	1 9	0.8
Oats, grain	146	19.2	26 4	4.2	1.0	1 8	1.0	5 5	0.4
Oats, straw	141	4.0	44 0	9 7	2.3	1.8	3.6	1.8	1.5
Barley, grain	145	15 2	21.8	4.8	0.6	1 8	0.5	7.2	0 5
Barley, straw	140	4.8	43.9	9.3	2.0	1 1	3.3	1.9	1.6
Indian corn, grain	136	16.0	12.3	3.3	0.2	1.8	0.3	5 5	0.1
Indian corn, stalks and leaves	146	4.8	41.9	8.9	1.2	2.6	3 8	3 8	2 5
Buckwheat, grain	141	14.4	9 2	2.1	0.6	1.2	0.3	4.4	0.2
Buckwheat, straw	160	13.6	51.7	24.1	1.1	1.9	9.5	6.1	2.7
Meadow hay	144	13.1	66.6	17.1	4.7	3.3	7 7	4 1	3.4
Red Clover hay	160	21.3	56.5	19.5	0.9	6.9	19 2	5.6	1.7
Timothy grass	700	5 4	21.0	6.1	0 6	0.8	2.0	2.3	0.8
Maize fodder, green	862	3.2	8.2	2.9	0.1	1.1	1.2	0.7	0.3
Red Clover green	800	5.3	13.4	4.6	0.2	1.6	4.6	1.3	0 4
Potatoes, tubers	750	3.2	9.4	5.6	0 1	0.4	0 2	1.8	0 6
Potatoes, tops	770	4.9	11.8	0.7	0.1	2.7	5 5	0 6	0 6
Turnips, roots	909	1 8	7.5	3.0	0.8	0.3	0.8	1.0	1.1
Turnips, tops	898	3 0	14.0	3 2	1.0	0.6	4.5	1.3	1 4
Carrots, roots	860	2.1	8.8	3.2	1 9	0 5	0.9	1.1	0 6
Carrots, tops	808	5.1	26.1	3.7	6 0	1.2	8 6	2.1	1.5
Hops, entire plant	250	......	74.0	19.4	2.8	4.3	11.8	9.0	3.8
Hops, the cones	120	......	59 8	22.3	1.3	2.1	10.1	9.0	1.6
Tobacco	180	46.0	197.5	54.1	7.3	20 7	73.1	7.1	7.7
Stable manure	750	5.3	69.1	6.8	1.5	1.7	6 8	3.2	2.8
Dungheap liquor	982	1.5	10 7	4.9	1.0	0 4	0.3	0.1	0 7
Fæces, fresh	772	10.0	29 9	2.5	1 6	3.6	6.2	10 9	0.8
Urine, human, fresh	953	6.0	13 5	2.0	4.6	0.2	0.2	1.7	0.1
Night soil, fæces and urine, fresh	935	7.0	14 0	2.1	3.8	0.6	.0.9	2.6	0 4
Bone dust	56	40	608	...	....	7	313	257	....
Nitrate soda	26	150	980	....	336	1	1	....	11
Sulphate ammonia	50	200	950	....	....	....	....	....	550
Fish guano	70	78	219	....	....	....	76	72	....
Ground kelp	98	12	211	22	44	12	11	3	68

To give an illustration with one of the substances which is absolutely essential for vegetable growth, I will take sulphuric acid, the proportions of which in 1000 lbs. of our ordinary crops are given in the last column of this table. Sulphuric acid, in the form of some sulphate, must be present in the soil. If we should remove all the sulphates from a given soil, it would be totally impossible to grow any crop or any plant there unless the sulphates were replaced. That is one of the first principles of agricultural science, which applies equally to all the ingredients stated in the table, with the possible exception of soda, as has been establish by such an amount of experimental evidence, that there can remain no doubt of it whatever. Sulphuric acid, or the sulphates, as they are found in nature, are very liable to be removed from the soil. The sulphate of lime is the form in which sulphuric acid chiefly occurs in land. This dissolves in about five hundred times its weight of water; and where the soil is so situated that heavy rains fall upon it, leach through and go out of it again, the sulphuric acid is rapidly washed away. Almost everywhere, except in the poorest soil, you find the water a little hard, when you use it with soap. This hardness is due to the presence of lime, and in most cases you find the water contains a little sulphate of lime, which is the same as plaster of Paris. This continually dissolves from the soil and passes into the springs and rivers. If the soil is not porous, but of such a nature that it can hold the rain which falls upon it to a large extent, the case is different, and the loss is not so rapid as from soil where the water runs freely through; but we have in this way a constant loss of sulphuric acid from the soil.

Unless there is an unfailing supply of sulphates in the soil itself, furnished, for example, by the chemical alteration of some other sulphur compound, as iron pyrites, there will in time come to be a deficiency of sulphuric acid from this washing process alone, and although this element of crops is the least prominent of them all in respect to quantity it is likely to be soonest exhausted. The moment when the available sulphates in the soil become less than is required for a full crop, it will be impossible to realize such a crop without making good the deficiency.

The soil in a given case may be unfertile, may become exhausted, simply because this one ingredient is removed by the processes of washing and cropping. Lime and soda are also washed out from the land, slowly to be sure, but continually, and in quantities whose aggregate is very large. There are other elements, like phosphoric acid, which we do not lose by washing to any appreciable amount. You do not commonly find this substance in the water of wells or springs, except in the minutest quantities. It is very rare to detect it in waters, except those which have passed through a very heavily manured soil, or unless it is otherwise especially abundant. Potash, for another example, rarely wastes from the soil, unless it is from light, coarse, sandy land, having but little fine material in its tilth.

If the substances which feed the crop, one or all, have become reduced in quantity or are not in proper condition as to solubility, we may remedy the exhaustion either by applying the materials in the form of some fertilizer which contains them, or we may omit that, and rely upon those processes by which the original rocks of the earth's surface have been converted into nutritive soil; the processes by which those substances, once totally unavailable for crops, have been made available. We can wait the operation of the natural agencies which are involved in what we call "weathering;" the action of water, and of the carbonic acid and oxygen in the air. When we leave land in fallow—a thing which is practiced much less now than formerly—these processes go on in the soil, and prepare a quantity of plant-food for the crop of another year. This "weathering" process is in constant progress and is of great importance in supplying the materials which our crops demand. If that process should be suspended, farming would become a very difficult business. That certain fields will produce crops of the same kind for years and years without any fertilizing addition whatever, is due to the fact, that as fast as the crop requires and removes the materials given in our table they are supplied by the soil itself; they exist in the soil, were originally stored up there, and they are made soluble day by day, as the crop may need. The rate at which this weathering process goes on determines, other things being equal, the natural yield in a given case. By active tillage, throwing up the soil, so that it is exposed more fully to the air, and by drainage, if this be necessary to ensure access of the atmosphere, this process can be hastened. Most saline fertilizers, such as common salt, nitrate of soda, superphosphate of lime, and plaster of Paris, also act in a similar way to dissolve the elements of the soil, and thus prepare them for the crop; so that, although these fertilizers may in some cases do nothing towards feeding the crop directly, they help to feed it by this indirect action in dissolving and bringing into an active form the materials which the soil contains in abundant quantity, but in an inert state.

To go back and review, in a couple of statements: Exhaustion is the reduction of the producing capacity of the soil below the point of profitable cultivation, and depends either upon the absolute removal of certain materials, or their removal to such a point that the supply is below the demand of the crop, and such removal of materials must be compensated either by suitable fertilizing applications or by making the unavailable materials still present in the soil available by fallow, tillage, &c.

Mr. Lawes, of England, a gentleman who has devoted a great deal of attention to agriculture, and spent a great deal of money in its study, and who has arranged the most beautiful and elaborate field experiments that have ever been made in any country, has brought out in a recent publication the distinction between the "natural strength" of the soil and what he designates its "condition;" and as this distinction is an extremely important one, I will devote a few moments to its consideration. The natural strength of a soil is its feeding power and adaptedness to crops in all those respects which belong to the soil by its original nature. This standard fertility or productive power is something characteristic of the soil, something you cannot separate from it, something belonging to its entire mass and dependent upon its original composition, texture, and properties. It is a thing which lasts a long time, and perhaps has scarcely any limit in the matter of duration, whatever may be its limit in the quantity of crop which the soil will produce. Every soil has its natural strength, greater or less, the degrees covering a very wide range. You have all heard of soils which are remarkable for their productiveness, or for their want of productiveness. The valley of the Nile, for instance, is a region which has been cultivated for a period longer than history can define with any accuracy, and produces large crops annually of the most exhausting kinds. Wheat and similar grains are grown there continuously, year after year, without any attention, except digging in the seed, watering and taking the crop off. We find in Hungary and Southern Russia large tracts of country, where, every other year, or every third year, large wheat crops are harvested. The land is cleared, the seed put in, and after the crop is gathered the land is allowed to rest one or two years, then another crop is put in, and so on. This process has been going on for centuries. Black Sea wheat is famous all over the world.

The export of wheat from those southern districts is immense. Until our western country came into bearing, that was the chief source of the wheat supply to continental Europe.

We have in our Genesee region, in central New York, a country where the soil is of remarkable natural fertility, and, after the first few years of cultivation, the farmers fell into a routine which enables them to take off a wheat crop every third year, right along, with great uniformity. The uniformity is great, so far as it depends upon the feeding power of the soil. Accidents, like the rust, the midge, or something of that sort may come in and destroy their crops occasionally, but the feeding power of those soils remains, as a certain quantity, and will probably so continue for a great length of time.

The most interesting case which I can bring up in illustration of the natural strength of soil is furnished by the English gentleman to whom I have referred, Mr. Lawes. In April, 1870, he wrote, in respect to a field on his estate, a paragraph as follows:

"The same heavy loam, of no extraordinary fertility, has yielded an average annual produce, without any manure at all, of 16 bushels of wheat for twenty-six years; 20 bushels of barley for eighteen years, and nearly 24 hundred weight (long hundred weight) of hay for fourteen years."

Mr. Lawes began, in 1844, to see what would be the effect of putting a given plot of land into the same crop year after year, with no manure whatever; and the result is what I have just stated. These averages which he gives are, with one or two exceptions, the regular yield, within two or three bushels, of this piece of land. A field, for example, which had been, this last summer, twenty-eight years in continuous cultivation under wheat, has averaged about 16 bushels; on one occasion, it went up to 23, and on one occasion it dropped down to five. These variations were due to the season, but otherwise the yield ranged between 12 to 17 bushels, so that this productive power of 16 bushels may be considered as the capacity of that soil in respect to the wheat crop. I do not see any reason why he and his successors should not go on for a hundred years and get the same amount of wheat, within about the same limits. Perhaps it would fall off somewhat. There is a little falling off in the last half of the period just completed. The yield is perhaps a bushel less than during the first half; but that may be accidental, and due to the character of the seasons. There is no reason in my mind why, for the next twenty-five years, the yield should not be a bushel or two more; but we have not lived those other twenty-five years, and we cannot tell positively.

The worst soil we can point out has a certain natural capacity. Take our rocky hill ranges in this State: if we should give a little care to them, we could harvest every twenty-five or thirty years, a certain crop of wood from them; and if we should begin that culture now, and carry it on for a hundred years, we should get the same crop the last thirty years that we did the first thirty. If we carried it on for a thousand years, the climate and circumstances generally, remaining as they are, we could depend upon getting from them three uniform wood crops every century. So in the poorest pasture, we have a certain natural productiveness, which remains the same, so long as the state of the soil is unaltered. The field may become a swamp, or its natural water-supply may be dried up by local changes, but independently of accidents like these, it will manifest a certain nearly uniform natural strength from generation to generation. All production of vegetable matter in the soil, of any kind, is the result of change —the result of chemical and physical change. Natural strength depends upon changes in the soil which act in a nearly invariable manner for long periods of time. The "Tooth of Time," is an expression belonging indeed to figurative literature, but one also fully justified by fact. It is a tooth whose action never ceases and whose sharpness is never blunted. The grand rock-ridges and peaks which make the mountains of the globe, although they have held their crests aloft in flinty defiance through all the periods of human history or tradition, are slowly wasting under its incessant bite, and the explorer in the high Alps hears from hour to hour the thunder-like noise with which the huge blocks of granite, loosened from the mountain-tops, crash downwards. At the base of any high cliff you may see a *talus* of sharp-angled stones reaching half up the breast of rock, unless some rapid stream of water or slow-pushing glacier is there to carry them away. Our level fields are or have been covered with lumps of rock, and our soil is full of them, but these are not sharp-edged as if just struck off by a hammer-blow, but they are rounded in all their outlines; the "Tooth of Time" has not ceased to eat away at every angle and corner of these tempting morsels as the teeth of children gnaw at sugar plums. Nor does the work stop here. As they lie out on the pasture or buried in the plow-land, the same invisible tooth nibbles at every point of their surface, roughening and corroding them until they are reduced to dust. Even the sand-grains are ever cut smaller and finer until they dissolve away from our sense of sight or feel, and the long imprisoned potash and lime, the phosphates and the sulphates, are released.

It is the "Tooth of Time" which thus levels mountains and crushes boulders into soil, and it is the same tooth whose incisive workings in the soil reduce the elements of the rocks to the impalpable state of food for the plant. Where circumstances remain the same, these changes prepare the nutriment for plants at a certain regular rate, and the natural strength of the soil is simply the expression of this steady development of plant-food and the corresponding production of vegetable matter.

To turn now to what Mr. Lawes calls the "condition" of the soil. Farmers are in the habit of saying, "This land is in poor condition"—or, "This is good soil, but it is rather run down; it is in poor condition at present." Or, looking over the fields of a neighbor, who has taken a little extra pains, "This is poor land, but he has got it up into good condition." "Condition," then, is artificial or accumulated strength; a thing we cannot depend upon, except as we can depend upon the continuance of the artifice or temporary causes of which it is a result. "Condition" refers to those elements of fertility which are capable of being turned to account in the growth of crops within a limited time. We may have a "condition," which is the result of natural causes, as is illustrated by the manner in which Indian corn is grown in some parts of South America, on land newly cleared from the forest. You know that in tropical latitudes, the year is usually divided into two seasons—the wet and the dry. During the former, abundant rains fall and vegetation grows with wonderful luxuriance. The other half of the year is comparatively dry, and plant-life is inactive. At the close of the rainy season, the planters chop down the timber, the brush, and everything that grows upon the land where they propose to get a crop. When the fallen vegetation is sufficiently dry, they set it on fire, and everything burns completely except the largest trees. When the fire has gone out, toward the beginning of the next rainy season, they have a field destitute of vegetation and coated with the ashes of the forest. There, with the smallest preparation, they plant their corn in the ashes, dropping it where they can, and get a magnificent crop. The second year they put on corn again and get another large crop. The third year they get another crop, and after that, it is cheaper to abandon that field, and to clear another. The first piece grows up to forest, and in six, eight or ten years, perhaps, they can burn it over again. Here, the fertility of the soil after burning is a "condition" which is produced partly by natural means, the growth of the forest, which brings up matters from below, and partly by artificial means, the felling and burning of the forests, restoring those matters to the surface.

"Natural strength" is something which is comparatively unaffected by cropping. Where the soil has great natural strength, you cannot permanently exhaust it; you may get it down to a point where production is unremunerative, you may say your land, once good, is "exhausted," but a skillful farmer will take hold of it, and by the use of some judiciously selected fertilizer, and the application of well-directed labor, he will bring up this exhausted soil in a short time, and make a profitable farm of it. It only needs a little "condition" to reëstablish its good name. "Condition" itself, however, is a thing which is easily run through with. You may take a poor, light soil, and make it productive by the application of manure and by careful tillage, but if you stop there, and undertake to work on that capital, you will find that it deteriorates rapidly. You will have to come down to the natural strength, and if that be small, your crops will correspond.

To illustrate further what "condition" means, take the case of those fields of Mr. Lawes, the natural strength of which was measured by a yield of 16 bushels of wheat, or 20 bushels of barley, or 2600 lbs. of hay, through a number of years. He took a portion of that land and put on it annually, fourteen tons of yard manure, to the acre, and during the nineteen years in which he carried on that process simply, he got 36 bushels of wheat per acre, as the average, some years a little more and some years a little less, and one or two years a good deal less than this quantity, on account of some peculiarity in the season. On another field of the same land, where he put four hundred pounds of ammonia-salts—sulphate of ammonia, I believe, mainly—he also raised annually, 36 bushels of grain. On another field, where he applied fourteen tons of stable dung, he got 48 bushels of barley, on the average, for nineteen years. The annual use of stable manure in this quantity, and the annual addition of a certain number of pounds of salts of ammonia, raised the crop of wheat from

16 bushels to 36 bushels, and kept it steadily at that point for nineteen years ; so that the difference between 16 and 36 bushels, that is, 20 bushels, was the crop which was produced from that field by the use of fourteen tons of stable manure in one case, and four hundred pounds of salts of ammonia in another. It was the stable manure and ammonia salts in those quantities which improved the "condition" of the land by the equivalent of 20 bushels of wheat.

We understand, then, that there is a natural quality in the soil which we cannot easily bring below a certain limit; and there is a "condition," an artificial, temporary or adventitious fertility, which we can easily increase and easily exhaust.

There are many circumstances which necessitate or justify a *Rotation of Crops*. I will not attempt to enumerate them all. Differences of soil and climate, the quantity of fertilizers accessible, the demand in the markets, ease of transportation, politicians, when they make fluctuating tariffs, weeds which come to infest the fields, insects even, may make it advisable to alternate our crops. It may not be uninstructive to go back in history and give a sketch of the gradual development of the practice of Rotation.

The earliest husbandry was simply pasturage. When the people of temperate climates found they could not support themselves by killing wild animals and gathering fruits, the natural produce of the country, they began to tame animals and keep herds of cattle, sheep, etc.; and you know that on the vast plains of Asia and South America, this sort of pastoral husbandry is still the only one known. As population became more dense, and land more valuable, people crowded each other, and there was not room enough to roam about at will and settle upon pasture wherever it could be found, unless, for a change, the people fell to fighting, and partially killed each other off, thus leaving land enough for the survivors. When civilization began, it became necessary to cultivate forage crops, or, at least, to take some care of the natural meadows. The next step was to assist these natural resources by growing some grain, and people began to break up a little land, and cultivate wheat and the various grain crops ; afterwards, attention was given to root crops. It may not be possible now to show how these steps of progress have taken place in any given locality ; but this is a general history of the development of husbandry all over the world, wherever it has attained any perfection. Farmers have always carried on their operations in a very simple way, at first, for many generations. On the continent of Europe, where we have the most authentic accounts, they plowed a small portion of land, and grew some grain upon it—barley, wheat, or rye—putting in the same crop as long as they could make it grow and get back a little more than the seed. They were content with much poorer crops than we regard profitable. They used the same land for several years, until its "condition" was gone, or until it was no longer remunerative, and then they left it and plowed up another piece. The old field would grow up to grass, and after a number of years they would come round to it again and sow it to grain. That was the earliest and simplest plan of conducting farming. In those days, there was but little skill or thought bestowed upon agriculture. The intelligence of the world was mainly given to government, war, and things of that sort. The peasant was a man who knew nothing except to grub the ground, and he did it year after year, generation after generation, as his father had done it before him, with little idea of change or improvement. In the neighborhood of cities, where there was better pay for this kind of work, and more intelligence concentrated upon it, of course it began to be found that a little rotation was a good thing. Where rotation started, we do not know. In some books it is stated that it was invented in England. But if you will read Virgil and Varro, you will find that the Romans were well acquainted with rotation, although Virgil, who was a poet, only mentions it in an incidental way. Leaving the results of modern science out of the account, there is not much in our agricultural practice that you will not find described in Latin books. Those people, who developed a magnificent civilization which they forced upon the unwilling savages of Britain and the north of Europe, who were our ancestors, did a great deal of good work in the way of agriculture, considering the facilities at their command.

After a time, there came into use in Europe a system which was practised there extensively in the ninth century, and is still followed in some parts of the continent. It was known as the three-course system of rotation. For centuries this system was carried on where the farmer had large pasturage, and little plow-land. The first year, the plow-land was left in fallow, but in the autumn was prepared, by what manure and rough tillage could be given it, for a sowing of winter grain, mostly rye, which occupied the second year. The third year the ground was put in summer grain which completed the shift. Then the farmer began again with a year of fallow and manure, a year of winter grain, a year of summer grain; and so he went on—three years—three years—three years—indefinitely. I suppose there are districts in Europe that could be pointed out where this practice has prevailed for nearly a thousand years, and it was early imported into this country. It was the subject of legislation in the time of Charlemagne. Some historians think that this monarch decreed the adoption of the three years shift; others think that he merely recommended it, as an improvement on what had been previously the custom among the less advanced peasants, of simply using the plow for a succession of years, without any rest for the land. In the vicinity of cities, where the plowed land increased in proportion to the quantity of pasture, and the supply of dung became inadequate to manure it sufficiently, so that the manure and fallow together could not make two good grain crops, forage plants—grass, clover, or roots—were introduced into the course; and in that way, a great variety of rotations came into use.

In England, there has been practiced, over a considerable part of the country, what is known as "the Norfolk rotation"—a four years shift. You have all read of it, doubtless; The first year, clover and mixed grass seed; the second year, wheat; the third year, turnips or rutabagas; the fourth year barley; and then the same course again, with, perhaps a little variation; perhaps the land was kept two years in clover and grass. In Dorset, Wilts, Essex, Herts, Suffolk, and Cambridge, in England, ten or fifteen years ago, this course was in almost universal use. I speak of this matter to bring up one point. There are certain advantages in rotation which being observed or conceived led to its adoption. But farmers, especially in long-settled countries like England, are apt, having once accustomed themselves to a routine, to adhere to it long after its advantages cease to exist. This is illustrated by the fact that Norfolk, which gave England the four-course system just described, began more than thirty years ago to amend its own improvements. The command of concentrated and artificial fertilizers which admit of easy application at any point in a rotation, led some of the best farmers there to introduce another grain crop—oats—into the shift, making a five years course, and according to Caird, in his "English Agriculture," "on a large farm where this system has supplanted the four years course the average produce of all the grain crops has increased in ten years between thirty and forty per cent.; the extent of land on this farm in wheat, having during that period annually increased till it has now (1850–51) become one-third greater than it was then."

In Great Britain, Germany, and other European countries, you will find in many localities very complicated systems of rotation. I saw the other day, in a book which I was looking into for some statistics, a long and curious calculation, showing the various materials—lime, potash, phosphoric acid, &c.—taken off and put on a farm, which was divided into ten equal fields, and each of these fields, went through successively with the same ten years' rotation; which was: 1, Summer Fallow, manured. 2, Winter Coleseed. 3, Wheat and Rye. 4, Legumes, manured. 5, Rye. 6, Potatoes. 7, Clover and grass. 8, Clover hay. 9, Pasture till 1st July, then summer fallow. 10, Rye and Wheat, "half manured."

It is a great advantage, in the conduct of a large estate of four or five hundred acres, to have the whole system of cropping made up beforehand, so that the men can tell just what is to be done from year to year. The management of farm labor is simplified by this arrangement. That is one of the reasons why such complicated rotations are adopted.

It should be well borne in mind that while there are circumstances in which rotation is extremely advantageous there are other circumstances under which it is comparatively unimportant. Certain conditions make rotation necessary, and others make it unnecessary. There are two kinds of agriculture, which have been defined as "extensive" and "intensive." The "extensive" is where land is cheap, and where capital, labor and manure are scarce. There the farmer must go over a great deal of surface, and depend chiefly upon the natural resources of his farm,—getting out of it what he can, "by hook or by crook." "Intensive" agriculture is where the circumstances are such that the farmer uses a comparatively small quantity of land and a large amount of capital, is able to get fertilizers in abundance, and sells his crop quickly and at a good price. He puts a great deal more into the soil and gets a great deal more from it than his "extensive" brother. He works in a more *intense* way. That is, his labor, instead of being spread over two hundred acres, is concentrated on fifty, and he is able to make his fifty acres more profitable than the other farmer can make his two hundred. In "extensive" agriculture we usually have a large quantity of pasture and keep a good many cattle, for we have to depend largely on their manure. We have to sell off a large share of the crops, which remove valuable materials from the soil, and we cannot or do not buy fertilizers to make good the deficiency. In the other case, the farmer can put in as many fertilizers as he chooses to pay for. He is able to buy them, and he finds his profit in using them. In "extensive" agriculture, which is made necessary by circumstances, the farmer must depend largely upon rotation; he must bring it into successful use. As he succeeds or fails to do this he carries on a paying or a losing business. In "intensive" agriculture the farmer is largely independent of this necessity; he can rotate or not, very much as he chooses. Rotation is not indispensable to his success. That is, the advantages that come from rotation are not so great as the other advantages which the farmer has at command by the use of plenty of money, plenty of fertilizers, by his nearness to market, and high prices.

Now, I wish to state some of those principles which should govern us in rotation, so far as this depends on what we may call the chemistry of the crop and the soil. So far as the feeding power of the soil is concerned, the special requirements of the crop should determine the rotation. Of course there are other conditions to be taken into account in practice. Winter wheat, for example, cannot follow itself beyond a certain length of time, even if the soil will allow, because the land ordinarily becomes foul with weeds; and it is better to alternate with some crop which will enable us to destroy the weeds by hoeing or which will choke them out directly. There are many conditions which influence rotation that I do not propose to speak of, but I shall confine myself to that part of the subject which is involved in the feeding of the plant. The broadest principle of rotation is to alternate grain crops and forage crops. That is, to follow plants having a short and rapid growth and which produce seed, by plants of a longer period of growth which are not allowed to ripen seed, but are harvested for their large amount of foliage.

Plants, like animals, have different ways of feeding. If you were to undertake to keep a dairy of hyenas you would have to provide a different food from that which you give to cows. If you should choose the giraffe as a domestic animal you would find that its habits of feeding are adapted to very different circumstances from those of your common pastures. The natural food of the giraffe is mainly the buds and twigs of a kind of locust tree that grows in the African wilderness, and the long fore-legs and long neck of the animal are shaped for browsing among the tops of those trees. The different classes of plants have peculiarities in their feeding arrangements which are as marked and striking as these differences in animals.

On comparing together the roots of our ordinary crops, we find that when they grow under similar circumstances there is a great difference in the depth to which they extend, a great difference in the degree in which they branch, and a great difference in the absolute quantity of roots. Unfortunately, we have not enough really satisfactory observations on these points to serve us in any very extended comparison, it being rather troublesome to make accurate observations of the roots of plants when they have once penetrated the soil. A few brief paragraphs in my book "How Crops Grow," embrace pretty nearly all we know about this matter of the growth of roots. As to depth, Schubart has made the most satisfactory observations we possess on the roots of several important crops growing in the field. He separated them from the soil by the following expedient: an excavation was made in the field to the depth of six feet, and a stream of water was directed against the vertical wall until it was washed away, so that the roots of the plants growing in it were laid bare. The roots thus exposed in a field of rye, in one of beans, and in a bed of garden peas presented the appearance of a mat or felt of white fibers to a depth of about four feet from the surface of the ground. Roots of winter wheat were observed as deep as seven feet in a light sub soil, forty-seven days after sowing. The depth of the roots of winter wheat, winter rye, and winter coleseed, as well as of clover, was three to four feet." Schubart further collected and weighed the roots of wheat, rye, and peas, and ascertained their proportion of the entire plant Hellriegel has also published some observations on the extent of the roots of barley and oats.

We have a few other observations of this sort, but not enough to enable us to determine the comparative quantity and depth of the roots of our cultivated plants with any accuracy. It will not do to draw conclusions as to the length of roots from such observations as these, made, it would appear, in different soils, differently treated and fertilized, because other observations show that the development of the root depends not exclusively upon any impulse which it receives from the plant (that is, the root must not necessarily weigh so much or measure so much), but depends also upon the nature of the soil. Where this is rich the roots tend to remain; they branch and ramify through all the pores of a small bulk of earth. Where this is poor they stretch off and are sparsely distributed through a larger space. Where they find plenty of food they grow and multiply upon it; where nourishment is lacking they seem to go in search of it. All observations must therefore be comparative. We know, however, in a general way, that the development of roots is different in different classes of plants. We know that clover has a much deeper system of roots than our ordinary grains. We know that where the soil is rich at the surface, and where it is adapted naturally, by its mechanical condition to the growth of wheat, for example, the large proportion of wheat roots are found within a rather narrow space. On the fertile plains surrounding the town of Leipzig, the principal commercial city of Saxony, situated in one of the richest agricultural regions of Germany, I have seen the same kind of plow going back and forth, which you will find pictured in the classical dictionaries as used by the Romans. If you should take a shingle five inches wide and sharpen it to a blunt point, you would have about the shape of the plowshare I refer to.

This wooden instrument, shod with thin iron, did not turn a furrow; it simply made a groove about four inches deep from crest to base, stirring and mixing the soil thoroughly, however, to that extent. This was the only kind of plowing I saw practised on these fields in 1854, and yet splendid crops were harvested from them. The soil was doubtless naturally of excellent texture and allowed a due penetration of the roots. But the fact remains that with such tillage all fertilizing applications must remain near the surface, and this makes evident that the roots of our grains need not go down to any very great depth. If the soil has nourishment and moisture for them, six or eight inches of earth will answer for the support of a crop. A foot will, in a majority of cases where the soil is of good quality, contain the bulk of the roots of the wheat crop. They may go deeper, as Schubart observed, but only because they must descend in order to find food or drink. It has been shown by experiment that roots develop in poor soil in the vicinity of any enriching material; so that we cannot say, because Indian-corn roots have been traced for twenty feet in a sand-bank, that it is the habit of the maize plant to send out roots twenty feet long. The length depends upon the soil rather more than upon the plant.

It is greatly to be desired that our knowledge of the relative development of the roots of our various crops should be completed. The roots are in one sense the most important part of the plant. We cannot influence a field crop, except through the roots. We do not manure the tops, or operate upon them in any way. All our efforts to promote growth must be directed to the root, and yet we do not know with precision what is the extent and depth of the roots of the wheat plant, for example, as compared with the roots of any other plant. We simply know that some plants have more and longer roots than others; that clover, for instance, is deeper rooted than wheat.

Some important contributions to our knowledge of this subject have been made quite recently, and I have placed upon the blackboard some figures obtained by chemical analysis of the residues of certain crops; i. e., the stubble, and the roots down to the depth of ten inches. At Proskau, in Prussia, there is a Government Agricultural School, and Dr. Weiske, one of the chemists connected with that school, a year ago last summer, measured off certain plots of land, several yards in dimensions, and carefully excavated the soil to the depth of ten inches and with extreme pains dug out all the roots he could get in that depth of soil. These he dried, weighed, and analysed, and these figures show the average of his results, calculated in pounds upon the surface of an acre. Unfortunately, he did not state anything about the quantity of the crops; but from the fact of their growing at Proskau, where the soil has long been under cultivation, it is to be presumed that these crops were good.

Composition of Roots and Stubble—lbs. per acre.

	Dry veg matter.	Nitrogen.	Lime.	Magnesia.	Potash	Soda.	Sul. acid.	Phos. acid.
Rye	3400	62	69	14	30	40	12	24
Barley	1515	22	40	5	9	3	5	11
Oats	2200	25	81	12	24	17	8	28
Wheat	2240	22	72	10	17	11	7	11
Red Clover	6580	180	246	46	77	19	24	71
Buckwheat	1630	45	75	7	9	4	6	10
Pea	2400	53	68	11	11	7	9	14
Lupine	2800	58	76	12	16	3	7	13

The first column gives the amount of vegetable matter which was contained in the roots and stubble. We are not informed what the height of the stubble was; probably it was rather short, as straw is too valuable in most parts of Prussia to be left on the ground. These figures were obtained to throw light on what happens under the circumstances that prevail in the culture at Proskau. We want a similar work done to throw light on what happens under our circumstances, and this work should be repeated several years, so that we shall arrive at average figures that can be fully depended upon. Referring to the table, you have of rye stubble and roots, 3400 lbs.; of barley, 1515 lbs.; of oats, 2200 lbs.; of wheat, 2240 lbs., of red clover, 6580 lbs.; of buckwheat, 1630 lbs.; of peas, 2400 lbs.; of lupine, 2800 lbs.

You see at once the bearing of these figures. You see that when you have got your clover hay off the field, there remains, within ten inches of the surface, twice as much vegetable matter as is necessary to go into the next rye crop, and three times as much as is necessary to go into the next wheat crop. That helps to explain why clover is a good preparation for these crops. Look at the column headed "Nitrogen." In rye, we have 62; in wheat, 22; in clover, 180 lbs. Take lime. In rye, 69; in clover, 246; and so on. What I want to show mainly by this table is expressed in the first column of figures—the amount of vegetable matter remaining in the roots.

Here we have another set of figures which refer somewhat in detail to two of our standard crops—Rye and Clover.

	Roots.	Top	Roots.	Ratio of Root to Top.
	av. length.	weight.	weight.	
Rye, before heading..........	6 inches.	50	30	10: 17
" headed..................	8 "	106	23	10: 45
" in bloom..................	8 "	143	24	10: 59
" ripe..................	8 "	253	19	10: 136
Clover, before bud............	18 "	56	35	10: 16
" in bud..................	16 "	94	50	10: 19
" in blossom............	14½ "	106	45	10: 23
" ripe..................	15 "	147	99	10: 15

In this experiment, due to Heiden, a mass of soil one foot wide, five feet long, and four feet in depth, was enclosed in boards, then lifted out and the roots removed by careful picking and washing. The average length of the roots was noted, and the total weight of roots and tops ascertained. This was done, as the table shows, at several different periods of growth.

You see from the second column that the roots of rye at the time of heading had an average length of eight inches, and did not gain anything beyond that. In the clover, at the time of budding, their length was eighteen inches ; in bud, sixteen inches. That looks like going back ; but you must remember that the roots measured in the one case were not the same as those measured in the other, but were from another plot of ground. In blossom, they were fourteen and one-half inches ; when ripe, fifteen inches. The grand result is simply this : that wherever rye roots were eight inches, clover roots were twice that length ; and this in soils which I suppose were quite similar in character. That is a piece of information of great value.

Mr. Lyman. I have heard old men express the opinion that the principal benefit of clover arose from the large amount of root which is left in the ground, even after it is plowed under. I suppose that to be the fact.

Prof. Johnson. Undoubtedly so.

Mr. Lyman. If we grow a plant which has a very small root, of course the vegetable matter to supply the succeeding crop is comparatively small.

Prof. Johnson. I have heard old farmers, and young ones too, say that they would give more for that part of the clover crop below ground than for the part above ground. You have here an accurate setting forth of the proportions. Look at the figures which represent the weight of the top and of the roots. You see there is a rapid increase in the amount of top in the rye plant—from fifty up to two hundred and fifty ; but you observe that the absolute amount of roots diminishes. Whether that is due to any actual decay of the root, or whether to the fact that each result came from a different plot of ground, or because of different care in extricating the roots from the soil, we have no information. It may be due to the fact that there was less development of root in one place than in another.

Question. Might it not be owing to an absorption of the root into the top?

Prof. Johnson. It may be. I had supposed that old roots would have the greater absolute weight. If these figures are correct, they are interpreted by your suggestion; which is supported by some observations that have been made regarding the mode of growth of the underground organs.

In the next column of figures we have the ratio of root to top. The root is taken as a fixed quantity, ten. In the case of rye we have, in the first place, 10:17 ; then 10:45, 10:59, 10:136. In the case of clover, 10:16, 10:19, 10:23, and lastly 10:15, which may be an error of observation.

Here you have another capital fact brought out—the greater relative quantity of roots in the ripe clover plant. You have half as much roots as top, in the clover plant, whereas you have almost fourteen times as much top as roots in the ripe rye plant. These plants, then, are very different in the way in which they act upon the soil, and therefore in the way in which they leave the soil. When you reap rye close to the ground you take away one hundred and thirty-six out of one hundred and forty-six pounds, and thus leave very little in the soil. When you cut clover you may leave half as much in the ground as you take off. That is a point of great importance in considering their relative bearing upon the question of exhaustion, and shows that you may expect a very different result from leaving clover roots and clover stubble in the soil than from the roots and stubble of rye.

Mr. Lyman. If we cut the rye low we take very nearly the whole of the plant off from the land, and it requires five times as much put back to bring the rye field up to an equality with the clover field, as it stands cut, with the roots in the ground. Therefore we cannot look for a crop that would be equal to what clover would bring us unless we restore this ratio.

Prof. Johnson. You are right.

Mr. Lyman. What is the difference if we plow the two crops under?

Prof. Johnson. The total weight of your rye crop is 272; the total weight of clover is 246; so that in this case the clover has a somewhat less absolute mass of vegetable matter.

Question. There are two or three other important questions. We want to know if the plants take from the soil a certain amount of manurial constituents of saline matter?

Prof. Johnson. They do, of course. That is one of the first principles of agriculture.

Question. Do these roots left in the soil create any thing?

Prof. Johnson. Nothing whatever.

Question. Then they take from the soil manures to grow them, the same as what you take off?

Prof. Johnson. Certainly. They take manures or equivalent nutritive matters.

Question. It took all these manurial matters to make this crop, and if you carry it off you carry away those manurial matters; whatever you leave restores what it took to make it, and no more?

PROF. JOHNSON. Yes.

MR. GOULD. Ought it not to be said that in its previous condition the manurial matter was in an insoluble condition, not adapted to the plant; whereas, what you leave is in a soluble condition, and assimilable?

PROF. JOHNSON. During the growth of a crop, plant-food in the soil does pass from an insoluble into a soluble form, and being taken up by the crop remains in that part of the crop left in the field in a state adapted for immediate use. The deep rooted clover also, in this case, brings up, from an average depth of sixteen inches, matter which remains in part within the range of shorter-rooted grain crops.

SECOND LECTURE.

I was speaking yesterday on the peculiarities of plants which enable them to act differently on the stores of nutriment which may be supplied to them in the soil. I spoke of the differences in the absolute quantity of roots which various plants put out into the soil and also of the differences in the depth of roots; and gave some illustrations on those points. I propose to speak this morning of the different structure of the foliage of plants.

We know with absolute certainty that a large share of the feeding of the plant is done through the leaves. We cannot certainly tell how much goes on through the leaves and how much through the roots, in highly manured and very rich soil, but experiments have demonstrated that all the carbon of the plant (which is about fifty per cent. of the weight of the dry plant) may come from the atmosphere; it is not necessary that any of it should come from the soil. The seeds of various agricultural plants—Indian corn, oats, barley, etc.—have yielded a larger increase under artificial circumstances, where the roots had no carbon whatever at their disposal, than is ever produced under field culture. It is a well known fact of agricultural practice, that soils which are nearly destitute of vegetable matter, and therefore have no considerable source of carbon in them, will produce large crops. Some very sandy soils, containing but little carbon, may be made to produce heavy crops by irrigation. Crops are also raised on soils free from organic matter, or from sources of carbon, by the aid of fertilizers which themselves furnish nothing of that sort. Carbon, then, which makes up half of the weight of the dry plant, is always chiefly supplied by the atmosphere and may be supplied by the atmosphere exclusively. It is not necessary that it should be in the soil.

The nitrogen of the plant, which forms indeed a small proportion—two per cent. perhaps, as an average—of the dry plant, is an important ingredient, for without it vegetation cannot exist.

Some crops have the power of gathering nitrogen without any difficulty; and they not only supply themselves with it but they even cause its accumulation in the soil. There are other crops which are dependent upon artificial supplies of nitrogen, unless the soil be naturally very rich in this element—crops which, if we undertake to raise them continuously on the same field, presently begin to show that they lack something, while if we apply nitrogenous compounds as fertilizers, the growth is ensured. We do not know in full detail how plants acquire a sufficient supply of nitrogen from the atmosphere, but we conclude, with great probability, from the results of practice, that different plants draw on the natural supplies of nitrogen in a different way.

Let us consider how the structure and habits of two typical crops, wheat and clover, stand in relation to their power of assimilating atmospheric nourishment. In respect of foliage we cannot certainly say that the wheat plant or the wheat crop when full grown, exposes a less surface to the air than full grown clover, but we know that the leaves of wheat, as of all our cereals, maintain their green color and succulence during a much shorter time than is true of clover. In case of winter grain the period of leaf-activity usually begins in October and ends shortly after heading out, in June, some weeks before the crop is harvested. Clover, on the other hand, is not arrested in its growth by any crisis of seed-production, but, when cut for hay, sends up new shoots, unfolds new leaves, and shortly yields an aftermath, its growth going on uninterruptedly all the summer and late into autumn, until checked by heavy frosts.

That the actual leaf surface of the clover crop, taking its duration into account, is much greater than that of the wheat crop, I do not doubt, because although the total weight of the harvested crops is, on the average, not very unlike when clover is cut for hay,*

* Corresponding crops are, according to	*Winter Wheat.* Lbs. per acre.	*Clover.* Lbs. per acre.
E. Wolff	6,230	5,340
Lippe-Weisenfeld	5,760	6,330
Rohde	4,270 to 6,400	3,480 to 5,230

the total amount of vegetable matter organized is much greater in case of clover than in that of wheat, as appears from the table on page 195, where clover roots are seen to constitute two-fifths (equal to six-fifteenths) of the entire plant, while the roots of rye, which doubtless do not differ much from those of wheat, are but one-fifteenth of the entire plant.

You see that the foliage and mode of life of these two classes of plants are very different for the purposes of gathering food from the atmosphere, and they must therefore be expected to leave the soil in a very different condition, because their roots remain there, and the material of those roots is gathered very largely from the atmosphere; so that when we raise a grain crop we leave in the soil a small quantity of material taken from the air, but when we cultivate a deep-rooted plant which grows the season through, we leave a large amount of atmospheric matter in the soil.

Again, in ordinary culture some plants are permitted and required to reach a crisis of growth which others are not allowed to attain. This crisis is seed-production.

Our meadow grasses are of the same botanical order as the cereal grains; which means that all these plants are of the same great race and closely resemble each other in their most characteristic features. The noble wheat and the scoundrel quack are, in fact, brothers of the same family, both being of the genus Triticum. The latter is sometimes termed wheat-grass, as if in allusion to this brotherhood. There are two other grasses, vagabond members of the wheat family, living obscurely in this country. Barley and the oat have each two brothers of low degree—worthless grasses, living on salt or sandy shores, or on rocky hills, and unknown to the cultivator.

If wheat, instead of being allowed to ripen its seed, as is our universal practice, should be mown or fed off just before heading out, it would throw out new shoots and continue to grow the summer and autumn through, would come on the second year and deport itself as a perennial; would in fact, become grass in the usual sense of that word. Wheat is probably not hardy enough to make a good substitute for Timothy, but it is sufficiently so to justify our statement.

The reason why wheat under our culture is an annual is that the process of seeding exhausts the plant, and as a consequence it dies out naturally. It is the universal opinion among farmers that the meadow grasses are weakened very much by being allowed to go to seed. I have myself observed that where Timothy seed was raised the crop of grass the next year was very small, although the soil was excellent. The plants had suffered severely from being allowed to go to seed, notwithstanding Timothy has a bulb at the root, which should fortify it considerably against this strain, and a small seed, which renders the exhaustion less than is the case with our bread grains. The production of seed is thus a critical thing for the life of the plant.

Let us consider again for a moment, the mode of growth of our cereal grains. Sown in the spring, the plant comes up and grows, slowly at first but with increasing vigor, up to the time of "heading out"—a period of two months. Then the growth acquires its greatest intensity. It heads out, blossoms, and the seeds begin to form and ripen, and this whole process of seed production requires but about a month when the weather is favorable for its completion.

In actual trials with the oat plant, it has been found by Bretschneider and Arendt that a large share of the growth of the overground part of the plant occurs at the time of heading and blossom. Thus the former observed that out of 6,886 lbs. of the dry acreage yield of the oat, 3,099 lbs., or three-sevenths of the crop, were produced from June 19th to July 8th, i. e., in nineteen days; the total period of growth being one hundred and six days. Arendt found that three-eighths of the total dry produce of the oat grew in twelve days, 18th to 30th of June, the period of heading and bloom, and during the twenty-two days between June 18th and July 10th, nearly three-fifths of the growth took place. [How Crops Grow, p. 205, et seq.]

Before the seed is ripe the lower leaves begin to turn yellow, and show that their activity is diminishing or has ceased altogether; and the ripening of the plant takes place to a great extent, by the removal of matters which have been previously stored up in the stem, leaves and roots, into the seed. You may cut any of the grains at the root when the kernel is in the milk, and the seed will still ripen, and although, if you cut it too early, the kernel will shrink, it will be perfect in its parts and serviceable as seed grain.

It thus appears that the cereal plant grows from the soil and atmosphere until the seed arrives at a certain stage of development, then the activity of the roots and foliage decreases, the acquisition of food from external sources gradually diminishes, until it ceases altogether, the plant concentrates all its energies upon the seed, all its juices flow thither, and the roots, as well as the leaf and stem, are exhausted in the effort. The seed grows, not directly at the expense of the soil and atmosphere, as the plant has done, but at the expense of the plant itself. It is, indeed, true in all cases that the seed is formed from the plant itself; but there are plants which, while feeding the seed from themselves, are still active in gathering food from external sources; and there are other plants, like the cereals, which do not, at the same time that they are elaborating seed, gather food from outside sufficiently to maintain their individual life.

In contrast with the cereals, look again at the clover plant. This starts from a seed, grows vigorously, buds, blossoms, forms seed, and the seed ripens; but there is not that uniformity in the time of budding, flowering and ripening of clover that is noticed with wheat. In a field of wheat, if the catch has been good and everything as it should be, when one head is ripe all the heads in the field, practically, are ripe. Every stem heads out, blossoms and ripens about the same time. In the case of clover, you have a much greater diversity, especially when the soil is rich and the plant grows thriftily. If the soil is poor, you will have a nearer approach to uniformity. When yon are getting a large amount of foliage, you will find on the same plant ripe heads and buds. If you pick off the ripe heads the plant will still keep throwing out new buds. The process of flowering and ripening is a continuous one, and it does not affect the vigor of the plant to nearly the degree that happens to wheat. During all the period of the growth of the clover plant until the seeds are ripe, the roots are still active and the foliage still vigorous. The quantity of seed produced by the clover plant is much less, relatively to the weight of the plant, than the quantity of seed produced by the wheat plant, and the energies of the clover plant are relatively less occupied in ripening the seed than is the case with wheat.

You would therefore expect these very different plants to have a very different function in the rotation of crops.

An annual plant, again, one that is sown in the spring, or in the fall, perhaps, and is harvested within a year, other things being equal, will be different in its relation to the soil, from a biennial plant, which lives two years, or a perennial plant, which keeps along indefinitely. Now, our ordinary grains are annuals, as we cultivate them; the clover plant is a biennial more nearly than any thing else. When it grows vigorously, it is usually spent in about the second year. We may not call it properly a biennial in a botanical sense, but in an agricultural sense it is a two-year old plant. We cannot depend, ordinarily, upon having much clover from the sowing of 1872, later than 1874, except as the result of self-seeding. Our natural grasses are perennial; they live, we do not definitely know how long. Their mode of propagation, besides from seed, is by root-suckers; the old root dies, but in the meantime it has propagated a numerous family, which succeeds it, and the race is kept up without trouble of sowing any seed or giving any attention to the matter at all. These distinctions make an obvious difference in the relation of the three kinds of plants to the subject of rotation of crops.

We have thus considered the plant itself, its roots, foliage, and manner of growth; now let us look more closely at what remains when the crop is removed. This matter came up incidentally, and a little out of order, yesterday, as I referred to the tables on the board. When I raise a crop and harvest it, I leave, of course, the roots in the soil, I leave the stubble on the surface. If each crop were taken out of the soil completely, root as well as branch, so that nothing of it were left in the field, the effect of any crop upon the soil would be measured simply by what we took away. But we leave a great deal in the soil. Ever since farming has been practiced, the value of what is left on and in the soil has been, to some extent, appeciated, but we have not known accurately the quantities or the relative proportion of those substances. We have known that clover leaves much more than wheat, but the precise relation we have not understood as we understand it now, and we do not understand it now as we ought to and as we shall understand it after further investigation. I referred yesterday to the table of Dr. Weiske, of Proskau, which gives the ingredients of the stubble and roots of various crops remaining on and in an acre of land after harvest. (See page 194.) This is the first, or nearly the first, exact experiment of the kind that has ever been made, and these observations must be repeated here and there, on different soils, before we can get entirely trustworthy data, to enable us to make a satisfactory calculation. Still, these first results will serve a very good purpose.

In the case of rye, for instance, you have 3400 lbs. of dry vegetable matter remaining in the soil to the acre. Ordinary rye straw contains some fourteen per cent. of moisture. The vegetable matter in the table is considered free from that variable amount of water which is always present in the plant, unless it has been dried at a temperature of 212°. In the case of barley, we have about half as much as in rye—1515 lbs.; in oats, 2200 lbs.; in red clover, 6580 lbs.; in buckwheat, 1630 lbs., and so on. You see that in the amount of matter remaining in the soil, the clover crop far surpasses any other. If it were a fact that the organic vegetable matter of one crop remaining in the soil, supplies the food for the following crop, you see that what remains in the soil from a good clover crop would furnish the material for about three oat or wheat crops. It is not the fact, that the vegetable matter from one crop acts as such directly to support the succeeding crop; but it is a fact that some of the ingredients of the vegetable matter are of use to the succeeding crop, and in some places must be supplied, in order that the succeeding crop may grow. That is especially true of nitrogen. We have in the clover field a residue of 180 lbs. of nitrogen; in rye, we have 62 lbs.; in oats, 25 lbs.; in some other crops we have a larger quantity; you see how the figures run. (p. 194.) This nitrogen came partly from the atmosphere by the foliage, and partly from the soil taken up by the roots. The clover residues contain three times as much nitrogen as those of rye and 7 to 8 times as much as those of wheat, barley, or oats. We have 246 lbs. of lime remaining in the residue of clover—three times as much as in that of any other crop. This, of course, came from the soil. All these shallow-rooted plants, when they succeed clover, find ready to their hand, in the upper eight or ten inches of the soil, material brought up by the previous clover crop from twice that depth, or more. The clover not only furnishes to the succeeding crop the mineral matters that were in the upper portion of the soil, but it takes them up from a depth where they would not be directly accessible to other plants, and puts them where they are wanted. The clover plant leaves in the surface soil, as the table shows, a much larger quantity of all those materials than any other crop. The only apparent exception is that of soda, and soda is a substance which is not, as the best information we have upon the subject tends to show, essential to any cultivated plant. We have of magnesia, 46 lbs. in clover, against 14 in rye. Of potash, 77 lbs. in clover, against 30 lbs. in rye. Of sulphuric acid, we have 24 lbs. in the case of clover, against 12 in the case of rye. Of phosphoric acid, which is, on the whole, the most precious mineral substance in the soil, because it is the most costly when we have to supply it by purchase to our fields, we have 71 lbs. in the case of clover, against 24 lbs. in the case of rye.

Now, the point comes in here again to which I referred yesterday; namely, the ratio of root to top and of foliage to seed. In the rye crop, when ripe, I have nearly 14-15ths of the vegetable matter above ground, (and the same is probably true of all the grains,) and when I get off my crop, I get off 14-15ths of the whole. (See table, page 195.) Fourteen-fifteenths of the vegetable matter is carried away in my grain and chaff and straw, if I cut close to the ground. In the observations whose results are given in this table, there was no stubble. If I leave stubble on the ground, I reduce the proportion of removed substances. When I take off the clover plant close to the ground, for every fifteen pounds, I take off, I leave ten pounds in the soil; whereas, in the case of rye, for every fourteen pounds I take off, I leave only one in the soil. That is a great difference. When I cut the grain crop low, I take it nearly all away; but when I mow off my clover hay, I leave two-thirds as much as I take. The assertion which has been made, that the part of the clover crop remaining in the soil is as good as that which goes into the barn, finds its justification in these figures. They show with precision and in detail, what observing farmers have long vaguely known.

The reason of the truth of the old saying, that if you can start clover, you can grow anything, is thus apparent; and we know further, from observation, that the habits of the clover plant are such that we can often start on a course of improving the soil with that plant when we could not with what are commonly called our more valuable cereal grains. Some years ago, I was in East Windsor, in this State, and I was shown two fields, separated by a fence, one of which you would call perfectly barren and useless; on the other side was a growth of red clover a foot high, which I was told by Mr. S. W. Bartlett of that place, had been brought up within twelve months by the application of a bushel or two of plaster to the acre and turning in some sheep. I believe there was no seed sown upon the field; the plaster alone brought the clover in. The plants were there in an undeveloped state, and I suppose the plaster, by furnishing sulphuric acid and lime, both of which are large ingredients in clover, supplied the two things, or the one thing, it may have been, which was necessary in order to give the clover a chance to live. On the other side of the fence, one or both of these substances was probably not present in sufficient quantity to develop the starveling clover plants and to start their deep roots into the soil; but with that start, there is no reason why that land could not be made agriculturally profitable. It could never be converted into such soil as the Genesee region or a western prairie, because the original constitution or strength was not there; but it was a soil which might, by judicious management, be improved, and brought up to a reasonable degree of fertility. It would be hopeless to undertake to reclaim any such field as that by the use of wheat grown for seed; it might be done by rye cut green, but it would be a much slower process than by clover. The fields in that neighborhood had been cropped with rye beyond the memory of the oldest inhabitant. The plan had been to take off a crop of rye once in three years, getting about nine bushels to the acre, leaving the soil to itself the other two years. Three years of weathering, and atmospheric action on that soil, put it into a condition to make a rye crop of nine bushels to the acre. If that rye were turned under, instead of being cut off, so as to make the soil more retentive of moisture, it could be brought up; but the clover plant is adapted to do that thing much more rapidly than the rye plant.

We now come to an important question, viz., the possibility of continuing the same crop on a field indefinitely. Should you ask me if that can be done, I could answer both "Yes" and "No," and be equally right in each reply. There are quite a number of agricultural questions that can be answered in just that way. Instances can be brought up in which almost any crop has been grown continuously, without interruption, or with no more interruption than the nature of the plant requires, for a term of years —in many cases for a long period of time. I mentioned yesterday the experience of Mr, Lawes, who has grown wheat twenty-seven years in succession on the same soil, and, without any manure has got an average crop of 16 bnshels to the acre; while with manure he has averaged 36 bushels to the acre. We know that tobacco can be raised year after year on the same soil, with the help of manure and thorough tillage. The same is true of onions, buckwheat, rye, in fact, I do not know of any crop that may not be grown in that way. And yet, "circumstances alter cases." Clover will not grow on this or that farm, or on this or that field, with such and such culture, to advantage, unless an interval is allowed between the crops. In some sections, you cannot grow rye without interruption, and anybody can find cases in which none of our crops will succeed, for several years in succession, or even succeed at all. These differences depend chiefly upon the soil, not upon the plant, and it is dangerous to make any sweeping or absolute general statement where so variable a thing as the soil is concerned.

Clover is a plant which has often given farmers a great deal of trouble to grow year after year, or to cultivate in quick succession. It is generally admitted as a rule of practice that there is, ordinarily, no profit in attempting to grow wheat two years, or, at the furthest, three years in succession on the same soil. It is admitted to be a good plan generally not to grow any crop more than two or three years in succession. Even our natural grasses are included in this rule, although in some particular localities they do well indefinitely. We have indeed natural meadows and pastures which are as old as the memory of man, and just as good now, for aught that can be seen, as they ever were. But even in the case of natural pastures we know that "circumstances alter cases." Each farm, perhaps, may have some low-lying piece of moist land occasionally flooded by a river, where grass can be cut year after year, year after year. Then we have uplands which must be broken up once in a while; they get "hide-bound," and the grass runs out. These facts are familiar to you all, and illustrate the broad statement that there are some soils where the same crops can be cultivated for a succession of years and other soils on which rotation is quite indispensable. There are soils where clover has been grown once in three years for a very long period. I have in mind a valley in the Austrian Tyrol—the valley of Saint Martin—where this has been done. No one living can remember the time when this practice was not followed on certain parts of that valley. They have a marl which is regularly put upon the land, and by its use the clover crop continues undiminished from generation to generation. Its growth there is also very luxuriant, the ordinary clover stems being five or six feet in height. This is a very remarkable case of ground, naturally adapted to clover, kept in continued productiveness by the use of a native fertilizer. But the land of Mr. Lawes, adjoining the fields where he raised wheat without interruption for twenty-seven years, would not carry clover except at quite long intervals Mr. Lawes made a series of experiments on this land, beginning in 1848 and going on until 1860, in which he applied stable dung, coleseed cake, super phosphate of lime, sulphates of potash, soda, and magnesia, sulphate and muriate of ammonia, soot, and fresh burned lime, singly and in various combinations. The following is a sketch of the history of the crops obtained from four acres, divided into eighteen plats, during twelve years: 1848; sown to clover and barley, having been manured the previous season and borne a large crop of Swedish turnips. 1849; manured with various applications. Three cuttings yielded at rate of from three and three-fourths to nearly five tons per acre. Seeded in fall to wheat. 1850; in spring clover-seed was sown on the young wheat. The wheat yield was at rate of twenty-seven to thirty-six bushels per acre. After harvest, the clover catch not being good, the land was plowed. 1851; after manuring again, clover-seed was drilled in, April 28; came up well and was cut in September. Best yield was at rate of one and one-third ton of hay. 1852; clover looked well in winter, but in March symptoms of failure became apparent in many of the plats; later it died out in patches, more or less, in all the plats, still on the whole a good plant remained, and two cuttings gave hay on best plats at rate of two and one-fourth to three tons per acre. 1853; plants stood fairly through the winter but nearly all died off in spring. Land was then plowed and fresh clover-seed drilled in; plants came up weak. There was no crop worth cutting in autumn and during winter nearly the whole died off. 1854; field was plowed and left fallow until September. After heavy manuring (twenty tons yard manure per acre on some portions, and 5,000 pounds quick-lime on others) clover-seed was drilled in October 10. Plants came up, but died off during winter. 1855; clover-seed drilled in April 14. Best crop was at rate of one and one-quarter ton of hay per acre. Plants died in winter. 1856 and 1857 land was left fallow. 1858; sown to barley without further manure: crop fifty-eight to sixty-five bushels per acre. 1859; without manuring, sowed to clover. Crop cut in September was one to one and one-half ton hay per acre. 1860; plants looked well through winter, but as spring advanced died off rapidly, and in June the few remaining plants had a stunted and unhealthy appearance.

Thus, after seven sowings and the liberal use of every fertilizing element, Mr. Lawes was compelled to see a complete failure of the attempt to keep his land in clover. He relates that in the rotations customarily practised in his neighborhood, a good yield of clover can be relied upon once in six or eight years.

DR. RIGGS. The land was what they call "clover-sick."

PROF. JOHNSON. "Clover-sick," and finally clover-dead!

Mr. Lawes made another interesting trial on a piece of originally similar ground, which had, however, been used as a kitchen-garden probably for two or three centuries. It was sown to clover early in 1854, and from this one sowing the plant grew well, without further manure, for six years and yielded in that time fourteen cuttings, at the rate of twenty-six tons of hay per acre for the six years, or four and one-third tons yearly.

In discussing the causes of clover sickness, Mr. Lawes suggested that the assumption that clover requires a portion of food to be supplied by the soil in the form of certain organic compounds—vegetable matters or humus, such as are contained in garden earth and come from the yard manure, would perhaps explain why the crop failed on ordinary soil, but should succeed in a garden which had been heavily manured perhaps for centuries. Mr. Lawes did not assert that this was the reason, only that it *might* be.

But I think we have facts enough to justify us in concluding that that is *not* the reason. When a student in Germany, I saw an experiment by Dr. Wolff of the Academy at Hohenheim, which he was in the habit of making for the benefit of his classes. He took a quantity of rather poor soil, and calcined it in a clay muffle —a kind of oven which is heated by fire burning all around it, so that its sides are brought to a bright redness. This operation completely burned out all the organic matter of whatever kind that was originally in the soil. To that soil he added the various components of the ashes of plants which are given in the table (see page 179), viz.: lime, magnesia, potash, soda, phosphoric acid, etc., in proper proportions, together with a certain quantity of saltpetre—nitrate of potash—and in that soil he raised the most beautiful clover. You can grow anything to perfection in that way. You do not need a particle of organic matter in the soil for the growth of any plant. Many plants have been grown in simple water in which the mineral elements of the plant, including nitrates, were dissolved or suspended.

The suggestion that the result, in the case to which Mr. Lawes refers, was due to the absence of vegetable matter, must therefore be regarded as destitute of foundation. I believe that if he had spaded his land as deep as the roots of clover go, and had fertilized it well to the same depth, he would have cured the clover-sickness effectully.

The weight of evidence goes to show that this "disease" is owing to the lack of nutritive material in the lower strata of soil, where the long clover-roots go, and where they must find nutriment. Those soils which are naturally adapted to clover are those in which an equivalent to deep manuring is created by the disintegration of the soil itself to a considerable depth.

MR. LYMAN. We have instances in this country where clover has grown for thirty years, in deep soil.

MR. GOULD. The soil of the Genesee wheat lands, where their regular practice has been, for seventy or eighty years, to alternate clover and wheat—wheat is their staple crop, and always has been, and they always prepare for it by a crop of clover—is what you would call a rich loam, mixed to a considerable depth with fragments of a slaty rock. This slaty rock decomposes so rapidly as to keep the soil constantly rich, and rich to a considerable depth. It does not decompose on the surface rapidly enough, so that they can get a wheat crop every year, but if they put on clover, and let its roots go down where there are materials which the roots of the wheat plant cannot reach, and bring those up to the surface, then their wheat crop runs right along, and if rust or insects do not interfere with it, they get a large yield every time they try it. They have two years of clover and one of wheat.

PROF. JOHNSON. Do they cut the clover entirely off?

MR. GOULD. They do, one year. They generally have a pretty good crop before they plow it in. They plow it in, usually, about the first of August.

DR. RIGGS. They take off the first crop, and plow in the second.

PROF. JOHNSON. There are some further facts in regard to clover which are very interesting. Dr. Voelcker, who has been Chemist to the Royal Agricultural Society of England for the last twelve years, when he was formerly in the Royal Agricultural College at Cirencester, found that some of the farmers in the vicinity not only thought that clover was an excellent preparation for wheat, but asserted that the wheat did better when, instead of plowing in the second crop, they took it off. The doctor we may suppose, was rather incredulous but he found other farmers who said, "Our wheat does best when we let the clover ripen, and save the seed, and put the wheat in after that." These opinions were put to him in such a way that he could but candidly say, "It would be folly to deny such statements on my knowledge of what is probable; I will look into the matter, and satisfy myself by my own trials. I am living here on the ground, and I can make the experiments, and if it be true, that taking off two crops of clover leaves the soil in better condition for wheat than when one crop is taken off, if I examine the soil when one crop has been taken off and when two crops have been taken off, I ought to find more available nitrogen and more available phosphoric acid in a given quantity of soil in the latter case than in the first case; and if it be true, that where the plant has been allowed to go to seed, the preparation for wheat is still better than in the other two cases, I ought to find still more of those materials." He made the investigation, and actually found that the quantity of those nutritive materials left in the surface soil after the clover seed had been taken off was greater than when two crops of clover hay had been cut, and greater when two hay crops had been removed than when only one had been taken off.* That is due to the fact, which I have already insisted upon, that the clover plant, after producing its seed, is still able, when the character of the soil is adapted to it, to continue its growth and bring up to the surface-soil those materials which the wheat plant cannot reach. We cannot, from cases of this sort deduce rules of universal application, and this English experience may not apply to the Genesee valley or to the lands of this vicinity, because of differences of soil, but these results of Dr. Voelcker are of very great importance. They enable us to make the experience of those Cotswold farmers of general value, by showing us the reason of their result. They furnish us a grand contribution to our knowledge of the capacities of the clover plant. If the farmers of Genesee do not find the rule to hold good with them, we shall find, by study, the reason for it.

QUESTION. It is often asked, What is to be done with our side-hill pastures in New England, that are too rough and hard or too steep to plow and get manure on? I have a pasture of this kind. It is naturally moist land, pretty stony, and it has begun to be covered with moss. Forty years ago, one acre of it produced more feed than two do now. What shall I do with that land? It is considerably steep, and it would be very unprofitable to undertake to plow, manure, and cultivate it. I have been thinking of

* Dr. Voelcker's researches on this subject can be found in detail in the Report for 1869, page 457 et seq., and are commended to careful perusal. S. L. G.

putting on a heavy harrow, well sharpened, with a strong team, in the month of March, when the ground is thawed say three or four inches deep, and harrow it severely, and then sowing clover. Can we not in that way resuscitate these old pastures, so that they will produce something again ?

MR. LOW. Travellers in the northern portion of this county will find a great many acres of that kind of land which are producing most luxuriant grass, the result of the application of plaster and ashes. You do not need clover seed if you put on ashes and plaster.

PROF. JOHNSON. There is one question to which Mr. Gold referred in a letter to me written previous to the one which I read yesterday, and that is, the waste of manure, which seems to belong to the production of some crops and not to others. Any man who for twenty-five years will cultivate a number of plots of land with different crops and different fertilizers, will get hold of a great many facts and find a great many questions coming up which it would be exceedingly interesting to discuss. This is what Mr. Lawes has done. He has shown that on his land, in order to get a large crop of wheat, he must use a great deal of one kind of manure. I mentioned yesterday that he got 16 bushels of wheat to the acre, for twenty-seven years, in unbroken succession, on land to which he applied no manure whatever; that by the use of 14 tons of stable manure per acre, applied annually, he was able to get 36 bushels of wheat. By using all the elements of our fertilizers, with the single exception of nitrogen, applying phosphates, sulphates, and muriates of lime, magnesia, potash, and soda, all the fertilizing matters which are found in ashes, in guano or in stable dung, nitrogen compounds excepted, he raised the crop to barely 25 bushels; but when, to one good dose of these materials, he added annually 400 lbs. of salts of ammonia, or nitrate of soda, the yield went up to 36 bushels and held at that point for years. This difference between 25 and 36 was unquestionably due to the nitrogen of the nitrate of soda or salts of ammonia. If the facts admit of any other inference, I do not understand the logic which can make it.

Let us compare the quantities of nitrogen in those two applications. In the salts of ammonia, there were about 80 lbs. of nitrogen; in the barn-yard manure, Mr. Lawes says about 200 lbs.; but there are usually nearer 300 lbs. of nitrogen in strong stable manure. It would thus appear that there must be a great loss of nitrogen, and the wheat crop has got the repute, among some writers, of wasting a great deal of nitrogen in its growth.

On another plot of land, where Mr. Lawes raised barley, he applied 200 lbs. of ammonia-salts, which contained 40 lbs. of nitrogen, and raised 48 bushels to the acre. When he doubled his dose, and put on 80 lbs of nitrogen, his grain was so heavy that it lodged and failed to ripen, and the crop was spoiled. Without the addition of any fertilizer, the soil gave him considerably less than half that amount.

I will mention some other experiments which may give us light on this subject, made by Dr. Hellriegel, who has been studying agricultural problems for some twenty years, having been all this time employed in one of the Experiment Stations kept up in Germany, partly by the government and partly by associations of individuals, for the purpose of making agricultural investigations, by the help of chemistry and physiology, and whatever aids can be brought to bear on these questions. Dr. Hellriegel proposed to himself to ascertain what quantities of the different materials which plants require for their growth must be furnished to them in order to get a crop. We have for some years known that phosphates and sulphates of potash, lime and magnesia, and nitrogen must be given, but we need to know how much of each of these various substances is necessary. In order to arrive at accurate results, Dr. Hellriegel had to experiment under artificial conditions. So he took for soil a perfectly pure sand, or one as nearly free from everything that would furnish plant-food as possible. In a large series of experiments, he mixed the soil with a sufficient quantity of all the materials necessary for the support of a crop, within each case one single and different exception. These excepted substances he added in graduated quantities, putting one quantity in one box of soil and a larger in another, and so on through a sub-series of eight or nine boxes, in order to ascertain by the growth of the plant, in which case he had hit the best proportion of these ingredients. His trials have been extended to the whole list of the elements of the plant In regard to water, for example, he found that the growth was greatly influenced by the quantity of this substance with which the crop was supplied. There was a certain quantity of water in the soil necessary to a maximum crop, other things being equal. In the sandy soil which he experimented with, the largest yield of rye, wheat, or oats was obtained when the soil held steadily ten or fifteen per cent. of its weight of water. On increasing this proportion, the straw in some cases was heavier, but the grain was reduced in quantity. Thus the very fact that the amount of rain fall is unequal in absolute quantity, and unequal in distribution from year to year, is of itself a reason why you get different crops, everything else remaining perfectly the same. *That is a matter always to be taken into consideration in judging of the value or effects of a fertilizer.* But it is the effect of nitrogen I am coming at. Dr. Hellriegel experimented with various quantities of nitrogen (in the form of nitrates,) applied also to cereals. The plants grew in the artificial soil, consisting of pure sand, with an admixture of ash ingredients, in such proportions as previous trials had demonstrated to be appropriate. All the conditions of the experiments were made as nearly alike as possible, except as regards the amount of nitrogen, which in a series of eight trials ranged from nothing to eighty-four parts in a million parts of soil. The following table gives the result.*

Effect of Various Proportions of Assimilable Nitrogen in the Soil.

Nitrogen in 1,000,000 lbs. of soil.	Yield of grain in lbs.		
	Wheat.	Rye.	Oats.
0	0.0	0.2	0.3
7	0.5	0.8	0.9
14	1.7	1.9	2.6
21	2.7	2.6	3.8
28	3.7	4.2	6.2
42	6.1	5.1	7.0
56	7.2	7.1	9.0
84	9.2	8.7	9.3

The maximum crops of wheat and rye were obtained with eighty-four parts of nitrogen to one million parts of this soil, but the maximum oat crop was got with fifty-six parts of nitrogen; at least, the gain between fifty-six and eighty-four parts of nitrogen, in the case of oats, was a mere trifle. Dr. Hellriegel made some other observations, which he has not reported in detail, which led him to conclude that he might have got his best crop of wheat with seventy parts of nitrogen, his best crop of rye with sixty-three parts, and his best crop of oats with fifty-six parts, to a million parts of soil. This soil which he used was not a large absorbent or fixer of the substances furnished to the plant. The nitrogen which he used was in the form of nitrates, which are

* See also "How Crops Feed," p. 288.

never absorbed by soils, so far as we know. The matters with which he enriched the sand, therefore, were soluble and entirely available to the plant. The latter had only to stretch out its roots to obtain its food, and the quantity of soil was small, so that the roots had not far to travel, and could so completely occupy the soil as to come in contact with all the nourishment it contained.

QUESTION. Does nitrogen form a part of the plant?

PROF. JOHNSON. Yes; an important part, always.

QUESTION. How large a part?

PROF. JOHNSON. In the entire plant, when dry, from one-half to two per cent. In the different parts of plants it varies greatly. You have fifteen per cent. of nitrogen, for example, in the gluten of wheat; one and one half to two per cent. in the wheat grain; you have no nitrogen whatever in pure cotton fibre; there is no nitrogen in the sugar or in the starch of the plant.

QUESTION. Does it exist in the wood in the form of nitrate?

PROF. JOHNSON. No; but in the form of what is called albuminoids; something which is similar to the albumen or white of the eggs of animals.*

MR. S. L. GOODALE, of Maine. What is the comparative value of a given amount of nitrogen in ammonia salts and in animal substances, such as blood, flesh, dung?

PROF. JOHNSON. It is very difficult to say; but these experiments of Mr. Lawes show that in order to get thirty-six bushels of wheat to the acre, he used two hundred pounds of nitrogen, in the form of stable manure, whereas eighty pounds of nitrogen, used in the shape of salts of ammonia, gave the same crop. The reason of that is, that the nitrogen of the salts of ammonia is in a condition to be made immediately available to the plant, whereas the nitrogen in animal manure exists in a form or in forms such that much of it cannot be taken up by the plant at once, if at all. It must undergo an alteration to become of use, and much of it, instead of passing into an available condition, doubtless becomes permanently inert.

MR. S. L. GOODALE, of Maine. What are the conditions under which the nitrogen of manure is converted into ammonia, which is retained in the soil, and what the conditions in which it is converted into nitrates, which may pass out of the soil?

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* See "How Crops Grow," pages 94 to 109.

Prof. Johnson. So far as can be judged from our imperfect knowledge, a rapid decay of nitrogenous matter which goes on with comparative exclusion of air, generates ammonia; on the other hand, where there is a large access of air, there we have nitrates formed. But we do not know minutely the conditions under which nitrates are produced. Another fact to be noticed is this: that in the decay of animal matters with access of air, there is invariably a quantity, and often a large quantity, of nitrogen liberated in the state of free, gaseous nitrogen, such as exists in the air about us, and which does not assume the form either of ammonia or nitrates, and thus becomes lost as a fertilizer.

Mr. Gould. The Professor has stated a distinction among plants—plants which exhaust the nitrogen and plants which accumulate nitrogen, in the soil. This is a subject of immense practical importance, and I think it will play a much greater part in questions of practical farming, than it ever has done in the past. The statement which he made would justify the inference, although he did not state it himself, that plants accumulate nitrogen in the soil in proportion to the surface of their foliage extended to the air, and to the length of time during which that foliage is in actual growth. The inference would be that there was a proportion between the amount of accumulation and the length of time. I desire to know whether the Professor wishes to be understood in that way?

Prof. Johnson. I would not assert that to be the fact, absolutely or unqualifiedly, but the indications very strongly favor that general conclusion.

Mr. Gould. That is my own impression.

Prof. Johnson. I was about to say how much nitrogen was needed in the soil.

A wheat crop of thirty-three bushels, with straw and chaff, contains fifty-six pounds of nitrogen. If we allow for stubble and roots one-fifth this quantity, we have for the total nitrogen required in the vegetation of an acre of wheat, say sixty-eight pounds.* Hellriegel found, by actual trial, seventy pounds of nitrogen to be sufficient to produce his maximum wheat crop.

Mr. Lawes' soil furnished enough nitrogen to yield seventeen bushels of wheat. Addition of forty-one pounds of nitrogen, in

* On examination of wheat roots collected by Schubart, June 8th, 1855, Stockhardt found that the roots composed a little more than one-fifth of the entire plant, or twenty-

form of ammonia salts, gave twenty-seven bushels, or an increase of ten bushels. Eighty-two pounds of nitrogen applied in the same form gave thirty-seven bushels, or twenty bushels increase.

The reason why Mr. Lawes was obliged to add eighty-two pounds of nitrogen to double the wheat crop, lies in the following considerations:

When ammonia is applied as manure, a portion of it is fixed in a comparatively insoluble condition in a clayey or loamy soil, and a share of this fixed ammonia it is doubtless very difficult for the plant to acquire. Again, nitrification, or conversion of ammonia into nitrates goes on, and the nitrates are freely soluble and wash out of the soil. Then we know that the roots of the plant cannot come into contact with the whole of the soil, so that we should not expect that all the available nitrogen there would be taken up. The figures show that from seventy to eighty pounds is sufficient, provided it is in a form and in a position in which the plant can appropriate it. In stable manure we appear to waste a considerable quantity simply because it is not present in a form in which the plant can use it.

Now, stable manure, when it is put into the soil, may be compared with clover roots or any other vegetable matter put into the soil. Stable manure consists very largely of vegetable matter which has passed through animals, and of more or less litter which we mix with it. There is a small portion of the nitrogen of the manure actually formed into the ammonia salts which Mr. Lawes applied, but most of the nitrogen, in order to be used by the plant, must be transformed, must pass into some other state than that in which it exists in the manure itself; must probably either be converted into ammonia or nitrates.

MR. LYMAN. Suppose I wish to use all the liquids of my stock, and absorb it all, and do not pay so much attention to the coarser

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two per cent., and the nitrogen of the roots was a little less than one-fifth that of the entire plant, or eighteen per cent.

Heiden found the nitrogen of the roots of ripe rye but one-tenth that of the entire nitrogen. Stockhardt's examination was made on the *unripe* wheat. By ripening, the proportion would doubtless have been reduced. Heiden found, in fact, that the ratio of root to top in blossoming rye was about one to six, but in ripening was reduced to one to thirteen and one-half.

If, then, the roots alone contain one-tenth of the entire nitrogen, the roots and stubble may be fairly reckoned to contain one-fifth of the entire nitrogen.

Weiske, indeed, gives twenty-two pounds of nitrogen per acre for the *roots and stubble* of wheat, but we are not informed how high the stubble was cut.

manure. What in your judgment is the relative value of the one placed by the side of the other? This question is being agitated extensively.

PROF. JOHNSON. That depends somewhat upon the food which the animals have. If they are kept upon low rations the liquids would be the best. But if they are supplied with rich food, grain, meal or oil-cake, that indeed increases the value of the liquids, but increases more, relatively, the value of the solids, because you cannot get into the circulation of the animal beyond a certain amount of nutritive matter; but you can run through the intestinal canal much more material which is only partially digested, and so the value of the solid manures, compared with the liquids, is increased by increasing the richness of the food.

When oxen or other herbivorous animals are kept on rations which just maintain them without much gain or loss of live weight, the daily urine usually contains rather more nitrogen than the dung. Sometimes the nitrogen of the dung exceeds that of the urine, but while all the nitrogen of the urine is adapted for immediate use as plant food, much of that in the dung is comparatively inert. The urine contains also more alkalies than the dung, but the dung usually contains nearly all the phosphoric acid and most of the lime.

Measured by assimilable nitrogen or by alkalies, the liquids are much the best; measured by phosphates, the dung is most valuable. Practically, however, we cannot make a sharp separation. The solids nearly always absorb a good portion of the liquids.

I think I have now gone over about the ground that I contemplated. At least, we have approached pretty near the hour for dinner. With regard to the question about the improvement of pastures, there are a variety of ways in which the land can be saved from being useless. One of the most practical methods is to put on a top-dressing of some sort. The fact that moss grows there indicates that the soil is getting a little too moist, and it is a question whether plants will do well unless that moist condition of the soil is somewhat broken up. If those fields admitted of under-drainage, and it did not cost too much, that would be an effectual remedy against moss; you would never see that again. My excellent friend, Mr. Blakeslee, whispers to me, "Put on a flock of sheep!" and that is also an excellent prescription.

MR. ———. We can't do it; the dogs kill them.

PROF. JOHNSON. The treatment which the gentleman suggests who asked the question, has nothing against it theoretically, and the fact that it has succeeded elsewhere shows it must be a good plan. There is no reason why such land should not grow into great value. If clover could be brought in it would probably raise the land in a couple of years to the productiveness that it had forty years ago, by simply bringing up the materials which the roots of other plants cannot get at. Probably any application containing lime or sulphate of lime, leached ashes, oyster-shell lime, or anything of that sort, would be beneficial. These things always favor the growth of clover.

WATER CULTURE.

A near kinship exists between Agriculture and Aquæculture, both having in view a common object, namely, the production of human food. Maine possesses remarkable facilities for growing fish in her numerous bodies of inland water, large and small, her great length of ocean coast line and in the streams connecting the fresh and salt waters. A conviction that these might be cultivated with even greater private profit and public advantage than her soils has led to the presentation of the subject in former reports, particularly in that of 1864. Since that date attention has been so much directed to it that less need appeared of its introduction in these pages. Many, however, will be glad to learn *how great* progress has been made and is making in this new culture, and that Congress has at length recognized its importance. Pending action upon a moderate appropriation from the national treasury, proposed to be made for its furtherance, Mr. Roosevelt of New York, made a speech in the House of Representatives in May last, so replete with instructive facts and suggestions that it cannot fail to be received with interest, nor to contribute to profitable results.

Aquæculture Compared in Importance with Agriculture.

BY HON. ROBERT B. ROOSEVELT.

The art of cultivating fish by artificial means is no new thing, it is not an untried theory, resting more in hope than in experience, but has passed the realm of experience into absolute certainty. It has become a fixed art, and, although as yet scarcely developed, has grown into a business of considerable magnitude and great importance. Persons unacquainted with the matter have little idea of the discoveries which have been made and the wonderful successes of those who have devoted themselves to the study and investigation of this subject, and do not appreciate the extent of the influence which it is certain to exercise on the future of this country, a country that is wonderfully blessed in this particular as in all others, and is adapted to fish culture to a degree that exists nowhere else.

The older nations had a vague notion of this industry. In China it has been carried on for centuries, as well ages ago as now, like most of the discoveries of that unprogressive people. The Romans were scarcely so well informed, and only developed the natural method; and the first real attempts which produced practical results were made in France in quite modern times, when the discoveries of the past were discovered over again. In that scientific and cultivated nation, however, the matter attracted immediate attention, and its importance was appreciated by a people which has long been forced to make the most of its food resources. The Government took it in hand, and soon satisfied of its practicability, built the national establishment at Arcachon. At first blunders, of course, were made. Finding uncertainty, an uncertainty arising solely from ignorance, in impregnating and hatching the artificially impregnated eggs, resort was had to collect the ova from the various streams of the country, after it had been deposited there, in the natural method, and developing it under proper supervision and guarded from enemies and disease. Directions were at the same time published for stripping the parent fish of their eggs, so that the ripe spawn might also be saved from any mature individuals which should happen to be caught.

This plan, however, was unsatisfactory; it was but little more than robbing Peter to pay Paul. Not only was much unripe and worthless spawn taken through ignorance or cupidity, but the natural supply was carried from the streams to such an extent that they were greatly denuded, and were run down to a degree which was hardly made good by the supplies of young fry which were afterward sent to them from the national establishment. These errors were, however, corrected in time; greater knowledge and skill were attained, better methods and machinery were invented, and in the end Arcachon became a success, fish-culture triumphed over the obstacles in its way, and many of the waters of France which had been entirely depleted were replenished, and the fisheries were restored to a condition of fruitfulness which they had not known for years, while a most important article of diet was furnished to the people at cheaper rates and in more abundant quantities. Up to this time deterioration and increasing scarcity had been the rule, but soon an improvement began which has far more than repaid the expense incurred by the Government, and has led to consequences the public value of which cannot be overestimated.

England was not long in following the example of France. The salmon fishery has been the principal estuary and fresh-water fishery of Great Britain, and it also had been injured by mismanagement and neglect and overwork. Salmon had long been far beyond the reach of all but the wealthier classes, and even they were beginning to experience trouble to obtain as much as they needed at reasonable rates. Streams which had yielded abundantly within the memory of man were comparatively unproductive, and in some instances were absolutely bare of fish. The Irish and Scotch fisheries were not so badly off as those of England, but even they were reduced far below what they had been. Steps were taken to replenish these, partly by private action, partly by public. Parliament appointed boards of fish conservators and an inspector of salmon fisheries and paid liberal salaries, and passed wise laws for the protection of the young and the spawning fish. The consequences were the same as they had been in France, and soon fish became more plenty; the salmon fishery on one river having more than doubled in actual rental in a few years, while the yield was proportionally increased. Germany, Austria, Russia, all followed the example; all made this a national enterprise and found it to their interest to pay liberally to restock their waters with a means of supplying food to the people which had been so nearly annihilated. In all, establishments for the artificial propagation of the most valuable varieties are established at various points, and yearly furnish most gratifying evidences of the industrial value of this, which promises to be the most widely beneficial of all the discoveries of modern times; for if it is true that that man is a public benefactor who has made two blades of grass grow where one grew before, much more so is he who has restored to the people a food supply which had almost ceased to exist, and the extinction of which was looked upon as the necessary consequence of the increase of population, it being expected to expire precisely when it was most needed.

Such is a cursory statement of what has been done abroad. It alone would justify the United States in following the example of the older nations, and taking this matter under national protection. It is essentially a national matter; the States alone cannot take charge of it and manage it efficiently; they cannot even pass laws which will thoroughly protect the fish at seasons when they should not be disturbed. Rivers run through different States, or are the boundaries between them, and the laws made for part or one shore might not be identical with those made for other places.

Unity of action is essential, for it is useless to protect in one locality if wanton destruction is permitted in another.

Many species are migratory; that is, pass from the ocean, at certain seasons of the year after they have grown fat feeding there during their period of rest, up the streams into the fresh water, where alone can they deposit their eggs and hatch their young. In these cases the fishermen along the coast are jealous of those on the upper waters; the former complain that the latter destroy the parents while they are spawning, and in this way destroy the race; while the latter complain that the coast fishermen use improper and murderous methods of fishing, and kill out the entire supply before they can have a chance to reach their spawning beds. Unfortunately, both these complaints are too well founded. Each class takes all it can, blind to the future, which presses closer and closer on the heels of such want of foresight; it looks only to immediate gratification, and accepts the proverb, "after me a famine."

The navigable streams of this country are subject to the jurisdiction of the national Government, and this is even more clearly the case with the coast line within three miles of the shore. This is a general rule of law, and if there are any exceptions to it they do not exist in the western States, where the rivers were expressly reserved to the nation It is not necessary for the purposes of this application to maintain so broad a proposition, as it is not intended to take any actual control of legislation on this subject at present, but only to develop the natural resources by artificial means, restock waters which have been exhausted, spread information concerning the matter, and lead the people either to protect their own rivers or to grant unquestionable authority to Congress to do so. And it is to that alone which the proposed law addresses itself.

The progress made abroad has been stated, and it has been shown to be sufficiently encouraging to induce our country to follow the example, but the cases are different in many points, and in every point to the advantage of the United States. The extent of our inland waters is something that is hardly understood abroad, and is not properly appreciated at home. Our vast lakes, enormous rivers, innumerable streams, brooks ponds, bays, lagoons, creeks, and rivulets, are not equaled in any other quarter of the globe. In the State of New York alone we have far more area of water than in Great Britain and France united, the actual acreage being 466,457 acres, while entire foreign States might be almost swallowed up in several of our larger lakes. Our rivers run a distance equal to one fifth of the circumference of the globe, and are navigable thousands of miles above their mouths. But more important than all this is the character of our fish, for we have the finest fish in the world for artificial cultivation, the most prolific, the easiest managed, and the most remunerative. This is a superiority more important than the other matters, and in this Nature has been wonderfully kind to us.

In order to explain this difference I shall have to describe with some detail the method of manipulating the parents and raising the young under artificial methods. Fish are exceedingly prolific; nature seems to have made them the great store-house of food which was to be held in reserve until an increasing population should require it for support. Every need of the human kind seems to be met as it is developed, and the earth apparently holds in its recesses the secrets which are to keep the world thriving and progressing for ages, and until it shall be covered with a swarming and happy population, denser than is now imagined to be possible, or than learned essayists on a subject they do not comprehend would permit as at all prudent. Fish food is manifestly one of the means which are to make such a result possible, and intellectual care is to develop this resource to a degree as yet hardly dreamed of by the most enthusiastic.

Different species of fish, however, vary remarkably in the extent of their fecundity. A cod and a herring each deposit a million eggs, so that a dozen females of either, were all their eggs to hatch and attain maturity, would furnish the entire yield of the present time. Twelve million cod is an incredible number, and unless nature had provided a means of reducing this fecundity the ocean would long ago have been filled, till there would have been more fish than water, and the sea would have been foul with their decaying bodies. There is, however, no danger of any such state of affairs; the difficulty at present lies in the other direction. These are the most prolific species, but others do not come far behind, shad producing from ten to twenty thousand eggs to each pound of their weight, and consequently yielding from thirty thousand to one hundred thousand eggs each. Salmon and trout are less productive, having only about two thousand eggs to each pound, and not even that in the largest. We have not yet learned to breed cod or herring, but we can breed shad, and hence we have an advantage over the European nations that is precisely proportionate to the relation that two bears to twenty. Here is an immense point gained, for shad grow as rapidly or nearly as rapidly as salmon and far more so than trout, and they are as delicious a fish on the table if not quite so substantial a meal.

Nor is this all. Salmon and trout require three months or thereabouts to hatch, while shad hatch within a week. The former must be carefully watched and have special appliances in the matter of water and location; the latter need no attention, and hatch in a common box with a wire grating fastened over the bottom. Salmon and trout are helpless for thirty days after they are born, being weighed down with what is called the umbilical sack, the unabsorbed portion of the egg. Shad are able to take care of themselves and seek their own food the moment they burst the shell. The former must be fed when young and protected from their enemies for months, salmon not leaving the fresh water and descending to the sea usually till a year or more after birth, whereas the little shad seek the ocean as soon as they are turned loose, and need no care or food till they come back grown fish ready for the gridiron or the baking pan.

To explain these differences fully, and to show also what can be done even with the least prolific fish, it will be necessary to describe the mode of raising the young by hand as it were, for it is not intended to confine the national operations of fish culture to shad by any means, or to exclude the nobler and more valuable if more troublesome salmon. There are three great classes of fish, as viewed from the stand-point of the fish-culturist, each having a different mode of laying its eggs and raising its young. First, the salmon tribe, what ichthyologists call the *salmonidæ,* which deposit their eggs in fresh cold water, digging nests for them and covering them up as fast as they are impregnated by the male; secondly, the herring family, which includes the shad, another migratory species, but whose eggs are left uncovered to drift in comparatively still fresh water; and, thirdly, the perch family, which includes the black bass, which deposit their eggs in a mass kept together by a mucous or gelatinous substance which is exuded from them. The latter cannot be hatched artificially, the mode of manipulating either fish or spawn not having been discovered, and it is only with the first two classes that the fish-culturist has anything to do at present, and these differ wholly in their methods of incubation, if that word can be used in default of a better.

The female salmon digs out a hollow with her nose and tail in the bottom of some cold stream, near its head-waters, and where the current has a gentle and regular flow. She brushes away the dirt and sand with her fins and leaves a bottom of broken stones the size of a bantam's egg. All this while her accepted mate, who has won her favor possibly after many a tough battle with rival suitors, watches near at hand to drive off interlopers. As soon as she has prepared the nest to her satisfaction and the first throes of egg birth come upon her, the male darts to her side, presses close against her, often seizing her by the gills and exudes the fertilizing fluid with his body in contact with hers, so that the eggs receive it the moment they issue. This act over and the male retires for a time to resume his watch, calmly devouring any stray eggs which come in his way or have been carried off by the current, while the female proceeds to cover those which have been impregnated. To do this she brings stones with her fins carefully and places them so as to protect but not injure her precious deposit. She is aided by the fact that salmon eggs are almost as heavy as shot, and have the faculty of sticking for almost half an hour to whatever they touch when they are first exuded, although they afterward become free. So they sink at once and adhere to the bottom long enough for her to cover them before they are washed away. As soon as the first deposit is properly covered, the operation of spawning is renewed, and so on perhaps for several days, till quite a mound of small stones is erected on the spot where the fishy labors have been expended. Then the parents, weary, exhausted, ugly, ungainly, almost dead, descend slowly to the sea, sickly in themselves and worthless as food until fine living on fat crustaceans and lively minnows shall have restored their flesh, strength and beauty. At this season they are utterly unfit for food, and those who eat them often eat maggots as well, and the ignorant epicures who put on their tables these fish in December have the satisfaction of knowing that they are eating salmon flavored with worms, and very poor and thin at that.

But no sooner has that pair of spawners left their nest than another pair comes along, and here begins the first difficulty in piscatorial housekeeping, for the second pair are exceedingly apt to select for their operations the identical spot chosen by the first, not only destroying the nest utterly but devouring with apparent gusto all the eggs which were so carefully housed. By instinct the most favorable spots, as where a brook comes in, or a spring bubbles up from the bottom, are first chosen, and these will be dug over half a dozen times, perhaps, before the last pair visits it and secures it for their young. Nevertheless, the perils of the embryotic state are not over by any means, for all creatures that live on or in the water seem to be fond of fish-roe. Eels wriggle about it, ducks poke their bills among the stones to reach it, little shiners and minnows devour it, and water-bugs of many varieties live on it. Nor is that all; sediment settles on it, silt washes over and smothers it, and fungus grows on it. It must be free to a steady flow of water or it will perish, and one bad egg will contribute the contagion to a dozen healthy ones.

The wonder is not that fish are so scarce, but that there are any at all. Still, some of it hatches, and what have we now? A poor, miserable little fish, half an inch long, left to his own resources in the world to get his breakfast, dinner and tea as best he can; and not only that, but actually loaded down with a big bag like an extra belly, which he must carry about with him and which impedes his every motion for thirty days. No wonder he hides his head under the stones and falls an easy prey to enemies too numerous to mention. Suppose he makes his way to shallow water, and there near the shore he hides till he has gathered strength and activity. He has to wait from six to eighteen months before he can venture to the sea, for were the fry in their then condition placed in salt water they would perish at once. The eggs are laid in November or December and the fry appear in January, February, or March, according to the temperature of the water—the warmer the water, the quicker the young hatch, but the more slowly they are developed the stronger they are supposed to be, their period of gestation varying from seventy-five to one hundred and twenty days. Next fall about one half of them will change their appearance and become covered with visible scales. They are then technically called smolts, and the scales, smolt scales, and they are then ready to descend to the sea. The residue will not undergo their change till a year later, when they also will seek a new life. When they have attained this age they are, comparatively speaking, safe, and are pretty sure to return the following spring as grilse, which is the sporting name of a salmon that has not spawned, and will weigh from two to six pounds, and be as beautiful fish as ever gladdened the heart of sportsman or stomach of epicure. After spawning they will again go to the sea and once more return the ensuing year the magnificent salmon of from six to twelve pounds, and thereafter gain every season nearly half a dozen pounds till they come to kick the beam at seventy or eighty, having attained an age that is a mere matter of conjecture.

Salmon invariably return to the river where they were bred. This has has been conclusively proved by many interesting experiments, one alone of which need be mentioned. The second back fin, the small adipose dorsal, as it is termed, has been cut off before they were allowed to descend the river, and while they were shut up in some fresh water pond. Grilse and salmon were afterward taken in the same stream without this fin. This habit seems to rule with all fish of an anadromous disposition, and although there was doubt whether it held good with shad, that doubt has been removed, and it is now established that not only will these return to the place where they first saw life, but to the particular spot, rarely stopping short, or ascending higher, even, than that locality.

It is perfectly apparent, from this short explanation, that the ova incur innumerable risks and are far more than decimated before they hatch. The only wonder is that any live, and it has been estimated that not one in five hundred comes to maturity. With this explanation it ceases to be a matter of surprise that nature has given this class of creatures such wonderful recuperative power; were it otherwise the race would die out in the face of so many difficulties and enemies. But at the same time the slightest thought will show how enormously this fecundity can be made to work in the interest of man, and what a ready means is here offered for the increase of food for the human race. Care can remove these dangers and drive away or exterminate these enemies, and turn this fertility to full advantage; and the method of doing so I will proceed briefly to explain.

The salmon, when they ascend the river to spawn, are shut in some suitable part of the water, being either inveigled there as a favorable spawning-ground or caught in nets and forcibly put there; and when they are fully ready, when they are ripe, as it is termed; that is, when the eggs lie perfectly loose and free in the stomach, they are taken from the water, held over a tin pan, and forced to extrude the spawn and milt by gentle pressure on their sides with the hand. And in this operation a wonderful advance has been made within the last year. Heretofore it was the custom to fill the pans with the water, as this was supposed to most nearly resemble the natural method ; but now little or no water is used, it being found that water drowns the spermatozoa or life principle of the milt. This change of practice alone has made a difference of fully twenty per cent. of the yield, as it is found that the impregnation is far more certain by this plan. Care must be taken, however, that the fish are entirely ripe, and that the eggs will run out under a slight pressure ; if they will not the fish is returned to the water till it is in proper condition.

The eggs are left for half an hour undisturbed, and then are washed and spread in troughs which are filled to the depth of an inch with clean pebbles, and through which flows a gentle current of filtered spring water, and there they remain away from fowls and fish and bugs, safe from sediment and fungus till they hatch. They only require occasional examination for the purpose of preventing the collection of deleterious matter, and to remove such as may die and endanger the others. When they hatch they are left in the troughs till the umbilical sack is absorbed, when they are placed in ponds and fed on beef liver, finely grated. Under this management all the serious perils of the natural method are averted and the difierence in the result is almost incredible, being little less than a thousand to one.

These directions apply to all the salmon tribe—the salmon, the trout, the salmon-trout and the white-fish, all of which have the same peculiarities. To explain the process more fully, I will quote from the report of the New York commissioners of fisheries, presented to the Legislature of that State March 19, 1872:

" *State Hatching-House.* By the last amendment to the act of the Legislature, concerning the protection of fish in this State, the commissioners of fisheries were authorized to build a State hatching establishment for the purpose of breeding the better kinds of fish for distribution throughout the waters of the State. This building was erected during the summer of 1870, and was completed in time for use in the artificial incubation of salmon-trout and white-fish. It is neither a very large nor a very costly establishment, but is the most efficient, practically, and the most productive in results of any in the world. The water is introduced in the ordinary way, through a number of flannel sieves, and is led into twenty-four troughs, which are sixteen feet in length by fifteen inches in the clear in width. These troughs are raised about two feet from the ground, so that a person sitting on a stool alongside of them can readily examine the condition of the ova during the period when they are hatching. The lower end of the trough is an inch lower than the upper end, so as to give a gentle motion to the waters which are introduced into them. The water flows from a spigot about an inch in diameter, and through another flannel screen, which is an additional protection against the accumulation of sediment.

"The troughs stand in pairs, so that the workmen can readily overlook them by passing on each side through a passageway left for that purpose. They are divided up into compartments at every two feet, and at first, when the eggs are being hatched, the water running through them is only about half an inch deep. The moment, however, the fish are out of the egg, screens are introduced at each compartment, and a piece of board being put across the lower end of the trough the water is raised to about three inches in depth.

"The State hatching-house has been greatly enlarged the past season, and operations for the winter hatching of fish have been, on an unprecedented scale, commenced. Millions of the spawn of salmon-trout were taken there from the great lakes to be distributed through the State, or to be developed and then distributed. It is much easier and less expensive to distribute the ova than the young fishes. The ova may be transported anywhere during the month of December, but no later. More attention than heretofore has been paid to the cultivation of salmon-trout, and less to that of white-fish, for it was found that objection was made to the introduction of white-fish into many of our ponds, on the ground that they have to be caught with a net, and that while they are being taken, many other fish which could be caught with a hook and line were destroyed at the same time. With salmon-trout this is altogether different; and as they bite readily at a hook, are a handsome game fish, and good for the table, it is proposed hereafter to raise a far greater portion of them, and few, if any, white-fish.

"A full detailed account of the operations is appended, and the commissioners pride thmselves upon not only building the cheapest and largest fish-breeding establishment in this country or in the world, but also in building one that has in every way proved an entire success, and which is capable of supplying all the public waters in this State with all the salmon tribes of fish."

So much for salmon. Now for shad; and it is rather remarkable that the whole process is dissimilar, so much so that it had actually to be discovered over again. So entirely different are the two processes that I cannot do better than describe the manner in which the latter mode was discovered. The credit of this is due to our country, and to Mr. Seth Green, of Rochester, New York, who is the ablest pisciculturist to-day in the world, and whose name will hereafter be written in the list of those who have deserved well of the Republic. He offered his services to the New England commissioners, and proceeding to the Connecticut river set about his operations in May, 1857. He had little difficulty in catching ripe fish and none in extracting the spawn, to which he was accustomed from handling trout, although he afterward ascertained that the true time to take the parents was at night, from eight to twelve P. M., as they seek the spawning beds principally during the dark, but he soon found other and more serious troubles. He naturally pursued the same method he had followed with the trout, placing the impregnated eggs in a trough and turning on a gentle current of water. What was his surprise, however, when he saw all the eggs wash out over the lower end of his trough. Here was the first striking difference, whereas trout eggs are almost as heavy as shot. The ova of shad have little more specific gravity than water, and will nearly float of themselves. Then he reduced the current and the eggs all died. This was failure number one He next tried leaving them in a pool near the shore, where there was no change of water, and found the eggs all opaque and lifeless next morning—failure number two. He then built a low dam of small stones so as to make a pond in the course of the current, and so that the water would find its way through the crevices, but still only a trifling quantity hatched—failure number three. He next tried boxes, putting wire sieving over the ends and the bottoms and the sides, but in vain, till he was almost in despair, and the season had nearly reached its close. Then fortune favored him. He happened to be standing in the water experimenting with a box that had the wire sieving on the bottom, and which was filled with eggs, and accidentally elevated the front end so that the current struck the bottom at an angle. He observed that some of the eggs lying in the lower end were lifted and kept in motion like the bubbles boiling up in a tea-kettle; he elevated the further end a little and more eggs boiled up; he raised it still further and they all commenced boiling madly, although the water did not pass over the top of the box at the lower end. The question was solved, and thereafter shad hatching was a certainty and a success, and no ordinary success either, for while of trout and salmon nearly ten per cent. are lost even now with dry impregnation, with shad the loss is so trivial that, practically speaking, absolutely all are hatched.

Mr. Green felt jubilant, but he was by no means out of the woods. He soon had his boxes filled with young, for instead of taking months, like salmon, shad issue from the egg in few days, and he proceeded to dispose of them as he would do with trout. The latter, as soon as they can swim, seek the shore to hide under grass, weeds and stones, but when the shad were set free in the shallow water all the shiners, dace, minnows, killeys, and other small fish in the entire neighborhood collected as though they were invited to a feast, and proceeded to devour them in a way that must have been exceedingly painful to a parent's eye. Here was a second perplexity, and there was nothing for it but to wait for an explanation, or an inspiration. So a pond was built on the side of the river, and the youthful adventurers left there till some one should find out what to do with them. Next morning they had apparently all disappeared, and were finally found huddled together at the outer edge of the pool. Here was a suggestion, and to test its significance another pond was made, narrow, but running far out into the stream, and into this the fry were transferred. Next morning they were again discovered collected at its outward extremity, and evidently trying to reach the center of the river, and that problem was solved.

Now, the moment the shad are hatched, the boxes are towed out into mid-stream, and there, away from the small but dangerous foes along the shore, and too minute to attract the bigger denizens of the deep water, the little fish are turned loose to find their own way to the ocean, which they do by gradually floating down stream, keeping their heads to the current to catch such food, invisible to man, as may come along, and feebly wagging their tails to acquire strength and activity. In two years the males return weighing something under a pound; and in three years they reappear, males and females, the magnificent fish, from two to five pounds, that are so welcome to our table.

The difference between the natural and artificial method is too great almost to appreciate. Take the case of shad depositing by the natural method sixty thousand eggs. Of these, at the utmost, one hundred and twenty hatch, and this is probably the outside limit. Of this number say one-quarter mature, the proportion in this stage being a mere matter of conjecture, and we have a final return of thirty for two or fifteen for one.

Now, by the artificial method the entire sixty thousand are hatched and started in life away from their enemies. Of these, if a quarter reappear, we have fifteen thousand in lieu of thirty. Keep this up at a geometrical ratio and the results are simply incalculable. Rivers that are now deserted could be filled to repletion, so that there would be abundance for netters, seiners, and fishermen of all kinds, whether they fished in season or out of season, early and late, and with murderous or legitimate implements. This is the object to be obtained, and although at first it may be desirable to have protective laws till the propagating-houses are established and in working, in the end they should be all swept away and the people allowed to pursue, catch, and eat whenever they might feel so inclined. No river on our continent yields more than a million shad annually; so that with a moderate effort the supply could be immensely augmented; but the effort should not be suspended until at least one hundred million young fry are placed alive in every stream of considerable size at present visited by these fine fish.

The vast superiority of shad raising over salmon raising is perceived in a moment by a comparison of the two systems. The former requires merely a few hundred boxes of common wood, with wire sieving over the bottom, covered with coal-tar to protect it from the action of the water. These boxes have pieces of wood nailed on their sides to act as floats, and at such an angle as to keep the bottom slightly inclined against the current, the degree of inclination being regulated by experiment. The boxes are strung behind one another in long lines, their floats projecting beyond the ends, and connected with ropes. The whole swings with the tide if in a tide-way, or tails out under the influence of the current, and needs no care except at slack-water when they need jogging now and then to keep the eggs from being smothered. The expense of all this is so trifling as hardly to be worth mentioning, while the product is immense.

The spawning-grounds are always near fishing-stations, and the fishermen can readily be induced to haul at night by a little extra remuneration, as they use the fish whether stripped or not. As soon as the net is hauled ashore and the fish thrown into a boat a pan half full of water—for dry impregnation has not yet been tried, although it will probably be universal in time—is placed near the operator, to whom the fish are handed one after the other. He manipulates them, throwing them aside as fast as they are stripped and when they have all been used he sets the pans aside for half an hour, during which time the eggs swell and become firm and turgid and the water falls ten degrees in temperature. This is repeated as often as the nets are hauled, and finally the pans are taken to the boxes and emptied into the latter, where the eggs remain till they hatch, the period varying according to the heat of the water from two days to seven. Nothing can be simpler than all this, and though, like everything else, it requires a little practice, the roughest and most ignorant man can soon acquire the requisite knowlede to manage the establishment.

The great results which are promised by this enterprise are not mere matters of guess work; salmon have been cultivated abroad so as to restock abundantly many streams which had been entirely depleted, and here the consequences of shad culture have proved themselves to be exactly what it was predicted they would be. The same fall that the first experiments were made in the Connecticut, shad fry were noticed as being unusually abundant in the lower part of that river, more so than they had been known to be within the memory of the inhabitants. Three years later they returned—they were not expected sooner, such being their habit—and in numbers surpassing anything that the fishermen had experienced in years. At first this was supposed to be only an accident, and was explained by the unbelievers upon various theories, and these asked a suspension of judgment until the next year. But all theories in opposition were put to rout next season when the fishing was actually unprecedented, being better than had been known in fifty years. So decided was the effect of this improvement that the price of shad fell in the northern markets to less than one third of what it had been previously. And I will in this connection again quote from the report of the New York commissioners:

"Shad were far more abundant and far cheaper than they had been for years, both on the Connecticut and the Hudson; especially so on the former river, the yield from which actually glutted the markets and reduced the wholesale price from eighteen dollars a hundred down to three. This was manifestly the consequence of the previous efforts, and confirmed the predictions of those who had studied the habits of the fish. It was expected that the great body of such as were hatched would return in three or four years full grown; and it was exactly four years previous that Mr. Seth Green, under the auspices of the New England commissioners, had first discovered the method of hatching shad, and had placed many millions of young fry in the Connecticut.

"Most of these returned to the river where they were born. The effect on the market, however, was mainly attributable to the yield of that river, which supplied New York and other adjacent cities so abundantly as seriously to reduce the profits of the fishermen on the Hudson. It is perfectly plain, from these results, that unless we keep pace in this matter with our eastern neighbors, our fishermen will be entirely ruined. So entirely are the latter satisfied of this, there is no difficulty in obtaining their consent to any measures that will tend toward accomplishing this end. The experiences of the last season convinced the most incredulous, and they are now as anxious to encourage the fish culture as they were once bitterly prejudiced against it."

When a process to add to the wealth and resources of the nation is so simple and yet so valuable, it would be criminal in the government to refuse to lend a helping hand, as, for the reasons already given, this can never be a matter of private enterprise or even of State industry. Trout can be preserved in private ponds, and should be, as they are, left to professional fish culturists to produce, and these drive quite a trade and make large profits, there being many hundreds of thousands of dollars invested in the business; but no one individual can retain any ownership over a fish which must go to sea, nor can even a single State, except in the rare case of the river being entirely within its own jurisdiction. We have established a National Bureau of Agriculture on a large and expensive scale. Why should there not be a similar institution for pisciculture? At least we can take a step in that direction, and begin on so small a scale as is proposed by this provision of law. The relative fertility of the water and the land is altogether in favor of the water. An acre of land will produce corn enough to support a human being, but an acre of water will support several persons, and could readily be made, with proper aid, to sustain the lives of many more. The former requires manuring, working, planting, and harvesting: the latter merely requires harvesting; and that where the fish are sufficiently abundant is hardly a labor at all. While the yield from the land is reasonably large the profit is exceedingly small. The field must be plowed, and harrowed, and fertilized; the corn must be planted; it must be plowed again; and still again, must be hoed; and at last the ears must be stripped, husked, and ground. What is the net result of this compared with the natural increase of fish grown in abundance, almost without effort, finding their own food, and finally taken in some net which does its fishing while its owner is sleeping?

Then the relative productiveness: the ear of corn grown from a single kernel will more frequently fall below than rise above a thousand grains. A shad lays, say sixty thousand eggs, of which we have said fifteen thousand can be brought to maturity with the care and oversight of man. Were the farmer to strew his corn broadcast over the sod and rock alike, "by the wayside and on the stony places," and leave it to come up with the weeds and tares without manure or attention, he would hardly expect a good crop, and would find much trouble in living on the proceeds, no matter how much land he owned, and yet this is precisely what we do with the fish. To judge by what has been effected it may be confidently asserted that fish culture is yet to add a very large proportion to the wealth and resources of the world, above all to the riches of this continent. At present our vast lakes are left untilled, some of the smaller ponds and many streams in the older and more thickly settled States have absolutely no edible fish in them, and some no fish whatever; the hook, the net, the spear and the "jack"—night spearing—has annihilated the last one. They teemed once with their natural inhabitants. Why cannot they be made to do so again? The evidence of our own and other countries clearly prove they can.

The decrease of fish is attributed to over-fishing and unseasonable fishing, which is true; but these are the ordinary concomitants of advancing civilization and increasing population, and only admonish us that man must use his mind to increase the supply. It has been alleged that the food had diminished even in the sea; and here again I cannot do better than quote from the report before alluded to of the New York commissioners:

"A familiar explanation of the decrease of fish, given by all those who are interested in keeping up the present unwise mode of destruction of the fisheries, is that their food has disappeared. It was essential in the first place to ascertain whether this was true; and to determine the question dredges were drawn over the mussel beds, and the water in various parts of the bays and ocean was examined, to see if it contained much animal life. These examinations demonstrated that instead of any decrease in the supply of food, it must absolutely have increased from reduced consumption and the destruction of its natural enemies; the bivalves, crustaceans, and all manner of similar creatures were abundant on the bottom, while the water was literally alive with animal matter, with polyps, infusoria, jelly-fish, &c. A bucketful taken from it anywhere was simply full of such animalculæ. Here was one point settled conclusively; true that the menhaden had been used for their oil to an extent that had made them scarce, and their disappearance had injured the more ravenous varieties of fish, but the bottom-feeders and the slow swimmers had around them more food than they could possibly consume."

The truth is the food is too abundant, for these creatures often prey on one another, the smaller varieties devouring the eggs and young of the larger, and becoming, in their turn, a prey to those of maturer growth. And here is the true explanation of the rapid extinction of fisheries when they become depleted beyond a certain limit. Nature balanced the number of each kind, providing that mutual destruction of one another should keep all in check. Man destroys this equipoise by killing those only that he can use. The rest then augment at an increased ratio, the enemies of all sorts of the edible kinds have no check, they multiply, and multiply until they obtain the mastery, and then quickly comes the end when the better sorts are exterminated. This is apparent, and is sustained by the fact that new varieties when introduced into unaccustomed waters increase for the first few years with inordinate rapidity. For a time their natural foes do not exist in sufficient numbers to curtail this growth, but as the latter develop the counterbalance is restored and the stimulated activity of reproduction ceases.

The time may come in the distant future when the edible fishes shall be made so abundant by artificial cultivation that the food of the piscivorous sorts may fail; then it may be necessary to breed those which live on water-grasses and vegetables to supply the others with sustenanee. At present, however, there is no such necessity; not only is the sea alive with food, but the large lakes are equally well peopled. It is a curious fact that in Lakes Huron and Superior is found the salt water shrimp in the deeper parts, and in quantities equal to that in the ocean. The shrimp, which itself is exceedingly prolific, is the principal food of the true salmon, the *salmo salar*, and is supposed to constitute the red color of the flesh. But if it were requisite the cyprinidae could be cultivated or introduced, or some other variety which lives solely on a vegetable diet, but which of themselves are not good for food. This will doubtless be done as soon as it is needed, and has already been successfully tried in Europe, so that should the present supply of fish food give out it could be replenished.

The fisheries of our coast are among the most valuable commercial interests of our country. Millions of money are invested and hundreds of thousands of men are employed, while the food thus obtained is a large per centage of the total supply of the eastern markets. Not only is the profit of this business a matter of general advantage, but the residents along the eastern bays and lagoons and upon the larger rivers derive their principal means of sustenance directly from these waters, and in all these districts far more families are supported by the water than by the land. In the West there is nothing of this sort. The markets are almost bare of fish ; a few cat-fish, suckers, and pickerel constitute the wretched and meager bill of fare they offer. The muddy Mississippi contains little or nothing. The beautiful Ohio has but one or two sorts of pike-perch, which the inhabitants flatteringly call salmon, while cat-fish hide in most of the discolored streams of our continent and suckers explore the bottom for their food.

If anything can be done to improve this state of affairs, to make fish and fishermen as abundant in the West as they are in New England, and to develop the same activity in this matter that exists in the East, it is well worth the serious consideration of the Government. By this means a new industry, an addtional source of income, an entirely different species of food would be introduced and an immense increase added to the wealth of the whole region of country. There is no reason why the waters of the West should be less prolific than those of the East, provided the right species were introduced ; and were trout, salmon, bass, shad, and sturgeon to take the place of catfish, pickerel, and suckers, the gain would be manifest.

It seems to me clearly to be the duty of the Government to assist in this very work of introducing new varieties, as well as replenish the old where they have been reduced. No private person can own a shad which is here to-day and in mid-ocean to-morrow, nor is a single resident on a river's bank sufficiently interested to incur the expense of importing fish for the benefit of his neighbors. This is the nation's duty or it is nobody's. The mighty rivers of the southern and western States, which now produce generally only the poorer sorts, could readily be stocked with the most palatable and prolific sorts. The shad has already been acclimatized in some of the Alabama rivers, where it never before was known, and the Potomac has been filled with black bass almost to repletion ; but that was the unaided effort of individuals as a mere matter of experimental curiosity. Other rivers remain still unimproved, and several foreign species of fish should be introduced. For instance, the magnificent Danube salmon, which attains a weight of a hundred pounds, might be acclimatized in the Ohio and the upper Mississippi, while the true salmon might be brought up to the Delaware and Susquehanna. This is perfectly simple and easy. Salmon have been transported while in the embryo state from England to Australia, half way round the globe; our white-fish, trout, and salmon-trout have been sent to England, and living shad were actually transported from the Atlantic to the Pacific, offering the possibility of supplying that entire coast and ocean with a new fish. This latter was a remarkable feat; but trout spawn are sent from one end of our country to the other with as little trouble or danger as letters, and are delivered by express precisely as other packages. The slow-hatching fish are the more easily handled in this particular, as the eggs develop slowly and will live perfectly well packed in damp moss, but other kinds only require care and experience.

The cost of this undertaking is insignificantly moderate. A salmon-hatching house can be built for $1,000 while the necessary implements for shad raising are too inexpensive to be worth mentioning. Some labor must be employed, but it is mostly unskilled and cheap, while the outlay for transportation is simply the mere charge of express or travelling fare. The people of this country would not grudge this were it a hundred times as great with the certain prospect of developing a new food resource and diminishing the price of living to the poor.

The importance of this matter can hardly be over-estimated. We raise animals for man's use, cross their breeds, study their food, and try and adapt their surroundings to their greatest development. We cultivate plants and vegetables, and strive to obtain new and improved varieties. We import cattle from Europe, horses from Africa, sheep from Spain, wheat from Egypt, sorghum from Asia. Our daily struggle is to make the most of whatever can be turned to the support of the human race, except with one great class which has always contributed, and, unless exterminated, always will contribute largely to that end. Who would have thought twenty years ago that a despised "love apple" could ever be converted into the useful tomato? And in earlier days who would have expected the change from the poisonous wild potato into the succulent root which now supports a nation and adds to the comfort of every human being?

What was done with the common tomatoes, potatoes, onions, and hundreds of other vegetable productions, which, as wild, were worthless, may in a higher degree be carried into effect with fish. Wild rice scarcely produces enough seed to continue the supply; but protected, developed, encouraged, it feeds a tenth part of the world. Fish neglected, destroyed, poached and wasted, can soon be annihilated. Their reproductive power can only maintain a certain equilibrium; incline that towards destruction, and the entire class will quickly disappear. Treat them like wild animals, and they will inevitably be exterminated; domesticate them, as it were, encourage their growth by putting them under healthful influences, protect them from unseasonable disturbance, let them breed in peace, guard the young from injury, assist them by artificial aid, select the best varieties for appropriate waters, and we will soon augment the supply as greatly as we do with either land animals or vegetables.

[It may be added here, that an appropriation of $15,000 was made by Congress; and notwithstanding the late date at which it became available, in the few months which have elapsed since, large numbers of shad have been introduced into the Allegheny river; into the White river in Indiana; into the upper Mississippi at St. Paul, and into the Platte at Denver, Colorado. Arrangements have also been made for securing salmon eggs on a large scale, some from the Penobscot in our own State, some from the Sacramento, California, some from the Rhine, etc. These are intended for introduction into New England waters, the Hudson, the Delaware, the Susquehanna, the Potomac, and into the great lakes. Nov. 72.]

CHEESE DAIRYING.

In my report for 1862, and again in that for the year following, a large space was given to the Dairy Interest. To procure trustworthy data in regard to cost and profits, improved methods of manufacture, apparatus, &c., those sections of other States which had been longest and most extensively engaged in it were visited, and minute personal inquiries and extensive observations were made. As a result of these, facts and considerations were presented to the farmers of Maine which, in the opinion of the writer, showed conclusively that the manufacture of cheese by associated action offered a rare opportunity, at that time, for so many of them as were favorably situated for it, to start up a new and highly lucrative branch of business. Confident anticipations were indulged that cheese factories would quickly spring up in considerable numbers. Had those anticipations been realized, no doubt can now exist, that the accruing profits during six or seven years would have been much larger than can be expected now. Within two or three years, however, several such factories have been put in operation within the State and with a degree of success which will probably lead to the establishment of more next year.

That dairymen in Maine can successfully compete with those of other States in the manufacture of cheese for export, at current prices, or at such prices as will probably prevail now that the business has been so extensively entered upon,* I am not prepared to assert; but to an extent sufficient to supply our own State, which now requires several million pounds annually, most of which is brought from other States, it would seem that small doubt can exist with regard to profitable production; and just as little that, to this extent, better prices can be realized than are obtained by those who make what is now brought here, inasmuch as the cost of freight, commissions and other expenses will be saved to the manufacturers. In view, therefore, of the desire of those who are now, or may soon be thus engaged, for information on matters relating to it, are here appended the addresses made by Messrs.

* Last year 1281 cheese factories were reported as in operation; 946 in New York, 103 in Ohio, 32 in Vermont, 26 in Massachusetts, 46 in Illinois, 22 in Michigan, &c. In 1862 there were less than thirty in New York.

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Curtis and Lewis at the meeting of the Vermont Dairymen's Association, last year, together with a paper on the Sugar Beet as an article of cattle food, by Mr. Lane of Cornwall, Vermont.

THE NEEDS OF THE DAIRY.

BY T. D. CURTIS.

The objects of this Association I understand to be, to improve the dairy interest. In this, and in every other well-directed effort for improvement, there should be no local jealousies, no personal rivalries, but cordial good will and earnest co-operation. Let each freely contribute his mite and avail himself of every opportunity to assist in rolling on the car of progress, and himself and the world cannot fail to be the better for it.

Practice and Theory must go Together. If we would make the most rapid and substantial improvement in any department, practice and theory must go together. They have remained too long unwedded; they should never be divorced. Too much practice without theory or a knowledge of principle to guide it, and too much theory without practice to test it, are alike fatal to progress. The one should be made to assist the other. United, they are unerring; divided, both are liable to lead astray. Theory is of no value until it is reduced to practice; and practice is often not only erroneous but even pernicious when not guided by true theory. Both *may* be right without their ever having been coupled; but they lack the element of certainty which a union would give them, and therefore have to be taken on faith, instead of on knowledge drawn from actual experiment. To make the way clear and certain, our practice and our theory must go hand in hand. Our theory must guide our practice, and our practice must support our theory.

More Brain and less Muscle. At present, most of our practice is like the Irishman's fiddling. It is told of the violinist, Ole Bull, that in his travels he came upon a group of jolly Irish peasants. They were dancing to the music produced by horse-hair and catgut in the hands of a burly son of Erin, who played with unusual animation. Struck with his manner, at a pause in the dance the great Norwegian fiddler approached the great Irish fiddler, and, bowing gracefully, asked: "My friend, do you play by ear or by note?" Drawing himself up and looking puzzled, Pat replied, with great dignity: "I fiddle by main strength, be jabers!"

We work too much on this principle in every branch of agriculture. What we need is more brain and less muscle. Our efforts should be directed with more intelligence, so as to save the great waste of power to which we are now subject ourselves. When the country was new and covered with timber, raw muscle was the principal thing needed; but now each year calls for more brain, for higher intelligence, in the management of the too much exhausted soil. Machinery takes the place of muscle, and every piece of machinery demands intelligence and judgment on the part of the laborer who may be called upon to operate it. Our agriculture, as well as our mechanics, is calling for skilled labor. The obvious inference is, that we must have educated farm laborers—more brain and less muscle.

A certain amount and kind of education is recognized as indispensable to cheese-making; but, unfortunately, our knowledge of the principles involved in this department of agriculture is still very limited and indefinite. But the need in this field is felt and acknowledged, and the required information will soon be forthcoming. Here, the call for more brain and less muscle is very urgent and loud.

Too much Spirit of Speculation. To come more directly to the subject,—"The needs of the dairy, and how to improve the dairy interest,"—I must deprecate the hasty spirit of speculation which has crept into it, as into everything else in this glorious New World. I am not of those who think that the chief end of man is to make money. I believe in industry and economy, and that every one should try to make some provision for emergencies and for support in old age. But physical and mental health are of some consideration, and I do not consider that man is fulfilling the highest objects of his existence, and answering the best demands of his nature, who is not steadily adding to his stock of knowledge and improving the moral man within him. This he cannot do if he worships the "almighty dollar."

But admitting that pecuniary gain is desirable, there is a homely but true old adage which it would be wise to bear in mind: "The greater the haste, the less the speed." The man who is in a great hurry to get rich is apt to sacrifice the future to the present. He does not lay his plans deliberately, and patiently await the result, but too often kills the goose that lays the golden egg. But in agricultural as in religious matters, that which is best for the future is best for the present, and yields the most fruitful harvest.

There is a broad application of the text: "Seek ye first the kingdom of God and His righteousness, and all these things shall be added unto you." Improve the soil of your farm and the soil of your immortal nature, and wealth and happiness will surely be your reward.

Must Build for Permanency. To come directly to the dairy interest, we must stop building in a hurried, speculative spirit, and build with reference to a permanent future business. Every farmer ought to decide whether his farm is to be devoted to grain-raising, to stock raising, or to dairy purposes, and build accordingly. In my section, hundreds of thousands of dollars have been lost by the erection of cheap factories and cheap private dairy houses. There was some excuse for this when the factory system first started. It was not yet demonstrated how it would work, and even if suited to some localities it was not known how it would operate in others. So our dairymen knocked together cheap buildings, that would answer for a few years and then could be thrown away or converted into hay barns or stables, without much loss. They furnished these buildings in the cheapest manner possible, often,—but not always,—got the cheapest help to be had, and commenced taking in milk. The experiment proved successful, so far as demonstrating the utility of the factory system. It was profitable for the factoryman, and it was profitable to the patron—especially so to the man with a small dairy. It furnished more money, it afforded him quick returns and gave him ready money to use, and—what was not, by any means, the least of its benefits—it relieved the hard-working, long-suffering and patient wife of a very great burden—the care and work of the dairy. To her, it was like opening the prison doors, and bidding her go free. It was no wonder, therefore, that the factory system at once became popular.

But while this system was a vast improvement on the old one, in many ways, our dairymen lost hundreds of thousands of dollars, and continue to lose, by the hasty and cheap manner in which it was introduced. They lost, not as compared with the old system, but by not securing all the benefits of the new. Few of the earlier built factories were erected with any reference to controlling the temperature—of either warming them in the cold weather of the spring and fall, or of keeping them dry and cool during the wet and hot weather of the summer. The consequence was—very great loss from imperfect curing, deterioration in quality, and loss of flavor. Many a poor cheese maker has undergone untold mental torture, and been unjustly condemned by the patrons for whom he worked, because he had not the proper facilities for curing his cheese. In the cold, wet weather of the spring and fall his cheese stood on the ranges turning to poor hog-feed, instead of changing to food fit for human beings; and during the hot days of July and August they were toasted at a temperature ranging from 80 degs. to 100 degs., which fried the butter out of them, hastened the putrefactive action to such a degree that the gases swelled them up like the housewife's batch of dough for bread, and of course destroyed the flavor. The result was, that the buyers "blowed" the cheese, if the flies did not, a less price had to be taken for them, and everybody was dissatisfied; whereas, if the make-room and curing-room had both been built with double walls, and lathed and plastered, so that the temperature could have been kept near 70 degs., everything would have been satisfactory—*provided*, the patrons delivered their milk in a proper condition.

Of late years there has been some improvement made in the curing-rooms, by partitioning off one end and lathing and plastering it, for curing early and late made cheese. But little or no provision has been made for keeping down the temperature in "dog days," while the importance of controlling the temperature of the making-room has been entirely overlooked. Many of the old factories still stand just as they were first erected, save they are growing dilapidated, are surrounded by the accumulated filth of years, and their walls are reeking with the crop of fungi which is ready to scatter its seeds everywhere and breed more devils than the magic of any cheese maker can possibly exorcise. In consequence of this, most of our old factories fail to make the progress that they should, and it may reasonably be doubted if they will ever be able to produce the finest grade of cheese until they are thoroughly renovated and cleansed.

You do not want to repeat our mistakes. You should build in a more substantial manner. You want tight, double walls, the inner one lathed and plastered. You want double windows, so arranged that they can be easily opened when required, and all the necessary preparations made for controlling the temperature of both the make and curing room. And, withal, you must provide for thorough ventilation; underdrain, if necessary, so as to have dry ground for your factory to stand on, and see that your whey and slop-water are conducted off, and not allowed to grow fungus and breed flies to annoy you and injure the products of your factory. All your surroundings must be airy, clean and sweet, and provision must be made for keeping them so. One would think common sense would suggest this. But in central New York, either our dairymen have turned a deaf ear to the teaching of common sense, or common sense has not done her duty. Perhaps it will be different here.

Secure Justice to the Producer. One great drawback in the factory system—an evil that must and can be remedied—is the crediting of the patron with the number of pounds of liquid which he draws to the factory, instead of the real value of what he delivers. Every patron should be given credit according to the value of his milk—neither more nor less. Under the present system of crediting by weight, the man who brings poor milk gets too much credit, and the man who brings good milk gets too little credit, if we take value into consideration. This is a very great evil, aside from the injustice it does. It in effect offers a premium to brutality and dishonesty, while it discourages the honest man who keeps his cows well and brings rich milk, unwatered, to the factory. I publicly called attention to this subject nearly two years ago. I concluded with these remarks: "The quality of the milk is nowhere taken into consideration. The man who has a well-selected dairy, keeps it well, and delivers milk that will turn out, for the season, a hundred pounds of cheese for every nine hundred pounds of milk, gets no more returns for a given number of pounds of milk than the man who delivers milk so poor that twelve hundred pounds of it will not make more than a hundred pounds of cheese, or the same as the former's nine hundred pounds. There is a difference of about twenty-five per cent. in the quality of the milk turned out by the good and the poor dairies. Some means should be devised for remedying this piece of injustice, if the better class of dairies is to be retained by the factories."

I have seen no cause to change my opinion since I wrote those sentences. The subject is beginning to attract the attention of our leading dairymen. At the last Convention of the American Dairymen's Association a committee of five was appointed to consider the question of giving credit to patrons according to value instead of according to weight. Of course, weight or measure will have to form the base of any system adopted. But many now believe it possible, by the use of the lactometer and cream-gauge, to decide upon some standard of ascertaining the value of milk that will be just and more satisfactory than the one now generally in use.

Importance of Systematic and Scientific Experiments. This brings us to the question of the importance of thorough scientific and practical experiments in connection with the dairy. There are very few points positively determined. We need a series of experiments to determine the value of different grades of milk for butter-making and for cheese-making. By such experiments I think we shall discover that there is a marked difference between a good butter dairy and a good cheese dairy, and that we should select our cows with reference to which branch of the dairy we wish to engage in. I think a good butter cow may be indifferent for cheese, and that a cow good for cheese may not be very valuable for butter. Hence the value of the milk of a cow will depend much on the use you wish to make of it. Two cows may be of equal pecuniary value, the one for butter and the other for cheese; but if we put them both to butter-making or both to cheese-making we shall find a marked difference in their value. If you are making butter, it is the cow which yields the most cream, no matter how small or how large a mess of milk, that is the most valuable. If you are making cheese, a large yield of caseine is what you desire. But if you are carrying your milk to a factory, the cow that gives the greatest number of pounds of liquid is the one that brings you the most money. It is for your interest that all your neighbors should send to the factory milk rich in cheese, with cream enough to keep up the quality; but you are desirous of having the largest number of pounds in your own milk-can, whatever its quality may be—and we of central New York sometimes find men dishonest enough to increase the yield of their dairy by resorting to the pump. It might not be so here, but, although there may be a moral difference, I see none when we view it in the light of equity, whether we carry milk watered so that it will take twelve pounds to make a pound of cheese, or draw it from the cow so poor and thin that it will give no better yield of cheese. But if we can hit upon a just method of giving credit according to actual value, it will be an object for even the dishonest patron to carry good milk to the factory, and to select his cows, and to keep them well, for that purpose.

Aside from determining the value of milk, and whether it is better for butter or for cheese, we need a thorough system of experiments to ascertain the best conditions and the best methods of manufacture. We have made very great improvements within the last ten years—especially in the art of cheese-making. Yet there are very few points in cheese-making that are finally settled. We do not know even the temperature at which it is best to set the milk. We usually set it at 80 degs. to 85 degs., and then gradually raise the temperature of the curd to 96 degs. or 100 degs.—usually to 98 degs., or blood heat. I strongly suspect that we should do our warming up before setting the milk, and then set it at the same temperature at which Nature sets it in the calf's stomach. There are many plausible arguments in favor of this; but I am not aware that it has ever been tested fully by actual experiment. The liquid is much more easily heated than the solid curd with its immovable particles; 98 degs. is only blood heat—the temperature at which the milk is drawn from the cow; the acid more readily developes at this point than any other; the rennet is more active at this temperature; and by raising the temperature of the milk before setting it we should avoid a good deal of stirring and a proportionate amount of waste. But what will be the quality of the cheese, how will it cure, how will it keep? Experiment must determine. We should most undoubtedly hasten the process and save labor, by heating the milk instead of the curd. But we can make cheese without raising the temperature of either milk or curd. The process, however, would be much slower. Which is the better of the two—the heating or non-heating process? Or are we practicing the best method now? Who knows?

In the pressing and the curing of cheese we are just as much in the dark. We are little more than poor imitators, and grope and stumble along in doubt and anxiety. We shall continue to do so until we bring science to our aid, and by practical tests determine every point in the process of cheese-making. In this way we may lift it to the rank of a science, and work with the satisfaction and success of rational beings who know what they are doing.

For the purpose of securing the results which I have indicated, not long since, I read before the Central New York Farmers' Club a paper in which I suggested the erection of a model experimental factory, to be devoted as far as required, to a well-arranged system of practical scientific experiments, analyses, &c., in both butter and cheese-making. Apparatus as well as methods should be tested, and a perfect record kept of the results. In short, I would "try all things and hold fast that which is good." The factory, when no longer needed for experimental purposes, would be worth its cost for an individual or a company to run for their own gain. In this way the desired end would be reached in a safe and economical manner, and who can doubt the vast benefit it would be to our great dairy interest?

Rennet. One of the most important things in cheese-making is rennet, and I do not think it is taken sufficiently into consideration by dairymen generally. For the purpose of further illustrating the importance of bringing science to our aid and wedding it to practice by a series of properly conducted experiments, and also for impressing upon your minds something of my own ideas of the attention we ought to pay to the subject of rennet, I must detain you by the recital of a few facts.

Two of the most valuable papers ever given to the dairy public were read before the American Dairymen's Association, at its convention in 1869. One of them was read by Mr. L. B. Arnold, of Tompkins County, and was entitled, "Rennet—Its Nature and Use;" the other was read by Prof. Geo. C. Caldwell, of Cornell University, and was on "Fermentation and Putrefaction in their Relations to the Manufacture of Cheese." I will first give the substance of Mr. Arnold's paper. After a twenty-five years' search for the active principle of rennet, he found it to consist of microscopic globules, so small that they could with great difficulty be separated from the liquid prepared for use in cheese-making. But by making a filter of a piece of charcoal, he succeeded in catching the microscopic globules, only the pure brine, destitute of any coagulative virtue, passing. These globules are about the specific gravity of milk. They begin to break and disappear at a temperature a little above blood-heat, and are all destroyed at a temperature of about 140°. Acids and alkalies do not affect them if weak, but destroy them if strong. On examining the inner lining of the calf's stomach, he found it "nearly as porous as honey-comb," to use his own expression. These pores were the mouths of tubes opening into the stomach, and the tubes were full of these globules, those at the mouth being more developed and larger than those following behind them. These globules do not mix much with the gastric juice when the stomach is empty, but adhere to the surface, forming a delicate, light flesh-colored coating, which easily washes off or flakes off when the stomach is handled. He says: "The first soakings of a stomach produce a better coagulation than those that soak out last. In the former, the curd is firm, and the cream globules seem to adhere to it tenaciously, while the latter produces a softer curd and is more like an acid effect, and the cream appears as if only mechanically enclosed. This difference occurs when the coagulation in the two cases takes place in the same time. It is greater in some rennets than in others." As to the number of these globules, Mr. Arnold rubbed a single rennet in a gallon of water, and found a drop of the liquid to contain at least 500,000. By computation he showed that the one rennet used by him contained not less than 130,000,000,000 globules. He adds: "These infinitesimal bodies, though exercising an insignificant influence when acting alone, when taken together, like polypes in the coral, work out important results. They not only effect coagulation in the milk, but are the cause of changing the curd into cheese."

We are wont to point with pride to Franklin with his kite, drawing electricity from the cloud; but does not the plain farmer of Tompkins County, New York, with his microscope and piece of charcoal, discovering the active principle of rennet, present quite as imposing a figure? He was the first to give to the American public a knowledge of this principle, and its mode of operation. It does not detract from his laurels that some of the German and French chemists preceded him in the discovery. He in a practical way demonstrated the problem for himself, and hastened to lay before the dairymen of America, the results of his investigations. I am not aware that any American can lay claim to priority of discovery. Certainly, he was the first to announce it, and to him is justly due all the honors of an independent though a second discoverer.

The fact given by Mr. Arnold that the first washing of rennet makes firm curd and holds the butter better, suggests to my mind the desirability of keeping two vessels for soaking rennets, and a third of twice the size to receive the liquid. In this way we may always have a batch of rennets in the first soaking and one in the second. We rub both at the same time and mix the contents of the two vessels in the third and larger one, thus avoiding the use of the weaker second rubbing alone. By the mixture we shall be likely to make an evener and better lot of cheese, besides retaining in it more of the butter.

We cannot be too careful in the saving of rennets, nor in taking care of them. Much of our bad flavored and poor keeping cheese, I apprehend, is produced by bad rennet. The difference in the strength of rennets is well illustrated by the experience, during the past season, of one of the best factories in Herkimer county. Mr. Moon, of the North Fairfield factory, sent to the *Utica Morning Herald* a report of the operations of his factory during the past season. Near the close I find these items: "Number of rennets used, 430. Of these, 330 were received from patrons, and each rennet, on an average, coagulated the milk for 462 pounds of cheese. The other 100 rennets were bought in the market, and called 'butchers' rennets.' Each rennet coagulated the milk for 158 pounds of cheese." It will be seen by this that the "butchers' rennets" were worth only about one-third as much as those saved by the patrons for coagulating purposes; and I have no doubt that the difference in quality was quite as great.

Too much care cannot be exercised in saving rennets. They should be taken from healthy calves with good digestive powers, soon after the stomach has emptied itself, carefully cleaned, so as not to lose any of the little globules that act on the milk, thoroughly salted, stretched on a bow or crotched stick, and dried in a cool place. This is the best method I know of, but experience may yet develop a better. We need experiments in this direction as well as others. Mr. Arnold succeeded very well in preserving rennets by soaking them in a weak preparation of carbolic acid and then drying them as I have indicated. But he found great care necessary to prevent the acid from decomposing the animal substance of the rennet so that it would dissolve and fill the liquid with particles of animal matter. His charcoal filter for deodorizing rennet I consider valuable. It is formed "by perforating the bottom of a butter-tub, or any thing similar, and laying several thicknesses of muslin on the bottom to catch the coal dust; then lay on two or three inches of pulverized coal, and on it one thickness of muslin; then lay on clean sand enough to hold the coal in its place. The sand will assist also in distributing the rennet over the whole surface of the coal. Then pass water through the filter till it will run through clean. The liquid rennet may then be passed slowly through by falling upon the sand in a stream proportioned to the size of the filter, when it will come through sweet and pure, with its efficiency but little abated. Rennet thus deodorized loses all tendency to huffing, and also its liability to give any bad flavor or smell to the cheese." Mr. Arnold adds:

"In most rennets the amount of foul odor is so great that the coal will soon become saturated and need changing."

How Cheese Cures. Turning now to the address of Prof. Caldwell, we find the discoveries of Mr. Arnold carried into the process of curing cheese. The little globules which he found in rennet, the Professor tells us are the spores or seed of the micrococcus, which is one of the various forms of the common blue mould. The spores are not only found in rennet, but exist to some extent in the blood of all living animals and in the milk of the cow. Their multitudinous existence in rennet, and their rapid development throughout the mass of milk, causes coagulation. They feed on the nitrogen in the milk, and continue to propagate in the cheese set on the ranges until the whole mass of animal secretions is converted into one of the forms of the common blue mould, which is a vegetable product. So it is a question for debate whether ripe, mellow cheese is animal or vegetable food. The quality of cheese depends very much upon the form of development which the spores in the rennet take. If they take the form which is found in vinegar yeast, we have a sour cheese. If they take the form found in lactic yeast, we have a sour cheese of a different kind. The development of alcoholic yeast must give us a sharp cheese. If we can preserve a balance between these, and the development does not get much beyond the form known as putrefactive yeast—that is, if we can keep the cheese in the first stages of putrefaction, until it is completely converted into micrococcus—the inference is that it is in the most palatable and nutritious condition. The direct path of development, according to Prof. Caldwell, seems to be putrefactive yeast, the first stage; then alcoholic or lactic yeast; then blue mould. It may be accompanied by three or four other products. It may pass through other channels of development. But the end is blue mould.

I do not wish to indorse or condemn Prof. Caldwell's assertion that the spores in rennet and the spores of blue mould are the same. Though similar in some respects, my impression is, however, that they will, on careful examination, be found to be dissimilar.

I do not pretend to have exactly indicated the different conditions which a cheese may go through on the road to blue mould, of which the active principle of rennet seems to be the seed, assuming that Prof. Caldwell is correct. I only wish to show that the development may take different forms, and that the form of this development will determine the condition and quality of the cheese. What we need is a series of accurate experiments and investigations to determine which form, or combination of forms is desirable, and how to secure the development which we want. We not only want to know how to prepare the curd, but how to cure it, so as to get such a cheese as we will, and then preserve it for use for a reasonable length of time. To do this, we shall have to begin with the milk as soon as drawn from the cow, and manage it with great care until the desired end is reached. As yet, to guide us in this, we have but a few hints. The spores already in the milk and those added in the rennet, do no harm, but appear to be essential to the accomplishment of our object. The spores introduced from the impure air and by contact with foul pails, utensels, strainers, etc., are highly detrimental. These intruders are the ones that play the mischief and give us all our trouble. They are the tares sown by the enemy, and the greatest vigilance is required to keep them out.

Pure air is found to exert a conservative influence. Hence, airing milk greatly assists in its keeping. Cooling it as soon as drawn and keeping it cool, retards very much the fungus development. From these facts we see the importance of milking in a clean atmosphere, of cooling milk as soon as drawn, and of keeping it exposed to the air. Nothing is worse than to shut up hot milk in a tight can, and leave it to stand over night, or to carry it from one to three miles, in the broiling sun, to the cheese factory. An experiment made by Muller is to the point. He put milk in two vessels, covering one and leaving the other open. The temperature of both was kept at 65 deg. The cream and milk of the open vessel were sweet at the expiration of twelve hours; but that in the covered vessel was not only sour, but emitted an offensive odor. Cool your milk as soon as drawn, and keep the tight covers off from your milk-cans as much as possible.

Increase the Consumption of Cheese. It would improve the dairy interest to increase the home consumption of cheese. One way to increase it, is for us all to eat it. It is nutritious, healthful and economical beyond almost anything else that we can put on our tables. Another way to increase the consumption of cheese is uniformly to make a better article, and allow none but the best to be cut for home consumption. If small cheese are wanted, we must make enough to supply the demand. For my part, I prefer a cut from a larger cheese. It is apt to be mellower, and to have a better flavor. I have never tasted a small cheese that was strictly fine. But whatever is wanted we must make, and stop selling our home dealers all the poor cheese that the regular buyers will not take. We can soon double the home consumption by allowing none but strictly fine cheese to be cut by our local dealers. It will create an appetite for cheese, and soon make people feel that it is better to eat more of it and less meat. This home market is of far more consequence to us than the foreign. It is steadier and more reliable, and costs much less to reach.

Reduce the Cost of Production. Another important consideration is reducing the cost of production. We can do this some by improvements in apparatus and methods; but we can do much more by increasing the productiveness of our dairies and farms. Our cows all ought to be as good as the best, and in a few years we may have them so. A good yield is thought to be 400 pounds of cheese per annum. Probably 350 pounds is nearer the average. This is about one-half too low. In the *Utica Weekly Herald* of January third, is a statement of the products of the private dairy of Mr. Nicholas Smith, of Herkimer county. He keeps twenty cows, and has sold 14,200 pounds of cheese made during the past year. This is 719 pounds to a cow. We all ought to know how he selected his dairy of cows and how he keeps them. By imitating his example, we might double our production, which will go far toward reducing the cost one-half. Is not this worth looking after?

Further, we must increase the productiveness of the soil. By under-draining, the proper preparation and use of manures, and a more enlightened system of tillage, we must make two blades grass grow where one grows now. It can be done easily, and in many cases we may increase the yield four or five fold. But perhaps some one will plead poverty—that he has not the means to improve his farm. Then make the farm produce the means. Begin with a small piece—the handiest you have. This will help you put a piece twice as large in proper condition. Keep on in this way, making the increased productiveness of one piece improve another, and in a few years you will have means to do as you please. But, if you always look for immediate returns, and do nothing that you do not expect to exhaust the benefits of the same year, you will always be poor, and deserve to be. Till your farm for the future as well as for the present, and you will reap an increasing reward. When you have seletced a dairy, and keep it so that it will turn you 600 or 700 pounds of cheese per cow each year, and have improved your farm so that it will keep twice the number of cows that it will now, you will have both wonderfully reduced the cost of production and increased your profits.

Importance of Education. Do not despise book-learning, but at once avail yourself of its benefits. There is a vast amount of knowledge "lying around loose," waiting for some one to pick it up and make it available on the farm. You can find time to learn a fact or master a principle every day that will ten times repay you for the time and trouble of acquiring it. Science is scattering knowledge broadcast over the world, and it is your business to help in utilizing it. It will not only enable you to make more money, with less exhausting labor, but give life a new interest and make you feel that it is worth something to live in the world. The time has come when our farmers must be educated. From mere drudges and the producers of raw material for the rest of the world, they must soon become the most intelligent class of men among us. No field of knowledge must be altogether unfamiliar to the farmer of the future. Chemistry, Natural Philosophy, Botany, Entomology, Geology, Meteorology, Physiology, Comparative Anatomy—these and many other branches of science he must have at least a general knowledge of, and with some he must become familiar. He should understand his own physical structure, and his own physical and moral nature. The principles underlying animal and vegetable life must be mastered, and he must understand the habits and characteristics of the insects, worms and weeds that he has to deal with, as well as he does the needs and wants of his stock. The composition of his soil, the kind and quantity of manures which it requires, and the demands of the crop which he is about to put in, he must know, and prepare to accomplish his end with the same intelligence, care and certainty that the chemist produces his results. There is no position in the world which requires so much knowledge and judgment as that of the future farmer. By the side of his, that of the professional man sinks into the shade. At present, the latter has his library and reads up for a special purpose, while the farmer, who has much more need of knowledge, both special and general, has no library, and seldom looks into any book but the Bible, with an occasional glance at the almanac. This must not, cannot be much longer. Our farmers must be thoroughly educated, and possess well selected libraries, to receive constant additions from the best publications of the day. The farm cannot much longer do without book-learning. And when we get it thoroughly planted there, thus wedding science with practice, farming will be considered the noblest calling on earth, and the best intellects will be found devoted to its service. Then indeed will "the wilderness blossom as the rose," and the millenial era dawn upon our now darkened world.

Educate your Boys and Girls. By all means, begin to educate your boys and girls for the new era, for the higher life in agriculture. Let them no longer look upon farm labor as degrading, back-breaking drudgery, but as demanding the highest services of the best intellects. In no other position is there the opportunity for so much progress, and for doing the world so much good. With the book of nature constantly open before us, and all the lights of science for our guide, where can the intellect have such ample scope, and all the powers of the mind be called so fully into play, as on the farm?

MR. LEWIS' ADDRESS.

I come before you on this occasion, as one having interests nearly identical with yours. Your State produces, and will continue to produce to the end of time, (with proper management), grasses unsurpassed for the production of butter and cheese, and for the feeding of horses, cattle and sheep.

So also Herkimer county produces grasses well adapted for the production of good cheese. And notwithstanding the changing policy of the Government, which will render an industrial pursuit, which is good to-day, worthless to-morrow, we can say, surely *all flesh is grass.*

The constant development of the varied resources of our country, embracing as it does almost every variety oi climate, and of soil, will also render certain interests unprofitable where they have been profitable, and others profitable where they have been unprofitable, or untried.

But owing to the very small area of good grass-producing lands, which are otherwise well adapted to the production of butter and cheese of the first quality, you of Vermont, and we of Herkimer can change our milk, produced from our rich, aromatic from our rich, aromatic grasses, into butter and cheese, of that quality which will enable us to defy competion in any market of the world.

For the purpose of enabling us to do this with the greatest degree of certainty, and with almost unvarying success, are we assembled here in council to-day.

At the request of your worthy Secretary, I will endeavor to present to you in the most simple terms, the Herkimer county method of cheese-making, as at present practiced by our most successful cheese-makers.

CHEESE-MAKING.

The evening's milk is strained into the cheese vat, as the milking is proceeded with, until all the milk is in, when the agitator is set to work by the waste water used to cool the milk, and by its gentle movements back and forth, the milk is soon freed from all new milk smell, or what is termed animal odor. It is not desirable to cool the milk very rapidly, and if it is cooled to the temperature of 65 deg. within three hours from the time the first milk was put into the vat, it will be found quite soon enough to cool it. Milk cooled below 60 deg. and kept at that temperature during the night, will not make so good cheese as that left at the temperature of 70 deg. Again, unless the temperature of the milk can be controlled independently of the temperature of the atmosphere, it is better not to cool below the temperature of the atmosphere, than to cool below and then permit the atmosphere to raise it again during the night. Those dairymen who have no running spring water with which to cool the milk, but use ice in connection with water from the well, often commit this mistake.

If the agitator has been in operation during the night, no cream will be found on the vat in the morning, and the agitator may be continued in operation until all the morning's milk is added, when the water should he shut off, the agitator removed, and the milk warmed to the temperature of 84 deg. for the reception of the rennet during warm weather; at from 80 to 82 deg. during hot, and from 86 to 88 deg. during cold or cool weather, provided the temperature of the manufacturing room is under control of the outside atmosphere. If the agitator has not been used during the night, (which I do not regard necessary during cool weather, unless all the cream is to be retained in the cheese), a cream will be found on the milk in the morning, varying in firmness and quality, according to the favorable or unfavorable conditions of the temperature of the milk, and condition of the atmosphere for its separation. This cream receives different treatment from our best cheese-makers, for the reason that no one of them is able to again incorporate it in the milk and retain any considerable proportion in the cheese.

Some dairymen mix this cream with the milk by thinning it with new milk and then passing it through the strainer back into the vat before adding the rennet.

This method requires the least labor of any, but if the whey is to be fed to the hogs, the labor of thinning and straining may be saved by turning the cream directly into the pig trough. Others add the rennet before returning it to the vat, upon the supposition that the rennet, acting upon the cream before it is stirred into the milk, will hold it in the curd.

Again, other cheese-makers reduce the cream to about the consistency of milk, by the addition of water at the temperature of 70 deg., then add the rennet before stirring it into the milk. This has enabled me to retain a greater percentage of the cream in the cheese than any other method I have yet tried. But the bad effects produced on the cheese by the addition of water to thin the cream, is greater than the advantage gained by the small amount of cream retained.

A trial of several years to retain the cream in the cheese by a variety of methods, led me to the conclusion that if the cream was firm when taken from the vat, no considerable portion of it could be saved in the curd by the action of rennet; the greater portion of it would separate itself from the curd while in the vat, or press, and float off on the surface of the whey.

The continual failures to save the cream in the cheese, led me to adopt the practice of churning the cream sweet, and of using the buttermilk for cheese, and the butter for family use. I have come to the conclusion, therefore, that by using the agitator during the hot weather, and by churning the cream sweet during the cool weather, that nearly all the cream can be saved.

With my former practice I have made during the summer season over a barrel of whey butter in addition to that used for greasing cheese; while with the latter I have often failed to make one-half whey butter enough to use on the cheese; and by careful estimates I have found the net saving some weeks as much as two dollars, besides having very nice, new butter for family use. This butter made from sweet cream, although not possessing long-keeping qualities, I regard as a very great improvement over the swill butter made somewhere on the road between the cheese vat and the pig pen.

The cream having been disposed of in some way, and the milk at the temperature of 84 deg., the coloring matter should be added in just such quantity as the consumers demand. Unless the annatto is well dissolved and thoroughly stirred into the milk, the cheese, when cut, will present a mottled appearance, which is altogether worse than if uncolored.

If the cheese is to be kept a year or more, add sufficient rennet to coagulate milk in about fifty minutes; but if it is intended for early use, a sufficient amount of rennet should be used to coagulate it in from thirty to forty minutes.

The rennet must be thoroughly stirred into the milk to insure its action upon the whole mass at the same time.

As soon as the curdled milk will break clean when the finger is dipped into it and raised up in a horizontal position, it is ready to cut. Now if the curd could be cut into cubic blocks one half inch in size at a single operation the best results would be obtained, but as no way of doing this has yet been discovered it must be done with a knife requiring as few motions and with as little friction as possible, for all crushing and bruising of the curd at this stage of the process will cause waste.

This fact should be kept in view during the entire process of cheese-making: *That if there is any waste the butter is invariably the part lost.*

After the curd has become somewhat firm, and settled about one seventh of its depth below the surface of the whey, heat may be applied gradually until the temperature is raised to 90 degs.

If the heat is equally distributed very little stirring will be necessary, only enough to prevent the curd from settling in a mass on the bottom of the vat, and if any stirring is to be done while the curd is soft and tender it should be done with the utmost care, and the whey should all be left on, as the curd will move with less crushing in a large quantity of whey. As soon as the curd becomes of sufficient firmness, so that it may be gently stirred without waste, the whey may be drawn down to near the surface of the curd, and the heat raised to 98 degs. or 100 degs., and maintained at about this temperature until the cooking or scalding process, as it is called, is completed. This is determined by the condition of the curd, in the following manner: Take a handful of curd, squeeze the whey out, and if the curd will drop apart as the hand is opened, the cooking has been carried far enough, and should be arrested, either by drawing off the whey or cooling down to the temperature of the room by the use of cold water between the vats.

After a little experience the careful cheese-maker will be enabled to turn off the heat in time to give the curd the required firmness by the time the temperature of the curd has fallen to a level with that of the cheese room.

And whenever the judgment of the cheese-maker, and the condition of the curd will warrant the adoption of this plan, it will be found less laborious and more economical.

Under the old system of cheese-making the curd was drained at this stage, then salted, and put to press.

But another chemical change is now considered necessary for the production of the finest quality of cheese. The milk sugar must partly change to lactic acid. This change should never take place until after the cooking process is completed. The acidifying process, as it is called, is by far the most important point in the whole process of cheese-making. To insure the right scald, and the right degree of acidity, care and good common sense are required, and in addition, an apprenticeship is absolutely necessary.

No rules can be given on paper which will serve the cheese-maker as an unerring guide by which these two important points can be decided so long as milk is ever varying in composition, and changing its condition with every change of temperature, from the moment it is drawn from the cows until it is manufactured into cheese.

These two vital points in cheese-making must be determined by sight, taste and smell. And as no two persons possess these senses in precisely the same degree of perfection for any considerable time, for the reason that they are liable to destruction and capable of improvement, no rules, as I said before, can serve and guide alike two individuals in the use of these faculties.

The most common practice of our Herkimer dairymen is to allow sufficient whey to remain in the vat to cover the curd until the degree of acidity desired is obtained, when the whey is drained off and the curd salted and put to press. The acid will always be detected in the whey before it can be discovered in the curd, and when both are left in the vat the whey should be decidedly sour and the curd perceptibly sour.

But the better way is to draw off the whey as soon as the cooking is completed, pack the curd together in one end of the vat, elevate sufficiently to allow the whey to drain off, and let it remain until the required degree of acidity is obtained. The whey often contains some disturbing element injurious to the cheese, and when it can be of no further service its absence is more desirable than its company. The curd, moreover, is improved by exposure to the atmosphere in its texture and its color. The curd may be exposed to the atmosphere while undergoing the acidifying process by splitting it apart horizontally with the hands, and spreading it out and turning it over, according to Mr. McAdam's plan for making Cheddar cheese; but the best time for exposing the curd to the action of the atmosphere is after grinding and salting. Most dairymen who practice grinding the curd, do it as soon as it becomes sufficiently soured. To this practice there are two objections. First, the quantity of whey contained in the curd is never known; and second, the amount of salt dissolved by the whey and carried out with it is likewise unknown.

The safer way is to press nearly all the whey out of the curd, which can be done in a few moments, without waste, if the cheese has been rightly manufactured, and then to slice up the curd with a knife, run it through the curd mill, and salt it. The early cheese, known as "hay cheese," should be salted at the rate of one pound of good salt for sixty pounds of curd. The proportion for grass cheese, up to about the first of September, should range from fifty-two to fifty-eight pounds of curd to one of salt. From the first of September to the close of the season, one pound of salt will be sufficient for from fifty-eight to sixty-six pounds of curd.

I would add that where the curd is pressed before salting, the salt must be fine and thoroughly mixed with the curd. If the curd is not pressed before salting, an average of one pound of salt for forty pounds of curd will be found none too much, and may be varied through the season as above directed.

When the temperature of the curd at the time of salting, is above that of the cheese-room, it should be spread in the vat and cooled to an even temperature with the atmosphere surrounding it, or near it, before putting it to press.

And now, in conclusion, allow me to present for consideration the following propositions :

First. *Perfect neatness* in everything pertaining to the dairy is an absolute necessity.

Second. Milk free from all impurities, taints and odors, or in other words, *pure milk,* is essential to success.

Third. The greater the yield of cheese from a given quantity of milk, the better the quality ; and the less the yield, the poorer the quality.

Fourth. The cheese-maker must be qualified for the business, first, by nature ; second, by study ; and third, by practice.

And, finally, unfailing success will attend those cheese-makers only who attend in time to all the minutiæ of the business.

In reply to a question Mr. Lewis said : To salt the curd without draining it, is the general practice, and where curd-mills are used, the curd is seldom pressed before grinding; but I would always do it, for you avoid guess-work—you never can tell how much salt the whey will carry out with it. If no mistake has been made in the operations I have described, you can press your cheese lightly or heavily, just as you choose. It used to be thought that an increasing pressure was necessary to secure good cheese, but I now conclude that the amount of pressure is of little consequence. If your cheese is made right, it won't hurt it either way ; if it is made *wrong,* neither light nor heavy pressure will help it. The "white whey" or cream cannot be saved; it will go off in the dry-room, if not before. I have had cheese out of which the butter would ooze, in the dry-room—it was made up too sweet, before the milk was fairly "ripe," as I term it. Many cheese-makers have yet to learn that milk must be kept at least twelve hours before it will make good cheese ; if made up before, poor cheese will result, and the fault is not in the rennet or the salt or the pressing. The cream cannot be saved after it is once skimmed ; when the separation is once made, it is a final divorce. I think curd will take the salt as well warm as if cooled ; but my practice is to turn off the heat at such a time that the curd shall be of about the right temperature when it is sufficiently firm to put in the hoop. Experience shows the advantage of this; but there is no objection to salting the curd warm.

On the Sugar Beet for Stock Feeding.

BY HON. HENRY LANE OF CORNWALL, VT.

The first and most important question for the dairyman to decide, is the selection of his cows. When the best selection has been made, the question next in importance is their feeding and management. The highest success will depend very much upon the amount and quality of food furnished; and unless supplied with an abundance of nutritious food for all seasons of the year, the farmer's expectations will be likely to be disappointed. One cow well fed will yield more profit to her owner than two equally good cows on less and poorer feed. The variation in the yield of milch cows is caused as much by the variation in the quantity and quality of their food, as it is by the difference in their milking qualities. A cow should be fed till she is satisfied, with food which contains a sufficient amount of nutriment, yet the food must have bulk sufficient to fill up to a certain degree the organs of digestion. In a good cow the excess of food over what is required to sustain life will go to the production of milk. It is poor economy to attempt to keep too many cows for the amount of food at command. The great secret of success is to keep the cows constantly in good condition.

Hay and grass are the most natural, the most important, food for cows. Let our other feeding be what it may, these will form the basis of every system of feeding. A cow will give more milk on fresh grass than on any other food, but our pastures begin to fail early, and by the last of August or the first of September are parched and dry. If we attempt to make up by allowing a larger range for the same number of animals, the feed outgrows the animals, and becoming rank and unsavory is no longer satisfactory to them, or profitable to the owner. In dry seasons our pastures do not hold out to exceed three months, and if in favorable years, and by turning into our meadows (which is of doubtful policy,) we can prolong the season of abundant grass to five months, it still leaves two months during which it is desirable to keep up a rich flow of milk. As our pastures do not supply materials for this, they must be supplemented from other sources. If during a dry, hot season, or from any cause, our cows fail to receive a good supply of succulent food for a short time, they will shrink much in the flow of milk, and the most generous feeding subsequently will fail to restore their usual yield, but will tend rather to lay on flesh, especially if the cow is in calf. To provide against the short feed during the dry weather of August and September, there should be in reserve a good supply of succulent food to be used as required. For this season of the year, corn, sown closely in drills or broadcast, is undoubtedly the cheapest and best green food we can furnish; but this will last only until the September or October frosts, leaving still two months during which time cows should be kept in milk. If not fully supplied, during this time, with some food more nutritious than the frost-bitten grass, or hay, they will shrink much in their flow of milk.

I believe we shall find the root crop the most valuable auxiliary food for the late fall months, and also in spring after the cows come in, and before the pastures furnish a sufficient supply of grass. Dairymen should turn their attention more to the cultivation of roots. Judging from my own experience, they will find it greatly to their advantage to make a special business of root raising, to feed their cows during the fall and spring to aid in the production of milk, and in winter for health. Unless we keep our cows in a sound, healthy condition, no profit can be expected; and with a view to this there should be frequent changes of food. Roots will best supply these changes. They are of more value than the mere nutriment they contain. They assist the digestive process, and enable the animals to obtain more nourishment from the fodder consumed than they otherwise would, keep them in better health, and give them better appetites, causing them to eat up the coarse fodder cleaner.

The question then arises, "Which of the various root crops, all things considered, is the best and most profitable to raise?" In deciding this question we must consider the quantity raised to the acre, the quality, and the expense of raising the crop. Labor is the great item of expense on the farm, and especially is this the case in cultivating the root crop. In raising roots we should always plan to economise labor.

Potatoes, containing as they do a large amount of starch, will fatten a cow rapidly, and will increase the quantity, but not the quality of milk. But the market value of this root is too great to allow feeding it extensively. The Swedish turnip furnishes a large amount of nutritious food to the acre, but one of the great objections to the turnip is the unpleasant turnipy flavor it gives to the milk and butter. The carrot I consider a most valuable root, but it requires more labor in its cultivation than almost any other, and cannot at the present time be raised at a profit, consequently its culture has been abandoned in this vicinity, and the sugar beet has taken its place in our farm economy.

When Merino sheep were considered more valuable than they are at present, sheep breeders in Addison county very generally adopted the practice of having their lambs dropped in March, thus requiring, besides hay for their ewes, extra feed for two months before coming to grass. By actual experience we found that no food would produce so great a flow of rich milk, or milk that would grow a lamb so fast as the sugar beet. We first raised the Silesian and the white French sugar beet. These varieties grow almost entirely in the ground, and are of medium size. In order to produce a good yield the drills and plants in the drill must be at about the same distance apart, requiring nearly the same labor in their culture as the carrot, and their weight and food-product per acre was far below an ordinary crop of the variety now raised. In 1858, I received from the Agricultural Department at Washington seeds of three varieties of the sugar beet, and two of mangolds. Those seeds I sowed separately, gave them good culture, and watched their growth with much interest. At harvesting the crop, the variety sent to me with the name, "*Imperial Sugar Beet,*" best filled my idea of a good beet to raise for stock feeding. The shape of the root, size, yield and quality, I thought was nearly all that could be desired in this root. All that I raised that season of this variety were saved for seed, and set out the following spring. From these I selected for seed the six beets which approached nearest to the particular type I wished to obtain. From the beets grown from the seed of these I again selected the best six for seed, and so on each year until the present time. Three years ago seed was first distributed outside of my own neighborhood, and to the beets thus obtained, by continued selection, I gave the name of *The American Improved Imperial Sugar Beet.* But earlier than that I gave seed to my neighbors, to sow side by side with the Silesian and white French varieties. After various trials the old varieties were discarded, and this has come into general cultivation. This is the only variety now raised in Cornwall and vicinity. It is such a decided favorite that I have often heard farmers say that they would rather pay five dollars per pound for seed of this variety to sow, than to raise the common varieties, even if the seed were given them. The cheapness with which they can be raised, and the large amount of healthful, nutritious food raised to the acre, have brought this beet into general use, almost every farmer raising his cellar full of them to feed, and hundreds of bushels are sold yearly in Middlebury village. Every man keeping a cow wants a load or more of beets to feed during the fall, winter and spring. By great care in selecting for seed beets that were of uniform shape, fair size, well developed, without forks or lateral roots, and good culture, this beet has been much improved since its first introduction. Yielding, as it now does, a greater amount of food per acre than any other, at less cost, of better quality than the turnip, ready to feed by the first or middle of October, keeping sound through the winter until late in the spring, this root is growing rapidly into favor and general use, cattle, sheep and swine feeding greedily upon it with favorable results in their health and condition.

Soil. The sugar beet does well in most soils, but, unlike the carrot, a light sandy soil is least suitable to it, while the various loamy soils, and especially those containing a large proportion of clay and lime, are best adapted to its growth. Some of the finest crops that I have ever seen, were grown on clay loam, a soil containing not more than twenty per cent. of sand. Such soil, when thoroughly drained, the surface made light with manure and deep tillage, is one in which the sugar beet delights, and will give remunerative returns.

Preparation of the Soil. In the first place all stagnant water, either on the surface or within reach of the roots of the beet, should be removed by thorough drainage. Although the beet requires a large amount of moisture to carry on a vigorous and healthy growth, yet I know of no plant that will show the presence of stagnant water quicker than the beet, by its assuming a yellowish hue and sickly aspect. It will not extend downward its usual length, but on reaching stagnant water will divide into numerous small fibers, which spread in all directions, to the great injury of the crop; hence in the preparation of most soils, and especially clay soils, thorough drainage is absolutely necessary.

The best one-fourth acre of land I have for beets was naturally very wet. On this I laid twenty rods of drain, and from this small plot of ground there flows during the spring, and in wet seasons as late as the first of July, a stream of water that would fill a common-zized pump log.

Land intended for beets should be kept in high condition by a liberal application of farm-yard manure, at least twenty-five [two horse] loads per acre. I have generally practiced plowing in the manure. From some recent experiments, applying the manure on the surface after plowing, mixing it thoroughly with the soil by the use of the harrow, I am inclined to favor surface manuring, especially if the manure is fine and well rotted.

Were it not so important to save labor in producing all farm crops, I would recommend for the beet crop applying one-half of the manure before plowing, and the other half at the time of sowing, as a top-dressing. Land should be plowed in the fall. This is very necessary if the soil contains much clay, as the action of the frost will mellow it. If, on the stiffer soil, plowing is deferred until spring, it will turn up a cloddy surface, which is difficult to reduce and make mellow and which is a great hindrance to a proper cultivation of this crop. Then again, owing to the early period at which the beet should be sown, it is important that the work of preparation should, as much as possible, be done in the fall. Fresh manure in a long state will obstruct the tap-root, and thus induce a development of fuzzy lateral roots, much to the injury of the crop. The use of coarse manure, therefore, should be avoided. Stones should be removed, and the soil in preparation for sowing, and in its after culture, should be minutely divided and pulverized, as this is one chief means of inducing fertility. Roots need a more thorough preparation of the land than most of the hoed crops,—such as drainage, removal of stones, deep tillage, &c. It has been my practice, when once fitted, to continue to raise beets on the same land for successive years. I know it is generally thought that, except in the case of onions, you cannot take crops of the same kind from a field in successive seasons, without a manifest falling off in the product; that all plants exhaust the soil, each in its own way, of the specific food suited to its wants; that to preserve its fertility a system of rotation must be pursued. But I can show land in my immediate neighborhood that has been cropped to beets for thirty successive years, and in many instances from ten to fifteen years, and invariably with increased crops, reaching in several instances in 1869 *thirty-five tons* per acre.

When the autumnal preparation, such as manuring and plowing, has been done, the spring preparations are very readily made. Harrow the ground thoroughly until mellow, ridge with the double mouldboard plow, making the ridges thirty inches apart—flat down the ridges with a garden rake. I sow with Harrington's seed sower, at the rate of four pounds of seed per acre.

Time of Sowing. As roots grow mostly after mid-summer, many farmers think that a difference of two or three weeks in the time of sowing will make but little difference in the crop. With turnips and carrots this is the case, at least it is not essential that these roots should be sown early. *With field beets the success of the crop depends very much upon early sowing.* The very first suitable weather after the frost is out, and the soil is sufficiently dry to be worked, should be improved, even if this is as early as the middle of April, as is sometimes the case. Beets, after growing to one half-inch in thickness, form a concentric ring or layer about every fifteen days; these vary in number from six to ten, depending upon the length of the season of planting. The oldest leaves are those at the bottom of the crown, and are in direct communication with the older and central layer. As new leaves are formed new layers are formed, the central leaves on the top of the crown communicating with the last and external layer. Each succeeding layer being external to the one preceding it, its diameter and bulk increases in an increased ratio, the last two being at least equal to the four internal ones, consequently doubling the crop, and this generally after the first of September.

If by late sowing the crop weighs but ten tons on the first of September, we can hardly expect it will increase after that date to exceed ten tons more, making the crop twenty tons per acre. Whereas, if by early sowing we grow fifteen tons by the first of September, our crop will at least reach thirty tons to the acre. A delay in sowing of fifteen days after the first of May will often lessen the crop ten tons per acre. There was a severe drouth in 1860, commencing early in the season and continuing until about the middle of August. Before the rains of that season the leaves of our beets had nearly all withered and died; apparently the crop was lost. Soon after the August rains, and the warm growing weather that followed, a new set of leaves started out from the crown of the beet, two layers of great thickness were formed, measuring in the largest beets one inch in diameter, and this rapid growth, after the first of August, produced a fair crop that year.

Planting or Drilling. Although drill sowing has long been my practice, I am inclined, from a limited experience, to favor planting as the cheapest and best mode. The preparation of the land for either up to the time of ridging is the same.

Cost of ridging one acre, one man, boy and horse, two and one-half hours	$1 12
Raking down ridges, one man one day	1 50
Sowing, one man one-half day	75
Whole cost of sowing one acre	$3 37

In planting I mark one way with a corn marker, drawing it in to thirty inches. The marking can be done by one man, horse and boy in one hour;

Costing	$0 45
Planting, one man two days	3 00
Whole cost of planting	$3 45

Making a saving in cost by drilling of eight cents. By drilling I use four pounds of seed per acre; by planting, one and one-half pounds is sufficient; making a saving of two and one-half pounds, which is at least $2.50. Another disadvantage by sowing in drills is the increased amount of labor required in "bunching" out the young plants, which will amount to at least two days work, $3.00. The "singling" of the plants and other subsequent labor required in taking care of the crop, is about the same.

Quantity of Seed. One pound contains about seventeen thousand seeds. These, though in appearance single, on opening show that they contain from one to five black kidney-shaped seeds; thus what we call a seed will produce from one to five plants, averaging at least two. If we sow in drills thirty inches apart, one pound of seed will leave one seed to each foot in the row; four pounds will leave four seeds, which number is none too many to provide against all casualties to the seed. Four pounds is the amount usually sown per acre. If planted in hills, eighteen inches apart in the row, two seeds to each hill, it will take one and one-third pounds, furnishing three or four plants to each hill.

Distances between Rows and Plants in the Row. I would not have the distance between the rows less than two feet, nor more than two and one-half feet. This latter distance I consider the best, as it gives more space to run the cultivator. At this distance I would have as many plants to the acre, for I would regulate the distance in the row by the distance between the rows,—thus, if the rows are two and one-half feet apart, let the plants stand eighteen inches in the row, and if the rows are but two feet apart, let the plants stand nearly two feet apart in the row. If they stand 24 inches by 24 there will be 10,890 plants per acre, inches by 30, there will be 11,616 plants per acre. At the latter distance

Each beet	weighing	3	pounds	would give	to the	acre.....	17	tons	848	pounds.
"	"	4	"	"	"	"	23	"	464	"
"	"	5	"	"	"	"	29	"	80	"
"	"	6	"	"	"	"	34	"	1696	"
"	"	7	"	"	"	"	40	"	1212	"
"	"	8	"	"	"	"	46	"	928	"
"	"	9	"	"	"	"	52	"	444	"
"	"	10	"	"	"	"	58	"	160	"
"	"	11	"	"	"	"	63	"	1776	"
"	"	12	"	"	"	"	69	"	1392	"

It is always better that the crop should be made up of large, sound roots, than that it should consist of a greater number of smaller ones, even though the weight be the same per acre. The large roots require less labor from the "singling" out to the final harvesting of the crop, and, indeed, until they are fed out.

Singling and Hoeing. After the plants have put forth their second pair of leaves the cultivator should be run between the rows, and the "bunching" should follow. This is done with a hoe, cutting out twelve or fifteen inches, leaving about three inches in the drill, untouched all along its length. Soon after "bunching," the "singling" and weeding should be performed. By "singling" out the plants at an early period of their growth, they have greater exposure to the air and light, and will sooner assume a vigorous growth. After "singling" out the plants and the first weeding is performed, the after labor is all accomplished by the hoe and cultivator, requiring but little more labor than an ordinary hoed crop. Beets require a large amount of moisture, and by frequent tillage the soil will retain this necessary moisture. During the first half of the season, the cultivator should be run between the rows at least once a week; twice a week would be still better, especially if the weather is dry. This work may be done by a boy who can handle a cultivator and drive a horse. Two hours time will cultivate an acre once over, keeping the surface light and porous and preventing the parching effects of drought.

It has been remarked, that "a man will raise more moisture with a hoe or spade in a day than he can pour on the earth, out of a watering pot, in a month." If this is true, how much moisture would a boy raise in two hours time, by running a cultivator between the rows on an acre of beets! The summer culture is simple, being merely to stir the ground often and keep it free from weeds.

Harvesting. In ordinary seasons the middle of October is a good time for harvesting this crop. Four years out of five, the third week of October might do, but it is not safe to pass the middle of the month with the crop unharvested. This beet can be lifted by hand without the use of a fork. The roots when pulled are left lying in the rows until dry, the tops are removed either by wrenching off by hand, or cutting with a knife. If the knife is used, care should be taken not to injure the crown. As the tops are removed place the roots in heaps to dry and go through the sweating process, previous to their removal to the cellar. Protect them at night, and from storms with their own leaves. After three or four days they can be carted to the cellar, and stored for winter use. If stored dry they will keep sound, even if hundreds of bushels are placed in one pile.

Yield. Twenty-eight to thirty-two tons per acre are common, in fact, about the average of well cultivated crops. Forty tons per acre is the largest crop yet reported with us. Beets averaging 7 pounds, standing 18 by 30 inches, would produce this yield. This is far below the yield of mangolds in England and France, or even in this country. Dr. Loring reports raising a few years since, 48 tons per acre. 60 to 70 tons is not an uncommon crop in England. In France a crop of 156 tons per acre was raised. In this crop each plant was allowed a space of five square feet, the roots averaging 37½ pounds each. One of the roots reached the enormous weight of 132 pounds. This exceeded the weight of the monster California red beet, exhibited at the fair of the California State Horticultural Society, held at San Francisco, Sept. 7th, 1859, which weighed 115 pounds.

That crops can be raised far exceeding any yet reported among us I have no doubt; certainly if expenses and profit are not to be considered. All our best beet crops have been raised by the application of farmyard manure, spread broadcast, and ploughed in or mixed with the surface soil. We certainly might expect a very great increase of crops if in addition to this we should adopt the English mode, of manuring with well rotted manure, in the furrows, between ridges, and then split the first ridges, and thus cover up the manure at the bottom of the furrows and form the crown of the ridge immediately over it. Then again, salt, guano, superphosphate, in addition to the barn yard manure, increase the yield. In England, experience proved that after the addition of more barnyard manure produced no sensible effect, an application of Peruvian guano increased the yield $7\frac{1}{4}$ tons per acre. An application of 500 pounds of salt showed an increase of $6\frac{3}{4}$ tons per acre. Thus we see that when the price of labor will allow us to apply our manure directly under the ridges, and when the price of commercial manures brings them within our reach, we can force our beet crops up to 50 or 60 tons per acre.

Cost of Raising. Without going into details, I estimate the cost of labor after the manure is applied at 40 dollars per acre; the use of land and manure 40 dollars more, making a crop of 1000 bushels per acre cost eight cents per bushel, which I think is a fair average cost.

Value for Stock Feed. Of the various estimates of the nutritive matter furnished by a crop of beets, comparing it in value to good hay, I have hardly ever seen any two alike. Some estimate 330 pounds of beets, to be equal to 100 pounds of hay, while other estimates place it at over 400 pounds. This difference is not strange, when we consider the modifying circumstances of different modes of culture, influence of soil, manures, and the modes of application, variation of the weather, the absence or presence of rain, and various other reasons which make the difference in two samples of the same produce to be very great. Analysis may indicate somewhat respecting the value of roots, but the observing feeder can best tell their practical value. I am inclined to place 400 pounds of sugar beets as an equivalent for 100 pounds of hay. Thus, a crop of 32 tons per acre would be equal in value to eight tons of hay,—not that beets can take the place of hay, but that 400 pounds of beets, and 300 pounds of hay, fed in connection, are equal in nutritive effect to 400 pounds of hay. Thus, if you have 24 tons of hay, by raising 32 tons of beets, and feeding them in connection with the hay, you increase the nutritive value to 32 tons of hay, and the effect of feeeding the two in connection, in the healthful appearance of the animals fed, is decidedly in favor of the mixed feed. It is thought by some that beets when given to cows fresh, soon after harvesting, are apt to purge them and thus lower their condition, but that after storing a certain time they will no longer act in that manner. This is not in accordance with my experience, nor that of my neighbors. Cows have been fed as early as the last of October, at the rate of one bushel per cow per day, with no injurious effects. I have fed beets in connection with unmarketable potatoes, and for one month, from the 20th of October to the 20th of November, my cows produced more butter than any month during the summer, except in the month of June.

One acre of beets will feed a herd of 25 cows, one-half bushel each per day for eighty days, with paying results, in an increased flow of milk and an increased per centage of butter. One-fourth acre of beets of average yield will feed ten calves four quarts per day, each, for six months, at a cost in addition to their hay, of one dollar and ninety-two cents each. If these are heifer calves, raised to renew the dairy, this mode of feeding will tend to develop those qualities most desirable for the dairy. Heifers from good milking stock wintered their first two winters thus, will, when put to dairy service, make cows that any dairyman may well be proud of. The hogs that every dairyman will keep more or less of, may be wintered cheaper on beets than on any other food. I use Willard's root slicer, which has proved an effective machine, cutting a bushel of roots in a minute. It slices them into shavings about three-fourths of an inch wide, and half as thick. I feed beets whole to my cows in the fall on the grass as I would pumpkins.

[NOTE, BY THE SECRETARY.—Experience in Maine, so far as is known, both upon the College Farm at Orono, and with cultivators in various parts of the State, including trials on my own grounds, fully sustains the reputation which Lane's Improved American Imperial Sugar Beet has obtained in Vermont.]

AGRICULTURAL EXPERIMENTS.

The complexity and inherent difficulties of most of the problems with which practical agriculture has to deal have led all thinking farmers to a conviction of the necessity of carefully conducted experiments, and these continued for a sufficient length of time, to ascertain, more fully than are yet known, the causes of variation in results, and to eliminate the errors which cluster about the interpretation of the results of such experiments as are frequently undertaken by individuals. Thousands of isolated experiments have been tried in the past, and are every year being conducted by persons who feel desirous to question nature, both for their own benefit, and with the hope that they may thus add something to the common stock of knowledge. And yet how very few doubtful points in farm practice have been thus satisfactorily settled!

In nineteen-twentieths of the experiments which are annually made and reported through the agricultural press, too much is attempted in each; many of the conditions affecting results are not apprehended, and, consequently, it is impossible to interpret the results correctly; yet a confident interpretation of some sort is usually attached to each. From imperfect data thus obtained, from half ascertained facts, which upon fuller examination are found to be no facts at all, but only guesses, attempts are constantly made to generalize, and to deduce laws to govern practice. Is it any wonder that *such* "book farming" should fall into disrepute and bring discredit upon worthy scientific labor?

The truth is, that not one person in a thousand has any adequate idea of the length of time and amount of labor and expense which must necessarily be involved in *such* experiments and series of experiments as shall yield positive, decisive and trustworthy rules of practice. Attention is very generally directed to the Agricultural Colleges as the places where these are to be made, and high expectations are indulged by many in regard to what they may accomplish in this direction. And, if the necessary means were at their command, much might be done, although not without many years of patient labor, however ample their facilities might be.

But a little thought will satisfy any reasonable man that, *as things are*, with an equipment of men and means inadequate for the purposes of instruction (as is the case with the Maine College of Agriculture and the Mechanic Arts, and with many like institutions in other States) such expectations ought not to be entertained. There is needed for this purpose in every State in the Union an establishment specially equipped for this express purpose at the public charge; something equivalent to the experimental stations of Germany, where competent men are furnished with the necessary means, and where they can devote well-directed and undivided efforts to the solution of agricultural problems, or, it may be, to original investigations undertaken for the acquisition of knowledge not yet attained, but which is indispensibly preliminary to their solution.

An impression very commonly prevails that these problems can be solved by chemistry alone, and that it is the special function of Agricultural Chemistry to solve them. Nothing can be farther from the truth. These questions are rarely such as merely require familiarity with the chemical forces involved. For the most part they are equally interwoven with animal and vegetable physiology, and the far more recondite phenomena of life are in constant activity in connection with chemical forces. It is also true that what seems at the outset to be a single problem, and an easy one, proves upon examination, to comprehend several questions, and some of them demanding a degree of knowledge not yet attained; so that preliminary investigations must precede work immediately directed toward its solution. Add to these considerations the further fact that the investigations are to be conducted, and that such views, hypotheses or conclusions as are reached from time to time, have to be tested under the varying influence of climate, weather and numerous other perturbing causes, and we begin to get a glimpse of the herculean nature of the attempted task.

A convention of gentlemen connected with many of the Agricultural Colleges was held at Chicago, last year, for purposes of mutual consultation upon many points connected with their efficient progress, including a programme of experiments to be undertaken by all, in order to secure uniformity of efforts and coöperation with one another. The discussions upon that occasion were highly suggestive and instructive. A part of them are here appended, and, although the report is evidently faulty in some respects, they will be found interesting and useful, and may contribute to a better understanding of the subject, in its practical aspect, than has hitherto generally prevailed.

Dr. Miles, of the Michican Agricultural College, opened the discussion as follows:

The subject is a difficult one to present. The number of experiments that might be tried by the agricultural colleges, and by those interested in agricultural improvement, is almost without end.

The programme provides for the discussion of the experiments that it would be desirable to conduct in common by the different institutions, and also the method of conducting them.

Very often we speak of experiments for the promotion of agriculture in a loose and indefinite manner. It seems to me desirable, on the start, to draw a line of distinction between those experiments which tend to improve the *science* of agriculture, and those which have for their object the improving of the *art*. Art is one thing and science is another. Art has to do with practice; it has to do with the ways and means of accomplishing objects. Science has to do with the explanation of those processes which are made use of in the art. We may have a rule of practice in the art, derived from observation and experience. Science may step in and explain that rule. The rule, as such, has been developed experimentally; it has been developed empirically—that is, by a series of trials. The explanation of this rule constitutes the science. Science has nothing to do with the practical application, in its strict signification. Science has to do with causes and effects. It matters not to the scientific man what pecuniary results are; he is concerned simply in the changes taking place in the matter which he is investigating. Now, if we attempt to combine, or rather if we confuse, these two terms in our experiments, we shall not meet with the success that we ought to expect from a systematic effort at improvement. Field experiments—experiments in the cultivation of different crops, the application of manures, analysis of soils, feeding of animals—all have to do with the art. We are simply making methodical hints for the sake of getting at rules to guide us practically. The scientific man may step in and make his investigation for the sole purpose of explaining these principles, or rules, which guide us in practice. Now, I apprehend at the present time no one can claim that we have rules of practice that are derived from the teaching of science. I know of none in the art of agriculture. The rules of practice have been derived from experience and observation. The world of science has stepped in and explained these rules. The rule is of no more force in practice than it was before. It simply serves to suggest new lines of inquiry for future experiments.

I will now speak briefly of some of the difficulties in the way of successful experimentation; and in this discussion I wish to be understood as limiting my remarks entirely to those experiments which we inaugurate for the purpose of improving our practice—experiments for the improvement of the art.

In the first place, we have great variations in soils. Unfortunately, they are variations we are not able to detect except by experimental trials; soils apparently similar so far as their compositions are concerned, and so far as their physical characters are concerned, give very different results. In the experiments at the Michigan Agricultural College, this was one of the most striking points brought out by our first experiment. Ordinarily, field experiments have been conducted by taking a single manured plat, and then comparing with it different plats to which has been applied different varieties of manure. The experiment was supposed to be complete. The comparison of the unmanured plat with the manured plat would apparently give an indication of the result. But such experiments misled us. We found on quite a number of unmanured plats, on soil precisely alike, so far as we could judge of the character and composition, a very great difference in yield. Peculiarities of climate and seasons will have much to do with varying results, and this seems to be one reason why it would be desirable to try experiments at quite a number of different points, having all the conditions precisely alike so far as we can, making the conditions that vary simply those of climate, soil, etc.

There is another difficulty in the way of conducting field experiments which is exceedingly difficult to obviate—that is, the difference arising from variations in the cultivation. The time of the cultivation of each plat should be the same. Not only the same amount of labor should be expended on each plat, but that labor should be performed at the same time. From this you will see the difficulty of experiments on very large plats. If your plats are very extensive, and you have a large number of them, you cannot harvest them all at the same time. You cannot put in all the seed at the same time. Some two years ago, at the Agricultural College, we sowed a field of turnips. One-half of the field was sowed on the 3d of July, and the balance on the 4th, the seed being all from the same package, the same drill being used, and the same person running the drill. There was no difference in condition, so far as we could observe, except a slight shower in the intervening night. The result was, that the turnips sowed the first day produced a very large crop; those sowed the second day were hardly worth harvesting. There were four or five times as many turnips from the field sowed the first day as those from that sowed the second day.

This shows that we should exercise great caution in regard to cultivation; that it should be uniform, not only as to amount, but as to the particular time of performing the labor. It is important that field crops subjected to experiment should be weighed at the same time. If you have a large number of plats that are to be compared, and these plats are quite large, it must occupy considerable time. If so, there will be a difference in the amount of moisture, and this will vary the result. I had a striking illustration of this the present year, in the continuation of some experiments we started several years ago.

A field had been planted with corn for several years in succession, the plats all being treated alike. We found a great variation in the yield. Corn was put on the next year, and there was a great difference in the yield, but the plats that gave the largest yield the first year did not give the largest yield the second year.

After this, part of the plats were manured, and we followed on through a rotation of crops until we came to the clover crop, which was harvested this year. As soon as the crop was ready to cut, we tried to get enough help do it in a short time. The clover was weighed green. It was then stirred up and exposed to the action of the wind and sun, and put up in cocks. The next day it was spread out again, and when it was supposed to be in a fine condition for going into the barn, the plats were weighed; but it was afterwards thought there might be some variation from this cause, and they were allowed to remain, and afterward weighed again. At the second weighing it was thought to be dry enough to go into the barn, and not dry excessively afterward. I give the result of the second and third weighings of the same plat:

SECOND WEIGHING.		THIRD WEIGHING.	
261	pounds.	185½	pounds.
84	"	61	"
100½	"	68½	"
41	"	30	"
251¼	"	175	"
119½	"	88	"
211	"	151	"
101	"	73½	"
165½	"	121	"
93½	"	71	"

It showed the manner in which we may be deceived by relying on our senses entirely.

You will readily perceive if we had a large number of plats, and they were of considerable size, you would get more difference in result if it was carried on in succession, commencing on one side and passing to the other side of the field. Guard against a difference in the results, arising from a difference in the amount of moisture, in root crops as well as others. It has been shown by some experiments made, that where turnips, for instance, have been manured, there was a great increase in the yield; but when the amount of water in the turnips was taken into account, it was found the amount of dry substance was precisely the same. The great increase arising from the manure was simply water—nothing more; and here is something that should be looked at.

In the feeding of animals, there are a great many difficulties in the way of satisfactory experiment. One of the first I will mention is that which may be termed individual pecularities of animals. You may take animals of the same age, and the same size, or, as we have fed, pigs of the same litter, and we find one pig will give a much larger return for feed than another. It is something we cannot get at, cannot measure, cannot detect, except by the experimental test of feeding.

Again, we find, when animals are first put up, they consume more feed in proportion to their weight than toward the close. We find they give a greater return for the feed consumed, during the earlier stages of the feeding, than afterward.

What is the cause of the variation? I apprehend there are three causes, and two of them I have no doubt about. The third, I am inclined to think, has an influence, yet it is an exceedingly difficult matter to determine. These peculiarities, or differences, are the age, the size and the ripeness. From the experiments we have already tried at the college, I have no doubt age has a very great influence upon the result. The young animal seems to have an organization capable of deriving more nutritive material from the same feed, so that it gives a larger return for feed, other things being equal, than when it gets older. The ripeness of the animal has much to do with it. When the animal is in a moderate condition, it will receive more nutrition from the food consumed than after it is excessively fat. The size of the animal perhaps has something to do with it. I am inclined to think it has, and you see we have a difficult problem to deal with, to determine how much of this variation is owing to difference in age, how much to difference in size of the animals, and how much to this difference in ripeness. By ripeness I mean the condition of the animal, as regards fat. The treatment of animals will have very much to do with the results. Animals that are carefully treated, and fed regularly, will give a larger return for food consumed, other things being equal, than those that are treated harshly, and kept in constant tumult from outside annoyances and interferences. The mental condition of the animal has undoubtedly very much to do with the progress it makes in feeding. We found when we were feeding sheep in the experimental pens in the sheep barns—this building being occupied by other sheep—they did not make as much progress as when fed by themselves, and they would fall away at once as soon as there was an unusual disturbance among the sheep in the outside pens of the same building.

There is another matter that should be taken into consideration; that is, the varying weights of animals, without apparent cause. If you weigh animals, at long intervals, you will undoubtedly find they are making very satisfactory progress from one weighing to another; but if you weigh them at short intervals, you will find they lose during one period, and gain the next. If you weigh them every day, you will find one day a loss, and the next day a gain, or perhaps two or three days a gain, and then a great loss. The progress made by the animal is an undulating line, and not a uniformly ascending line.

I do not know that I can give any satisfactory explanation of this variation in weights of animals, but I presume it is owing to a difference in the action of some of the secretory organs. It is probable their fluctuation in weight was owing to loss of water in the animal rather than to a loss of dry substance, because where we find an animal has made a very great loss at one weighing, it will frequently make the best gain at the next weighing. If this loss in weight was owing to a defect in the animal, then we would suspect the animal was sick, or there was some derangement of the organs, and would not expect it to make such a rapid gain at the next weighing.

To obviate these difficulties, and make our experiment satisfactory—that is, in order to accomplish the object of experimenting—it seems to me we should pay especial attention to several particulars which I shall enumerate. In the first place, the experiment should be as simple as possible. A large proportion of the experiments made thus far have been of no value, for the reason that too much was attempted. For instance, a person wishing to test the real value of potatoes of different sizes for seed, plants his small potatoes in drills two feet apart, and the large potatoes in rows three feet apart. Here, you see, is a double variation. There was no condition the same, and no chance to compare such experiments; and a very large proportion of experiments have been vitiated in that way. It arises from attempting to determine two things at once: that is, the effect of variation in the size of the seed, and the effect of variation in the rows. You have two elements, and you may try such experiments as long as you please without any valuable results. It would be better to try one experiment to settle the matter in regard to size, having all the conditions precisely the same, and then take, as a separate experiment, one in which the different distances of the rows was the object of investigation. In reference to this difficulty in regard to the variation of the soil, it would be necessary to have a large number of unmanured plats for comparison. The increase of the manured plats over the unmanured should be where the plats are treated precisely alike.

I think it would be desirable, also, to put crops for two or three years in succession upon the same land, before using it for experimental purposes. For instance, if you wish to test the value of manure as applied to soil, it would be better to mark out your plats accurately, and crop them for several years without any manure until you ascertain the peculiarities of this crop, and then continue the same crops with the addition of manure afterward; but in this case at least one half of the plats should be left unmanured for comparison, so that you may compare results alongside of the manured plats, and compare the plats with themselves, and also with the crops on the same plats in preceding years.

The question is often asked, what sized plats it is desirable to make in field experiments? That is a difficult question to answer. On some accounts it would be desirable to have the plats very small; on other accounts it would be desirable to have them of considerable size. Dr. Anderson states that he thinks the smaller plats are desirable; he would not have plats exceed 1-100 of an acre in area. Mr. J. B. Lawes, who associated with Mr. Gilbert, in experiments conducted at Rothamstead, writes me he has no confidence in the experiments made on plats of less than 1-20 of an acre. These are two high authorities. Dr. Anderson is an able chemist and a very successful experimenter. Lawes and Gilbert are perhaps the best agricultural experimenters we have had. Their experiments are not fully accurate, but, taken on the whole, they are the best that have been made. My own experience is, that a plat of from 1-100 to 1-20 of an acre should be the limits in size. The difficulties of the very small plats are, you are liable, when you are manuring, to have it extend its influence to the adjoining plats, and the roots of the plant will extend some distance into the soil, so that you are liable to be misled. When you come to weigh the produce of the plats, a very slight error will amount to considerable; when you make the calculation to ascertain the yield per acre, the error in a single plat would be multiplied by 100 in getting the standard for an acre. In a small plat it requires very great accuracy in weighing, great accuracy in the division of the plat, and great care in the management of the experiment throughout. To obviate this objection, that the roots run from one to another, I think it would be well to have spaces between the plats—a space of several feet left between those plats that are to be used for experimental purposes, and these spaces should be kept clean and free from weeds. But here comes another difficulty. Suppose you have plats laid out, and spaces of three feet between them, you must cultivate the spaces, and need to expend the same amount of cultivation on each one of the spaces as on the other, so that the crop adjoining may be equally influenced. Again, the spaces should be weeded carefully at the same time, cultivated at the same time, and managed as carefully as the plats themselves, or you will vary the result in the plat.

The objection to the large plats I have already mentioned, but

I will refer to it again. It is the difficulty of getting over a large area in a given time. If your plats are so large that it takes a whole day to go over them and perform the labor, you will be very liable to error from the variations mentioned.

Wires may be used for separating the plats, and that is a very convenient plan, and one we have practiced at the agricultural college, but it does not obviate the objection that the roots pass from one to another. It enables you to make a fair division between two adjoining plats, which is exceedingly difficult—more so than a person would think who has had no experience in the matter of making exact divisions through a crop of growing grain.

In the feeding of animals, I would be particular, as I mentioned, to have but a single animal in a pen. If I was going to feed twenty animals on a given feed, I would place each one in a pen by itself, and then would confine them to a single article of food. It would be an important matter to test the nature of corn meal, and corn prepared in different ways, as food for swine. The natural mode that would be suggested, for conducting the experiment, would be to put a number of swine in a pen and give four or five of them corn unground, four or five more of them cooked corn meal, and four or five more uncooked corn meal. But I apprehend the results of the experiment would be very unsatisfactory, to say the least. I would not like to place any very great amount of reliance on it. I would prefer to take the same number of hogs and put them in pens separately and feed them with unground corn, and follow that up until I got the range of variation between the animals. Then I would take the same number and feed them corn meal; and if your arrangements are of sufficient extent, you may have these experiments going on at the same time. We have been feeding swine for a number of years, and have from ten to fifteen pens. We have fed nothing but raw meal thus far. The question is often asked, "Why don't you feed cooked meal?" I have not yet got the standard of comparison with raw meal, by which I can compare results with the cooked meal. There is a great range of variation in the animals, and there would be made a serious error in the experiment. This error has arisen very much from the force of circumstances. We could not get animals of uniform size and uniform ages to fill our pens, and for that reason, the attempt to do the two things which I have mentioned is objectionable. There has been so much variation in this matter that we need to have more experiments with cooked meal, and I would hardly know what to compare them with. So far as raw meal is concerned, notwithstanding the great variation, the rule I laid down holds good almost uniformly: the greater increase of food consumed during the early stage, and the dissemination of fat as the animals fatten. The animals for feeding should not only be of the same age, but they should be as near as possible of the same size, and of the same degree of fatness, when they are put into the pen, in order to get a fair opportunity for comparison.

I have one other suggestion to make in regard to the methods of conducting experiments, and that is the method of obtaining manures. The term manure is a very indefinite term. We take manure from our barnyards at different times, and it will vary very much in quality. The value of manure will depend on feed consumed; that is a fact well settled.

It is impossible to make a chemical analysis so as to get the value of it. A chemist may take a quantity and tell you what there is in the sample, but he cannot analyze each load that you use. The method I would adopt is this: to take the animals and put them into a pen—into a box-stall—and would have it constructed tight, so there is no chance of losing any of the liquid constituents; and I would feed to the animals a definite amount of food; then I would take the results of these articles of food as we have them furnished by chemists in tables, as the measure of the value. Then take the manure from the box, and put it on the plat. By pursuing this method, you may get a number of boxes of precisely the same strength for all parctical purposes.

In regard to the experiments which it would be desirable to try, I have mentioned but a few. There are many more that suggest themselves to me, and I speak of these simply for the reason that they seem to me as important as any, and for the further reason that I think they would be as easily tried as any. It does not seem to me best to attempt very complicated experiments at any particular institution, until a long experience has been had in experimenting—until the person experimenting becomes thoroughly familiar with all the difficulties in the way. For the feed experiments I would simply try to ascertain the value of Indian corn in its different forms. After this is accomplished we may then take other grain in the same manner. After that I would take the grasses. In these experiments it would be desirable to have the same conditions observed by all the experimenters, otherwise the experiments cannot be compared. If I feed corn meal in a particular way in Michigan, and it is fed in a different way in Illinois, Missouri or Pennsylvania, we cannot compare results at all. You are not assisted in the one place by the investigations made in the other. The experiments must be conducted in all places in precisely the same manner; then you can compare results, bearing in mind that certain conditions which cannot be controlled may influence the result.

The next class of experiments which I will suggest would be to determine the best methods of applying manure—the application of manure on the surface, or the application so that it may be plowed under—and it would be desirable, likewise, to make experiments with reference to the application of these manures at different seasons; whether it would be best to apply manure in the spring or in the fall. This will be found to be a very complicated problem, and one that will require great caution. I would endeavor, likewise, to ascertain the value of commercial fertilizers as compared with barn-yard manures. You want to know the constituents of which the manure is composed, and the fertilizer should be analyzed carefully. Barnyard manure must be our staple. If we purchase other manures we ought to know how it compares with this.

I would like to have experiments made showing the effects of change on the growing crops. In a system which has been tried, wheat has been grown for quite a number of years in succession, and a yield of from thirty to forty bushels obtained without any manure. The system is this: The field is divided into strips of three feet in width. The wheat is sowed on the alternate strips. The vacant strips are kept thoroughly pulverized during the season, and the next year the wheat is put on the strips left bare the year before.

It would be desirable, likewise, to ascertain the methods of seeding corn—whether hills or drills would be desirable. These experiments all require a great deal of care and accuracy, and they will require a good deal of study in order to fix the conditions upon which they shall be tried by a large number of persons, so that the results may be compared.

Prof. Hamilton. I scarcely know how to get at this matter. It seems to me, that before we start out to experiment at all, we should understand one thing, and that is, that in this art of agriculture, as it has been defined, aside from the science, no absolutely accurate result can be obtained from any experiment; that it is only by comparison—only relatively, in their relation one to another—that they become of value. Crops may differ largely in weight, as to the times in which they are taken. It has been shown that after they have been considered dry, there is a difference in weight. This fact, that they do differ in weight at different times, does not affect the experiment, because if they were weighed green, just as they were cut and taken into the barn, it shows the relation of these plats to one another; I think this would be found to be true in almost every case. Every part of these experiments is attended with some error, and we wish to eliminate the error as far as possible, and in weighing of plants in that way—all of the plats at the same time, or as soon as may be—we get a result that is almost correct—not absolutely correct, for no result we obtain is absolutely correct, and correct results can only be obtained by carrying on these experiments for a great number of years. The system of experimenting, as it has been carried on, has been a failure, inasmuch as they have been dropped after they have served a certain purpose; they have not been carried on persistently year after year, thereby developing a principle in agriculture, and not merely satisfying the curiosity of some person who is experimenting.

Now, in our experimenting at the Agricultural College in Pennsylvania, we have tried to avoid what the gentleman has clearly shown is an error we are apt to fall into, and become confused—that is, attempting two systems of culture, or putting in the same thing for two objects. It cannot be done. We failed on several plats for that very reason. The earlier experimenting was about a failure, just because we attempted to do too many things on the same grounds, and had more objects than one. There must be confined to each plat but a single object. If you have more, you lose control of the experiment, and afterward you have to experiment again to find out which of the two it is.

In regard to the size of these plats, the plan of having them very small is probably more liable to error than having them large, although there are difficulties on the other hand; if your experiments are extended over a great deal of ground it is almost impossible to have them all carried along under the same conditions, but you can overcome that by going to extra expense. We try in all experiments to do this in one day, and in a portion of the day after the dew had gone from the earth; we try to get it as nearly in the same condition as possible, and if necessary hire extra help to insure this. There are accidents which happen—such as rains coming up—that no oversight can provide against. They affect the experiment to some extent, but if carried on for a succession of years, the probability is the next year one will be able to avoid this, and get such an average as will form a guide. The objection to the small plat has been stated: that if you make an error at all in weighing, or in the size of your plat, or in any particular, that is multiplied by just so many times as it is less than an acre if you take that as a unit. If you take a larger piece the multiplication of the error is not so great.

We had some experience in the matter of small plats. One of our farms in Chester county started before the one at the college, and before the one at the western part of the State, and they started some independent experiments—sowing little plats of wheat of different varieties, and patches of one thing and another. It was found that these patches were very difficult to care for. Whenever we have small experiments the tendency is to increase the number, and it is scarcely possible to keep them all separate. The effect of that was that the superintendent, who was carrying on the experiments pretty much on his own hook, allowed shocks of wheat of different varieties to stand in the field, and would thresh one and then another, taking several days in doing it, thereby occasioning greater error than would come in the having of large plats which were brought in and put in separate places in the barn, and not having so many of them. In regard to the way in which the plats should be laid out: I do not see exactly why the gentleman thinks it is necessary to cultivate between the plats. It seems to me, if the grass between the tiers of plats has an influence on one plat, it has that same influence on the other plat, and so the same influence goes on through the whole series of plats. There is the fact that we may use manure and we may not; inasmuch as this system of experiments is one that is only relatively compared, the same thing would be true if the plats were not cultivated. It would not bring in any greater error, probably, than if the plats were cultivated. The keeping in mind of this one fact, that our results are only relative, I think clears up many of the objections. Also in the feeding of animals, this same thing holds good. I have only taken up the matters that have been suggested by the remarks of the gentlemen here, and given my views upon them, as I understand that is the object.

In this matter of feeding stock, it seems to me if we could place equal weights of stock in different pens—pigs, for instance—instead of having a single one in a pen, if we could place a number in one pen, and then a number in another, that would give a better result, because we divide up a greater amount of increase. When we come to show the effect the feeding has had upon the animals, we divide it up, having a greater number of pounds to go on, and we get a more correct result in the division.

In this whole thing, there are three principles necessary to be kept in view, in instituting the experiments; that there are three grand divisions into which these experiments can be divided, one of which is to show the rotation of crops and method of culture. Those two are intimately united. They are of practical value to farmers. They wish to know the methods of culture and the proper rotation of crops. Another is testing different varieties of grains, seed and vegetables, showing which are best adapted to certain soils, the ways of developing and the varieties that suit certain methods of cultivation. The next is in testing the qualities of different manures. These three things are the great questions of the day in agriculture.

PROFESSOR DANIELS. I have been very much interested in hearing the remarks that have been made, and I would agree with both the gentlemen who have spoken in this: that experimentation is difficult to carry on, and definite conclusions are difficult to reach, on account of the great number of things that are brought in and the great number of elements involved in the experiment. The weather, the different character of the seasons, different conditions and different processes, as applied to the soil—all these render it exceedingly difficult, and no absolute results can be obtained. They must be relative, as it has been stated. The experiments which can be carried on generally with uniform action through the colleges, are, I should think, such as have been stated; the feeding of stock, and the general results that may be obtained from feeding stock in different, definite, prescribed ways, and also in the methods of culture, and in regard to varieties. In regard to varieties of our crops, perhaps nothing so absolute can be obtained, on account of the difference in the climatic conditions in the different portions of the country in which the experiments have been conducted. Our experiments mostly have been these, so far: The comparison of the different varieties—for instance, a comparison of all the varieties of oats that we have, and all those which we could obtain ; a comparison of the different varieties of potatoes, and so forth ; and the testing of some varieties of winter wheat and spring wheat, and different methods of culture, and especially some of the simple matters. But under the circumstances in which we are placed, with an income which is small, we have not been able to do much, and the Agricultural Department is simply one department of the University. We cannot apply all our energies in one direction. We look more to institutions that have devoted their energies more especially to these matters, having more money to expend than we have had ; any series of experiments, however, that the convention would recommend, we should be glad to carry out to the furthest extent possible.

Dr. Miles. I would like to correct a misapprehension and draw out some further information. I understood Professor Hamilton to say that although an experiment might be conducted carelessly, and the result not accurate, if an average is taken in large numbers, it would give satisfactory results.

Prof. Hamilton. I did not mean to say "carelessly"—not by any means ; but after as great care as possible has been exerted, the result is not correct, and the only way to get accurate results is to compare, and in the end get some law that is general and as near accurate as may be.

Dr. Miles. I understood you to say experiments might be tried in a certain way, and although they were not accurate, yet by reason of the large number of them, we might get at great results, which is the only means by which accuracy could be secured. It seems to me if that be the position, it is going to lead us astray at once. We must understand it is impossible to secure absolute accuracy; if it were otherwise, the matter of experiments would be an easy thing, and we could go right along with it. But if we cannot secure absolute accuracy, it seems to me we must avail ourselves of every means to reduce the error to the smallest possible amount, and even then we may find it difficult to draw satisfactory conclusions from the experiments. I apprehend we have been misled in our attempts to draw conclusions from averages of a large number of experiments that have been made. I think we cannot get accurate results—we cannot get at any principle, any law—by comparing experiments that are filled with errors, provided those errors are of any considerable amount. For that reason, I would insist upon being exceedingly particular on every point in conducting experiments. I have made this subject a study for a great many years, and I have collected a large library upon this subject. All the agricultural experiments I have been able to lay hands on, I have brought together, and have examined and compared; and the more I study the published experiments, the more I am in the dark in regard to underlying principles. I see fallacies that are of very great consequence. I can see omissions in the statements which would lead me to suspect that proper precautions had not been taken.

In regard to cultivation between the plats, I, perhaps, might have stated the matter a little clearer. If you have spaces between the plats, they are there for the purpose of separating the plats, and if you have something growing there, it is not a fair separation. If weeds are allowed to grow, some of the spaces would contain more than others. What I mean by cultivation is, the space should be kept clean and free from weeds, and nothing be allowed to grow upon them, because if you leave plants to grow upon them, they will extend their roots to the plats and defraud the crops by drawing the nourishment from them.

In regard to putting up cattle and feeding: If the conclusions I have drawn from our experiments are correct, the putting of the same weights into pens would not answer the purpose. I might have in one pen 500 pounds of small animals, and in another 500 pounds of animals considerably larger. But if you are taking the larger class of stock, there might be 1,000 pounds in one pen, consisting of five animals, and 1,000 pounds in another, consisting of one animal. You could not compare them if there was a difference in age and a difference in condition. The matter of individual peculiarity of animals is a very important one. I found where I had two or three animals in a pen, there was no increase. In another pen adjoining, where there was the same number of animals, there was a remarkable increase. I said, "why is this?" I weighed the animals separately, and found one animal was losing and another gaining. If you want to know the value of any feeding substance, it will not answer to take the averages of the animals. The amount of food required to produce a given increase is what we want, and I would have each animal's food by itself, so that when that animal made no return at all, I would know it was out of condition and not a fit subject for experiment, and throw it aside. There is another reason why I would put animals in separate pens. They do much better.

When the animal gets contented in the pen in which he is placed, with none to molest, he eats his food quietly and lies down. Where there are two or three together, perhaps one is quarrelsome, and is continually disturbing the others by not allowing them to eat or to lie down. It is with animals as it is with persons. One is restless, and another is quiet. When you have a large number of persons together, you find it exceedingly difficult to keep the room still. It is so with animals. One animal gets nervous and keeps the others confused and unsettled.

PROF. HAMILTON. I took it for granted, when I made the statement in regard to putting a number of pigs in the same pen, that the same care would be exercised as when there was but one animal in the pen.

PROF. PRENTISS. I have had enough experience, and seen enough, to convince me that the difficulty in the way of conducting experiments is even greater than has been set forth by the remarks this afternoon. The materials and the forces of nature are so varied, and life is everywhere so variable in plants and in animals, that we cannot tell whether to attribute certain conditions to the plants, or the animal. Dr. Miles referred to what he calls the individual peculiarities of animals. Botanists recognize very great peculiarities in plants, that they readily see and recognize, but cannot describe; it is what Linnæus has termed "physiological peculiarities of plants"—some hidden mystery about them, something that controls them, something that we see, but do not yet understand, and probably never will. For instance, you take two seeds of an apple, apparently alike, and plant them. One developes into a tree, which bears a large, excellent fruit—a tree of vigorous growth and handsome appearance; the other develops into a small tree, producing a fruit of little or no value. Perhaps the conditions of the soil and climate are precisely alike, and yet these differences are developed in the growth of the different seeds. The same truth applies, only, perhaps, to a less extent, to every plant that the farmer grows in a field, to every plant of grain in a field of wheat or corn. So, when we take these plants and subject them to culture, to see what method is most valuable, we cannot tell whether it is a difference in culture that is productive of the different results, so much as individual differences in the plants themselves. So, in every way in which we look at these experiments, difficulties present themselves. I would not infer that all experiments are of no value, because I believe they are of great value; but the experience of a single year I consider to be valueless. The experiment must be repeated time and again; and finally, notwithstanding the difficulties, I believe a result would be obtained which, to a certain extent, might be considered as a general law. The proposition which has been made in reference to having the different agricultural colleges conduct the same experiments, I consider to be in the highest degree valuable; because the more these experiments are tried, the more varying the conditions, and taking them year after year, the more sure would be the results. So, as I look upon the matter, I believe the value of experiments in this country has just commenced, or rather the experiments that would prove of value are just commencing, and the step we are about to take I consider to be of the utmost value in this direction.

Dr. Detmers. There is one point I consider to be of great importance, and that is, the different agricultural colleges uniting in their efforts to demonstrate and to find out what influences the soil and climate in different localities have upon the development of our different domestic animals, and even upon the different breeds of domestic animals. It is well known that in one part of the country, fine handsome horses are produced, but the cattle in that locality amount to but little. In another locality they raise excellent cattle, but the horses are inferior. In another, they raise fine sheep, and in another sheep do not succeed at all. We may know the cause, but not thoroughly enough; and this would be a very good object for the united efforts of these agricultural colleges. For instance, if you ask a dozen different men what is the best breed of cattle, you will receive as many different answers. Some will prefer one kind and some another; one prefers the Devon, another the Ayrshire, and so on; all are liked, more or less. It would be of great importance to explain, not only to the agricultural student, what are these different conditions and varieties, but to the agricultural public, what makes one breed thrive so much better in one locality than in another. We know it is almost impossible to raise sheep successfully in low, wet ground. We know that horses thrive better in a high and dry country than in a low and wet one, although they may get a great deal more weight in the latter. But there are many points which might be explained by proper and rational experiment.

A good deal has been said about feeding cattle; and I want to mention one simple point, established by empiricism. It has been found out that where we attempt to fatten animals when kept separate, they never thrive as well as when two or more are kept together. It seems that two animals, or three, or four kept together, eat better. They are somewhat jealous of each other, and each afraid the other will get more than its share; and they eat more, and consequently thrive better on that account.

Dr. Gregory. The committee have taken it for granted, I suppose, that all the agricultural colleges, or institutions that are teaching agriculture, are conducting experiments. It is of course understood, that agricultural colleges are not for the purpose of experimenting, first and foremost, but for the purpose of teaching agriculture, or the branches of learning relating to agriculture, and it has not been uniformly accepted that the agricultural colleges are to be experiment stations. They are not necessarily experiment stations. One of the questions for us to settle is, how far they can be made experiment stations, how far their forces and funds can be diverted and used for this purpose. In Europe experiment stations are sometimes connected with the agricultural institutions, but not always. If I am rightly informed, there are some thirty-three different agricultural experiment stations in Europe, under the charge of some sixty agricultural chemists, besides other parties assisting them. These experiment stations, some of them at least, are found connected with the institutions. Those that I saw myself were always connected with them, because I did not turn aside to visit any of those that were not; but many of them, like the celebrated experiment station of Lawes and Gilbert, are not connected with any of the institutions of learning. We know this, that the country is demanding of the institutions that they shall conduct experiments. The agricultural public expects us to conduct experiments. They are constantly calling, through the agricultural press, at agricultural conventions and otherwise, upon these colleges to help them to settle questions relating to agriculture. Whatever might have been claimed at the outset to be the duty of these colleges, I trust we shall fulfil a public demand by instituting experimentation. It seems to be the judgment of the gentlemen present here, and all I have known in connection with the agricultural colleges, that experiments shall be prosecuted. What has been already said here will, perhaps, sufficiently lead us to infer the great difficulty attending these experiments. But we have been told long ago that there is no excellence anywhere without great labor. The truth does not lie on the surface always. It hides itself in the depths. It is to be sought for with great patience, and with great care, and great study. When it is found at last, be it after ever so long a search, and after ever so great expense, it will richly reward the seeker. Now, in the solution of the problems in agriculture, the discovery of laws in agriculture—for I suppose that is the object of the experiment, and not merely to gratify the curiosity of the experimenter, not merely to get at some half-way results, like weighing a thing by taking it first in one hand and then in another, and then giving a guess—it is possible to determine, approximately at least, what are the facts, and ultimately to reach a law.

What are the laws and forces which enter into any agricultural product, animal or vegetable? What if they are many and complicated? Are they more so than the forces that have entered into the other results and deductions that men ultimately have reached, and determined the laws of? We should remember this thing: If we can get one single element reduced to its law—if we can, in one single case, discover a law that is fixed and invariable, and has the force of law in a multiplicity of things—we have put, as it were, a streak of sunshine into it; we have got one fixed element in the problem, and everything else will be more readily solved.

As far as Dr. Miles' experiments which he suggests, and very wisely, in the matter of feeding, you can take simple corn in its various forms, and, by a series of experiments carried out, you can ultimately arrive at something like a law in regard to the effects of feeding an animal on this one article of diet. May you not ultimately reach a law of animal feeding, and growth, and fattening, which you will carry elsewhere? The multiplicity of forces that enter into these experiments, to my mind, only prove this: the necessity of combination and co-operation. Suppose, for instance, that the Agricultural College in this State would try certain experiments as carefully as we can. We are trying them under a careful experimenter, who is present, and we may ultimately, in the course of years, reach a conclusion, as we think. Somebody in Pennsylvania tries the same set of experiments, and he reaches a different result, revealing to us what we alone should not have suspected, perhaps—that there were climatic differences, or something that modified the result, and which therefore vitiated our supposed law, and compelled us to start afresh before we dared to publish the results of our experiments to the world, as an established agricultural law. It seems to me the argument is sound in the matter of the proposed co-operation. How far this co-operation can go will be determined by the nature of the experiments. We shall see how far we are under different conditions, such as will compel us to make allowances for our own and other experiments. To me it is a very serious practical question, and I suppose it is to the gentlemen connected with these institutions. The public are expecting certain things of us. They ask us to do, perhaps, what we can not. They ask that we shall so experiment as to discover for them how they may cultivate corn to the best advantage in this and other States; or how to feed animals, or what varieties of corn are best worth cultivating. They ask us to enter upon a set of experiments to determine it.

Suppose you in Pennsylvania, or in Wisconsin or Michigan, go and work isolated and alone, and the rest of us wait until you have accomplished your experimentation; you reach a result and you publish it to the world, and the first practical farmer that makes a trial of that supposed result and law, discovers that it won't hold in his community, and at once throws contempt upon your agricultural science, and convicts you, as he says of not knowing what you are about, and pretending to discover some things which are not true. If, instead of conducting the experiment in isolated schools, and not helping each other at all, we are prepared to say that a set of precisely similar experiments, arranged by the same man, and conducted according to the same rules, and as far as possible in the same manner, produces such and such results, we defend ourselves against unjust criticisms at least, and put ourselves and the whole public with us on to vantage ground, for giving new investigations, if no more. We are at least all agreed in one thing, which Herbert Spencer says: "Scientists and religionists are all agreed in, if in nothing else, that there is something to be known, there is something to be discovered." There are some questions to be asked, but I doubt whether you are prepared to state distinctly and fully just what the questions are that are to be settled. Strip them naked and set them before us, and see if we can determine precisely what is to be experimented upon. We want to experiment in order to learn how to experiment, and to know what road we want to travel and what results we ought to aim for. What we want ultimately to reach is a law—not a fact—but a law. Ultimately, truth; but what law, what truth? Who will tell us? Will Dr. Miles? I do not know of any body better prepared, but I do not know whether he can tell us to-day.

It seems to me we cannot too much insist upon the utmost care and precision, so that we may eliminate, as far as possible, every single source of error from these experiments, and reach some results that can be looked upon as derived from the causes suspected at least. Nothing struck me more impressively in agricultural experiments going on at the European stations than the nicety and care with which these experiments were being performed. I remember at Munich I saw some plats, less than those recommended here, in which not only the seeds, even when they were grass seeds, were measured, but they were carefully weighed and counted, and at the head of every plat was placed the number of seeds. The professor told me that every result that was obtained from that growth, was weighed, root, branch and fruit, hoping ultimately to reach more clear and distinct results. Now we all know that science never began to make advances until it called mathematics to its aid. When it began to weigh and measure, and count and number, then science began to make progress. Science in agriculture can make progress no better than in any other branch, unless it comes down to measure and weight and count, and applies mathematics to get precise results, and measures and weighs, as far as possible, all the forces that enter into it. We see the difficulties, but we cannot help ourselves. We did not make them. We are to encounter them. If I heard to-day for the first time, the sentiments of Dr. Miles and Professor Hamilton and Professor Daniels, I should shut my eyes almost in perfect despair; saying, there is no use, the thing is so complicated. But when I remember that every other science was, at the beginning, just as much of a riddle as this, and only solved by long and patient study; when I remember that, I still hope there is something to be learned in agriculture, by the same patience and the same processes.

PROF. SWALLOW. I think you will find there will be some difficulty in extending the experiments to all the colleges in the country—to some of them, at least. As a general principle, when we are experimenting to discover new laws, we should not override the laws that are well known and already discovered. I was reminded of this by some remarks made about putting animals in separate pens. I suppose there is no law so well established as this: that solitary confinement with many animals is very deleterious. It is as much so with animals as with men. I suppose if the giant in the old story had tried to fatten his men in solitary confinement, he might not have succeeded so well. I remember separating two horses that had been together a long time, and continuing one on the same feed; but he fell off all the time until his mate returned. I do not know how you will feed them so as to get accurate results. Sometimes, if you put animals together who do not agree, as will often be the case, there will be little parties of them that will naturally run together. If you could get those parties together and feed them, that would be better than if they were mixed with those for whom they have no affinity, as you may say. It would be difficult to manage this matter; I would rather regard the social principle, for we know it is a general law, than to disregard it.

I want to call attention to one thing—the question as to experiments in feeding. Experiments made in Maine and in Louisiana are almost worthless, unless you take corn from Maine to Louisiana, and from Louisiana to Maine, so as to feed them on the same corn; for the corn in Maine is worth much more a pound than that raised in the South. They can not raise the corn we do, and we can not raise theirs; and the comparison of experiments made in such localities would be of little value, although not so much as those in Europe. What we want our colleges to do, is to investigate the principles applicable to its own locality. You may prove, for instance, in Michigan, that in your sandy soil a certain kind of manure is the best for corn and wheat, and we try it off in Missouri, and it would be a failure. We know it beforehand. We place your barn-yard manure on the ground for wheat, and it will injure it; but on the sandy soil in Michigan it will be of great value; on some other soils animal manure will lessen the crop rather than increase it. There are certain things which you know and we don't know. It seems to me we can do more by having a certain class of colleges whose relations are very near to each other as to soil, take up one series of experiments, and another class of colleges, having another kind of soil and climate from those already related, take another class of experiments—that is, have each take up a certain class of experiments which would come within range of its climate, soil and stock. I do not see, especially in the feeding of animals, that any experiments in Maine would be of much value to us in Missouri—the climate is so different. I do not see, on the other hand, that their feeding hay would benefit us much. We raise timothy and red clover as they do, but it is a different thing from theirs—as much as the corn is.

In regard to raising corn, for instance: You may try experiments with corn in Maine, and we try the same experiments in Missouri. The experiments are made with different varieties of corn, and we scarcely compare them. They may raise less pounds, and yet more nourishment than we would. One kind of corn needs a little different nourishment from another.

I do not see how we are going to establish a series of experiments throughout the country on any point which has been spoken of, so as to make the comparison as valuable as it would be if they established, as I said before, a series of experiments with a few colleges whose conditions are about the same. Another thing: if you are going to conduct a few experiments by all the colleges, you and I will be dead before we know much about the results. People are in a hurry in these days; and if we can do a little to aid those around us that will be the better way. I think the law contemplates experiments. I know that in our reports we are required to give the results of experiments.

PROF. DANIELS. I concur in the remarks made, as to the difficulty of experiments, and I believe it is true, as has been said, that nearly all the experiments that have been made are useless as such—that is, useless as giving any general law, or any data from which we can draw conclusions. But they have been of use in this: that they have taught us where we must begin. There is another thing that I think is true—that the very men from whom we must look for opposition, and who will be continually against us, are precisely those men for whom we are laboring. They are looking for immediate results. They expect, as I heard a farmer say, the kind of education from the agricultural colleges which will enable a man to take up a handful of soil and feel of it, and tell you all it is composed of. That is the kind of knowledge they are looking for, and those are the men from whom we get opposition—the men for whom we are laboring. I do not believe that any man who has not been personally connected with careful and accurate experiments has anything like an adequate idea of the difficulty there is in connection with carrying on the experiments. It grows upon me every year as I am connected with it. I have lost faith in the results I have obtained every year, because I see how slight variations affect the experiment. So I have not a great deal of faith in the experiments that have been performed, I do not care by whom, or where. But I know we are getting nearer and nearer to what is true, and the only way to get at it is by patient, earnest work; and although we get opposition from the farmers, as I know we shall, yet we can only work on earnestly and faithfully, and good will certainly result.

In regard to the remarks of Professor Swallow, with reference to a series of experiments being prepared for one section of the country, I think I see the fallacy of his reasoning. Let us take the example of the corn culture in Maine and Louisiana. The experiment that is being conducted in Maine may not discover a law which will apply to Louisiana; but if we conduct the experiment in a certain way, and we find that certain results, if we carry on the experiment with any other variety of corn in Louisiana, follow relatively, it only follows that the law which we have been trying to learn, is a general law, and that it applies not only to Maine, but to Louisiana as well. It seem to me this shows at once how important it is that these experiments should be carried on generally over the country—over a great area, in order to get some data from which we can generalize—not laws that are local, but general laws which agriculture may look to as settled and definite laws.

PROF. HILGARD. I agree with the gentleman in this: that the more we employ experiments, the more apt we are to come to general laws instead of local experiences. The matter of experimenting has been run into the ground. Experiments made by private individuals have been reported as general laws, or illustrating general laws, without any basis for the assumption. It is that which make a great portion of the agricultural journals worthless, and a stumbling block to one who is trying to learn the the truth. Each man tries to put forward his own experiences as the proper course to follow in all cases.

I cannot agree with the strict separation that has been suggested between experiments of a practical nature and those of a scientific nature. One gentleman suggests we should come as soon as possible to the point, and do something which will tend to check the opposition we are apt to receive. I believe with Professor Daniels, that we must face the music, and stand up and say, we are not able to give general rules that will hold good for all parts The practical men, so called, are really the most impractical in the long run. We must educate the people, show them the difficulties in the way of immediate results, and the good we hope to accomplish by patient and continued effort. It takes time to do all this. An experiment of ten years is not a long experiment, and yet, how frequently has it happened that the eleventh year, that which seemed to be certain and fixed, has failed. I am confident we must not look to a compromise with those who would push us on to declarations, as principles of things, which we have not sufficiently tested.

Dr. Miles. I would like to say a word or two more. The separation of animals in feeding experiments has been objected to on what seem to me to be purely theoretical grounds. It is easy to make an assumption, and from that, reason to erroneous conclusions. We are all aware that solitary confinement is not profitable, yet from that fact it would hardly be safe to reason that we could not separate animals for experimentation. The question really is, how have we found it in our experience in the treatment of animals?

The facts are simply these, so far as my experience goes: that the animals in a pen by themselves are more quiet, and thrive better, and do better every way, than where there are a number of them together. Take the case that Professor Swallow suggests of animals that have been associated together for a long time, and then separated. Take a span of horses that have been together all their lives, and then separate them in the expectation of getting a good result in feeding them, and you will be very much disappointed. I have tried that—placing a number of animals together, and then separating them after they became acquainted with one another, and when they were separated they fell away at once, notwithstanding there was an increase in their feed. In selecting animals for experiments, it would be desirable to get those that have not these strong attachments. If there were two or three together, it would not be well to separate them and commence experimenting at once, but they might be first separated for a sufficient time to form new habits. We keep a large number in pens by themselves, and they do not come in contact with other animals except occasionally, they seem to be as contented as those where there are two, three or more in the same pen. Calves that we keep in box stalls are better contented than those where there are two or three together; so that really this is not a question of theory, but is to be determined practically—how we can best promote the growth of animals.

In regard to division of labor in experiments, it seems to me that the argument is carried a little too far. We know it is desirable at the present time to make a division of labor. It is impossible for one man to master the entire range of sciences, and become an adept in each. Great discoveries have been made by certain men confining their attention to certain objects, and working them out. It is desirable, of course, to repeat experiments, but the mere fact of repetition does not insure accuracy. If your experiments are defective, you may repeat them through all time and never get a satisfactory result. That is the point that should be kept in mind; repetition is absolutely necessary in experiments, but is not the only element. Accuracy is of the first importance, and then the repetition of an accurate experiment is essential. That is, when developing a law or principle from an experiment, we must do it with all the precautions that can be used. The progress of science has not been on account of the multiplication of observations, but the increased accuracy of them, and the employment of more perfect means of observation. Our senses become more acute, and we are able to detect slight changes; then the repetition of a nice observation has given us wonderful progress in science. I would seek a division of labor, and the benefits of co-operation at the same time. In this division of labor, I insist, in the first place, on the importance of confining our investigations to a single point. We should not try to mix science and art; we should not grow a crop of wheat, and then send a chemist to examine the soil, and draw a conclusion as to the manner in which the plant has grown. We have had too much of such science and investigation. How has progress been made by the scientific men, and what are the scientific experiments to which I refer? The chemist or the physiologist has wanted to know what particular elements were taken up from the soil by the plant, and in what particular form. How does he go at it? He takes distilled water and puts in certain definite substances; he shows what they are, and then grows his plants in that; he has certain accurate conditions in his experiments. The scientific man must control all of the experiments in his investigation; he must control all of the conditions of the experiment in his investigation, or he will not be successful as a scientific man. It will not answer for him to have control of two or three conditions, and then guess at the rest. Here is the difference between investigation in science and art. In the investigation in art, we cannot possibly control the conditions; we will control what we can, and then must compare observations for a long time, to get at the probable elements of error. Where we are drawing deductions as to the results of experiments, we must make allowances for the elements of error which underlie all our experiments. The distinction between the two lines of inquiry is very clear. In art we want to get at certain rules of practice. An experiment that would be satisfactory, so far as that is concerned, would amount to nothing, so far as increasing our scientific knowledge is concerned. Scientific investigations must be made with more care; one great reason why such a change has taken place in our agricultural chemistry has arisen from the fact that former experimenters in chemistry did not control all the conditions; they had not apparatus sufficiently delicate to detect all the slight changes which took place. Just as long as we work in this direction we are going to meet with disappointment.

In regard to the quality of corn in Maine and St. Louis: I do not know there is such a difference in the feeding quality of this corn. I am not aware that the matter has been tested experimentally. I am aware there is a difference under certain circumstances; an analysis will show a difference in its composition, but it does not follow there is a difference in the feeding quality of the grain. We have been running along for a number of years with the theory that the composition of the grain was an index of its nutritive value. No one now will pretend to advance that doctrine who has examined the latest researches in physiology and chemistry. But, admitting there is a difference in the corn of Maine and St. Louis, what we want to get at is this: the result of feeding in Louisiana or Missouri under the same conditions precisely, and the same care taken to secure accuracy. If the corn from Maine was taken to St. Louis, there would be a difference. There is an element of error underlying that we can not get at. We may not reach it in our life-time, but we must determine it before we can get at principles that are safe for us to follow in practice. If experiments must agree exactly in order to be of value, we may as well stop experimenting, for you will never get any two experiments to agree precisely, because you can not control all the conditions. But we can get at the general principle after elminating the error. For instance, I wish to know what the effect or value of a certain commercial fertilizer is. Should I apply it to one plat, I should have to examine a large number of unmanured plats and find their variation, and then I may compare the unmanured with the manured plats. But in order to get at the value, I must deduct the variation of the unmanured plats. We can only make approximations toward accuracy, make the experiments as accurate as we will. If we have the experiments tried under the same conditions in different localities, we have the means of comparing them. I have been for years collecting different experiments for the purpose of comparing, in order to get some underlying principle, and my difficulty is here: each one is tried in just a little different manner from the other, and there is no chance to compare them. I attempted a comparison of Lawes and Gilbert's feeding experiments with my own. He took pigs nearly grown up, and fed them for eight weeks; we took young pigs but an hour old, and raised them, first feeding them milk and then corn meal. We got better results, so far as the feed was concerned. When we took corn meal, we did not try all the different kinds, but confined our attention to milk and corn meal. When I came to compare the result, they differed materially; yet, notwithstanding his experiments were tried in England and ours here, and he had corn meal that was imported, I found a very marked agreement. They differed, and yet they agreed in principle. They agreed in this: that the animals consumed more in proportion to their weight in the ealier stages of the experiment, and gave a greater return for the food consumed, than afterward. They are experiments wide apart, and each taken by itself would be, perhaps, of little value, but together they corroborate one another.

It will not answer to experiment for the sake of our bread and butter. We must go at it as earnest scientific men, seeking to develop the truth, and let it make no difference who is pleased or displeased with the result. I know that farmers demand of the agricultural colleges impossibilities; I know they are expecting immediate results. A person said to me, two years ago, "I do not think much of your agricultural colleges." I said, "I am not surprised." He said, "Why?" I said, "because you are expecting something impossible from it. You think we claim we can take a green boy out of the city, knowing nothing about it, and give him a little agricultural chemistry and physiology, and then turn him out qualified to instruct old farmers." He said that was about it. I told him we believed and claimed nothing of the kind. Agriculture must be studied, and our rules must be based upon experience.

Prof. Swallow. The point I wish to make is this: to show that twenty experiments, with twenty elements of error in them, are not so good as two with no elements of error. That is the idea. We have forty colleges in this country making the same experiments, and in one-half of them there is an element of error which we know must be there, and the result will not be so valuable as if ten of these colleges were making the experiments without this element of error. No man would accept it as conclusive. You may as well say you could feed one animal on wheat and one on corn, and the results would be the same. I want to get at results as soon as possible. My idea was, we could get at some results more rapidly by having a sufficient number of colleges take up a certain class of experiments in which they could experiment without any necessary element of error, that we know of. I say you would get no more accurate results by having other colleges perform the same experiments.

There is a popular idea that we must do something for the public, and I think we can do a great deal. I have been accustomed to say, for a great many years, there is something for agricultural colleges to teach, even now. There is a vast amount of knowledge that our farmers do not possess, and which the colleges ought to give at once. I would not be misunderstood in this. I am for going ahead and finding out something else, while we are doing this.

Dr. Miles. Prof. Swallow and myself are agreed that we are anxious to get at the result as soon as possible. We only differ slightly as to the way. One object I had in proposing the method of conducting the experiments was, that it would save time and get at the results sooner. I agree with the Professor that it would be better to have two experiments without any error, than twenty with error. I will go further than that. I would rather have one without error than twenty containing error. The difficulty is this, however, and is one we must face: We can not make an experiment in feeding, without it contains an error. But if we co-operate in trying the experiment, we will sooner get at it, owing to the manner in which the experiment is conducted. I might experiment this year and get one result, and another next year. I do not know whether the variation is owing to differences in climate or not. If it had been tried at two different points under the same condition, it would be better than the same experiments tried two years in succession on the same ground. If the subject is assigned for me to settle, I might go on for fifteen or twenty years to do the same thing over again; but if twenty of us take hold of it, we can go along four or five years, and when we get one thing disposed of we can take another.

Let each institution try as many of these experiments as it can, and just such as it chooses to try. If there are those that are strong enough, with means to devote to the matter, so they can keep on with all of them at the same time, so much the better; but it is better to try some experiment than do nothing. We must not expect to get absolute accuracy, but to find the element of error, so that it can be eliminated. Even some of the most perfect instruments for philosophical investigation and observation are imperfect—as the thermometer, the barometer, and many other instruments; but tables are constructed for the correction of these errors, after observation and trial, and results are then reached which are practically accurate.

PROF. HILGARD. I am glad to see, from the remarks of Dr. Miles, that there is no difference between his views and my own, except he does not call science what I call it. The practical experiments are altogether scientific; that is, they are made on a scientific basis. What I object to is, making the experiments without controlling, as far as possible, the circumstances, and among them those referring to positions, soil and so forth.

DR. MILES. I do not undervalue scientific investigation. I believe we should have, in each of our colleges, proper apparatus, and a man to conduct experiments for the promotion of science. The distinction I would make between science and practice might be illustrated still further. In feeding stock, for instance, we want to get at the money value; we want to know what corn is worth in dollars and cents. In the scientific experiment which has to do with the explanation of these results, we want to know the elements that enter into the constitution of these things, and in what proportion they are combined. There are two lines of inquiry. We must conduct practical experiments with the accuracy of scientific experiments, applying the same methods. The scientific man, if he understands practical matters, is more capable of improving a practical experiment than a man who does not understand scientific matters. But the scientific man who makes experiments in the art is not familiar with the details, in many cases, and he is looking for scientific results, while we want to get values in dollars and cents.

AUTUMN SESSION OF THE BOARD.

The autumn session of the Board was held at Skowhegan, October 9th, 10th and 11th. The attendance was not as large as on some previous occasions. This was in consequence of the urgent press of farm work at the time, occasioned by the excessive wetness of the season; frequent and long continued rains having delayed the usual operations of the farm almost beyond precedent.

Prof. Fernald read the following report of the delegates appointed at the last session to attend the National Agricultural Convention held in Washington:

REPORT.

The National Agricultural Convention to which the undersigned were delegates from the Maine State Board of Agriculture, assembled at Washington, D. C., on the 15th, 16th and 17th of February, 1872.

In the language of the CALL issued by the Commissioner of Agriculture, it was proposed "that each Agricultural College, State Agricultural Society, State Horticultural Society, and State Board of Agriculture, depute two delegates to meet in Convention at the city of Washington,"—"to take such action regarding the interests of agriculture as they shall deem expedient."

In response to this call not less than a hundred and fifty delegates assembled at the time and place appointed, and the Convention was permanently organized by the choice of Dr. George B. Loring of Massachusetts, President, with one Vice President from each State and Territory represented, and a Recording, a Reading and a Corresponding Secretary.

Called as the Convention was with no definite object in view, beyond the good which might accrue to the cause of agriculture from a free consultation and interchange of views, its first work was necessarily that of arranging a plan, or topics for consideration. Among the subjects which received the attention of the Convention and which were the most important of those considered, may be mentioned the following:

1st, The expediency of seeking further land grants from Congress for the promotion of Colleges of Agriculture and the Mechanic Arts.

2nd, The subject of establishing Experimental Farms and Stations for the promotion of agricultural knowledge.

3d, The question of modifying the military instruction given in the national colleges of Agriculture and the Mechanic Arts.

4th, The best methods of co-operating with one another and with the Department of Agriculture.

5th, The preservation of timber lands, especially of the west.

6th, The establishment of State Boards of Agriculture in those States in which they do not now exist.

7th, The utility and necessity of a general plan of meteorological observations and crop reports, and of a general system of communicating the same by telegraph, "to the end that our knowledge of the laws which control the functions of the atmosphere may be increased, and that accurate and useful forecasts may be made at frequent intervals as to weather and crops in all countries."

For the proceedings of the convention in detail, reference is made to the full report published by order of the Senate of the United States. Some of the facts however, elicited by the discussions of the topics given above, and some of the conclusions reached may be of sufficient interest to justify their insertion in this report.

It appears from the discussion of the first topic, viz: the expediency of seeking further land grants for agricultural colleges, that the government has given for educational purposes of all kinds about eighty million acres of the public lands, while of this amount less than ten million acres have been devoted to the endowment of State Colleges of Agriculture and the Mechanic Arts. For railways and wagon roads more than two hundred million acres have been given. Of the public domain yet unsurveyed and unsold there remain more than a thousand million acres.

The statements made by the officers of the agricultural colleges represented in the convention, clearly demonstrates the inadequacy of the endowment of 1862 for the important work it is proposed that these institutions shall accomplish. In view of these facts the action of the convention in soliciting from Congress, additional land grants in behalf of these institutions, must commend itself to every friend of scientific agriculture; to every one who favors increased facilities for the education of the industrial classes.

Perhaps there was no subject which received the attention of the convention, more important than that of establishing Experimental Farms and Stations for the promotion of agricultural knowledge. Upon this topic an able report was prepared by Prof. S. W. Johnson of New Haven, Conn., from which we extract the following statements:

"The first requisite in this work is a clear vision of what it is practicable to accomplish. There are questions whose solution would be of the highest service, which it now appears nearly hopeless to expect will yield to anything but the most scientific and prolonged siege. There are others which in all probability, may be resolved in a short time. To the first class belong the higher problems of cattle feeding. The precise condition of the formation of nitrates in the soil is a subject of the very highest practical importance in its bearing on the economy of manures and on the rotation of crops, which doubtless might be quite fully elucidated by a comparatively easy chemical investigation.

In the second place, a full knowledge of what has been done in other years and in other countries must be obtained before the work of investigation can be intellectually laid out. In Great Britain, France, and especially in Germany, has accumulated a mass of observations, facts and conclusions, which constitute a capital for prosecuting this business, which we can borrow by paying the slight interest of translation and publication, and without which we shall waste years of work in simply rediscovering what is already known and in repeating the trials which have been found fruitless."

It is gratifying to record the fact that the task of eliminating from this material, and preparing for publication whatever promises to be most serviceable to American farmers, has been intrusted to Prof. S. W. Johnson, who was requested by the convention to prepare such further report as in his judgment may be best fitted to set forth the character, value and practicability of Experimental Stations.

The following resolve, relating in part to military instruction in agricultural colleges, introduced by Senator Morrill of Vermont, and readily passed by the convention, sufficiently explains itself:

"*Resolved*, That as a sense of this convention, we deem it of paramount importance to ask of Congress, as we do earnestly, for an additional donation of land, or proceeds of land, sufficient to found a professorship of some of the branches of practical science in each of the colleges now wholly or in part sustained by the previous land-grant of Congress, and also that the War Department may be directed at the earliest practicable moment, to assign an officer of the army to each of said colleges, in every respect competent to give mathematical and other military instruction."

As regards the protection of timber lands, a committee of five were appointed to report to the Commissioner of Agriculture on the best method of preserving the timber of the country, especially the timber of the Rocky Mountains and the central prairie regions of the republic.

The convention recommended the establishment of State Boards of Agriculture in the States of the Union in which such Boards do not exist. It is proper to mention the fact, that, as a result of this recommendation a Board of Agriculture has been established in at least one State, as shown by the preamble of the act organizing such a Board in the State of New Jersey. It reads thus:

"*Whereas*, The National Convention at the last meeting in Washington, in taking action for the promotion of agricultural interests, resolved that the several States in which boards of agriculture do not now exist, be requested to organize such boards by legislative action;" &c.:

"Therefore, be it enacted * * * * * * That the Board of Managers and Superintendent of the State Geological Survey, the President and two of the Professors of the State Agricultural College, chosen by the College faculty; three members of the Board of Visitors of the Agricultural College, chosen by their Board; the President or other representative sent by each of the State and County Agricultural Societies that may be in correspondence with this Board, shall constitute the State Board of Agriculture."

The proposition of a general and systematic plan of meteorological observations and crop reports, was heartily sanctioned.

The distribution of valuable seeds and plants by the Department of Agriculture, was encouraged, and a special request was made in behalf of New England, that it distribute in these States samples of the Treadwell and Diehl winter wheats, grown in Michigan, and of the best spring wheats grown in Nebraska. Another subject considered by the convention, to which allusion has not before been made, was the destruction to crops by noxious insects. The importance of this topic is evident when we remember that our country annually loses from this cause more than three hundred million dollars. The *action* of the convention upon this topic is indicated by the passage of the following resolutions, introduced by Mr. C. V. Riley of St. Louis, Entomologist to the State of Missouri:

WHEREAS, The injuries caused by the noxious insects to the different crops of the country are among the most serious drawbacks to successful agriculture, and all knowledge that will enable us to counteract the ravages of these pests of the farmer should be disseminated throughout the country; and

WHEREAS, It is known to the members of this convention that Mr. Townsend Glover, Entomologist of the Department of Agriculture, has been for many years engaged in preparing expensive illustrations and other materials for a work on insects; and

WHEREAS, The labors of said officer are in great part lost to the country for want of sufficient means to publish this work; therefore,

Resolved, That this convention earnestly ask of Congress an appropriation to the Department of Agriculture to enable it to publish the work at once.

Resolved, That an annual appropriation of at least $10,000 be furthermore asked for the special purpose of causing experiments for the destruction of noxious insects to be made by the different State Boards throughout the country, whenever the Commissioner shall see fit to so instruct and direct said Boards, the results of such experiments to be published in and disseminated through the monthly reports of the department."

Many topics incidentally considered, and resolutions of minor importance are necessarily omitted in this report. It was determined that another convention be holden in Washington, to meet on the third Wednesday of February, 1873. The President of the United States honored the convention by his presence on the third day, during a portion of its proceedings.

In conclusion it is proper to state that an accurate impression of the real doings of the convention would hardly be obtained from the published report of the proceedings. Much important work was done in committees of which the report gives but a very imperfect idea. Great good must come from the comparison of views for which the convention furnished an opportunity. The movement inaugurated for the more liberal endowment of agricultural institutions, and for their establishment in those States in which they do not now exist; for the establishment of experimental stations; for the preservation of the forests of our country; for the establishment of Boards of Agriculture in the States in which they have not hitherto existed; for the dissemination of the knowledge requisite to secure our cultivated lands from the ravages of noxious insects, must commend themselves to every intelligent cultivator of the soil, promising, as they do, results the most beneficent in the interests of agriculture. All of which is respectfully submitted.

S. L. Goodale.
M. C. Fernald.

The Junior Class of the Maine State College of Agriculture and the Mechanic Arts at Orono, gave a class exercise in The Elements of Agriculture, designed to exhibit the character of the instruction given at this Institution, and acquitted themselves with much credit. Hon. Charles J. Morris, then delivered the following lecture on

Life's Callings.

There is perhaps no question of more importance, not one on which more erroneous views are entertained, than that of life's callings, and this arises from a misapprehension of what constitutes a calling to the duties of life, and a misconception as to the nature, comparative importance, and dignity of these duties. A brief discussion of these several points, will constitute the first division of our subject.

The great masses have no just appreciation of such a call, or of any special claim which it imposes upon them. In the minds of many honest, conscientious men, it is associated with the more spiritual duties of a religious life. Reverently accepting the truths of revelation as their guide, it has never occurred to them that the special call has a far wider and more comprehensive meaning than they have usually accorded to it, that the revelation in which they so implicitly trust teaches that there are diversity of gifts, but the same spirit; and that in the wondrous gifts the Creator has bestowed upon his creatures there is variety in kind as well as degree. From the bias of our judgment by natural tastes, early education and habitual associations, we are often led to overestimate or undervalue the different callings in life; forgetting that in this great whole there are many members but one body; that the eye cannot say to the hand "I have no need of thee," nor, again, the hand to the feet, "I have no need of you."

Taking no exception to that common form of expression, that the religious teacher must be a man called from God, we only ask, believing it would be an important step towards true success, that something of this same sacredness be attached to all the pursuits of life.

Through the operations of this law one man may be called to the ministerial office, another to be a tiller of the soil, one to be a mechanic, another a statesman or an artist, and the tastes and talents which the Creator has bestowed upon them is their call to the work, and the instruments with which they are to win success, which, viewed in this light, becomes a duty. And the complete success of a life harmonious in all its parts, is only to be obtained by reverently listening to that call, and yielding implicit obedience to its commands. If with no uncertain sound it calls the young man to cultivate the soil, do not divert the order of nature by making him a religious teacher. If he possesses mechanical skill, develop and give it a practical direction instead of burying it in a counting house. If he has an aptness and love for the quiet duties of teaching, it will be useless to seek for him the stirring and more exciting pursuits of life. If love for poetry, music and art are his leading characteristics, you cannot reasonably expect that he will attain to marked success in physics and mathematics.

Every man is called with sufficient distinctness, to give a practical direction as to what shall be his pursuits in life. It was intended, and is necessary, that there should be a diversity of gifts as well as of form and feature, and each is to engage in his work, as of the ability of which God giveth; and the divine wisdom is beautifully manifested in the adaptation of this law to the demands made upon it and the work to be accomplished. There is no more cause for apprehension that a greater number of persons will be called to be farmers, mechanics, ministers or statesmen, than their several interests require, or than there is in the law which governs the proportion of the sexes. The great difficulty we have to contend with is, that some departments are over-crowded by those whom God and nature intended for other spheres. It is be regretted that so many cherish the idea that they have a genius which will enable them to successfully engage in any and every department of life's callings. The partial success which is sometimes obtained in violation of this law, can only be regarded as an earnest, or prophecy, of what they might have been had they been true to themselves in obeying this law of their being.

It is more difficult than we at first may suppose to estimate the comparative value of our great material interests. They are so intimately interwoven with each other, that we cannot easily determine when one commences and another ends. It has been said that agriculture, manufactures and commerce, are the three great pillars of our national interest. Commerce has done so much to advance civilization, universal brotherhood, and christianity itself, so much to develop the material interests and to stimulate the arts and sciences; it has furnished so fruitful a field for enterprise, and can point to so many brilliant examples of individual success, that it presents strong claims for pre-eminence in a a comparative valuation of the great branches of human enterprise, and yet commerce, without manufactures and agriculture, could have no existence.

Contrasting the condition of some degraded, uncivilized tribe, where the products of human skill are but little in advance of the teachings of instinct in the brute creation, with the inhabitants of more favored lands, where art and industry have been stimulated to meet the demands of a higher civilization, we find so wide and striking a difference—a difference extending to the physical, intellectual and moral development of these two branches of the human family, that we might for a moment be led to claim preëminence for manufactures. But manufactures are largely indebted to the facilities afforded by commerce, and without agriculture, as a foundation on which to build, they dwindle into insignificance or perish altogether. Shall we claim, then, as a natural consequence, the highest place for agriculture? We can hardly do this when we remember that we cannot have a single agricultural implement without the aid of manufactures, and although literally we might claim for it a separate existence, without the aid of manufactures and commerce it would not be worthy the name.

There would seem to be no great preëminence or post of honor in these three great primary divisions, which, in an important sense, may be claimed as the foundation for civilization and human progress. Each is so far dependent on the others as to preclude the idea of a separate existence for itself. But time and the occasion will not admit of so wide a range, and I shall confine the further discussion of the subject to the consideration of agriculture as one of life's callings. A brief reference to the present standing and progress of this great interest, will aid us in forming an estimate of its comparative merits.

The census of 1860 gives the area of farms in this State as 2,704,133 acres of improved, and 3,023,538 acres of unimproved land; number of farmers 64,843; farm laborers 15,865; making a total of 80,708 persons engaged in this business; while the number engaged in manufactures was 34,419, of mariners and fishermen 17,054, and the total of all occupations in the State 206,667. These farms were returned at a cash valuation of $78,688,525, with farming implements at $3,298,327, making a total of $81,986,825; being but $370,525 less than one-half of the valuation of whole State. My original intention was to present in connection with these statistics, a statement showing the comparative increase of our principal material interests, but there are not sufficient and reliable data available in connection with agriculture, on which to base such a statement. It might be given for a single decade, but to be of practical value it should extend over a much larger period. It must be conceded that great advancement has been made in the practice of agriculture and that it occupies a very prominent position among our great industrial interests and yet by far too great an extent, this has been accomplished by the natural and inherent advantages and necessities of the case, and on the drifting principles rather than by the intelligence, enterprise and progressive spirit with which it has been prosecuted.

In this connection I ask your attention for a moment to what has been accomplished in other departments. Our commercial marine in 1861 was second in rank in the extent of its ocean tonnage, while we were acknowledged superior to all other nations in the science of naval architecture and in the efficiency of our mercantile marine. And in this respect Maine stood in the front rank of the States. From very small and feeble beginnings our manufactures had attained in 1868, as shown by a carefully prepared statement made by direction of the Governor and Council to an investment of $40,000,000 and the annual products to $81,287,695. At the organization of our State government, there was not a mile of railroad within its borders, while the amount invested in them to-day, amounts to $3,000,000 more than the original valuation of the whole State. It is a proper and very important question—how did these enterprises attain to such marked success? It certainly was not by the drifting principle; by letting things take their own course; but it was by earnest and persistent efforts, it was by a combination of brain power with liberal and judicious use of capital. The movers in these great enterprises scanned the horizon in all directions, and were thoroughly awake to all the possibilities. Instead of a chronic dread of innovation, they have been alive to the spirit of improvement, and progress has been their watchword. They have not only desired, but they have won success; gold has flowed into their coffers and they command the services of the strongest intellects and the best executive talent in the land. Success has given them position and influence, all the more striking in comparison with the position occupied by agriculturists, and not only has this extended to to the acquisition of wealth and social position, but wealth, intelligence and influence have given them political power and control to a far greater extent than their numbers entitle them.

But how has it been with those engaged in agriculture? While there are exceptions, and we are happy in the belief that the number is greatly on the increase, the great masses have been governed by a different principle. To a great extent they have been following the old and beaten track, with no liberal and far-seeing policy. They have contented themselves with present acquirements with but little thought for future possibilities. Improvements and progress have been regarded in too great a degree as innovations; science and taste have been too much ignored, and joyous beauty and sentiment, regarded as at best but a weakness.

In the departments of theology, law, medicine, commerce, mechanics and the arts and sciences, men are educated for these particular callings, and whatever will aid their successfully engaging in them is freely given, and when the advantages afforded by our own country are exhausted, foreign travel and schools are added to give the finishing touches. But how many, think you, of the more than 80,000 engaged in agriculture in this State, were dedicated to, and carefully trained for this great work? While a horse for speed and a human being for a prize fight, must receive the most thorough and careful training, our young men are expected to take agriculture in the natural way as they would the mumps and measles. Cases have doubtless come under your own observation, where the farmer has given his children the best advantages for education within his reach, with the desire and expectation that they would engage in some other calling; or if his means have not been sufficient to educate them all, has selected the most talented and promising for other callings, leaving the dullest and most ignorant to follow the plow.

Five year's experience as a member of our State Legislature, has convinced me that it would have been impossible to secure the necessary appropriations for our industrial college, had it depended solely upon the members from agricultural districts. In a great measure it was accomplished by the votes, and the earnest and persistent efforts of members from cities and larger towns.

There is, in other departments, a professional pride, a spirit of enterprise, an earnestness of purpose, persistency in overcoming obstacles, and faith in the success to be achieved which is in striking contrast with that manifested by farmers as a class, and it is these characteristics, in connection with superior training, which has enabled other professions to achieve greater results.

Before passing to another division of the subject, I wish to present a few incidents which have fallen under my own observation. I am aware that they are very simple, but they illustrate the peculiarities to which I have referred; and there is not probably a person present, who could not duplicate these cases, many times, in their own acquaintance.

A piece of woodland in the form of half a circle, was owned by two parties, the division line passing very nearly through the centre. This was cleared of wood, and after a few years the ground was broken up on both parts at the same time, planted for several years, and at the time to which I refer, was ready to be laid down to grass. It was in those terrible days of financial distress which followed the eastern land speculation. Leaning over the division fence, these two neighbors exchanged friendly greeting, and naturally talked of their affairs. The one who was in the best pecuniary circumstances regretted that he had not grass seed to sow with his grain, adding that it was no use to talk, the times were so hard he could not spare money to buy seed. The other thought he could not afford to lay down his land without seed, and by some means he must have it. The next year one side of that division fence was a miserable crop of sorrel, and small at that, on the other as bountiful and beautiful a crop of clover as ever gladdened the heart of husbandman. Although but twelve years of age at the time, that morning's conversation and the marked results which followed, made a deep impression on my mind, it set me to thinking, induced habits of observation, and was the primary cause which led me thirty-seven years afterward, to attempt an agricultural address.

About six years ago, a Portland merchant purchased a farm and removed to it, six miles from the city. That was before farmers' clubs had attained their present prominence. Enthusiastic in his new calling, he thought it would be both pleasant and profitable if the farmers in the vicinity could be brought together for a general interchange of views in connection with their calling; notices were posted for such a meeting. To guard against the possibility of a failure, he made it a point to see them personally, explaining the object and soliciting their attendance. Now mark the result. There were present, the minister, the physician, the only members of the so-called learned professions in the place, the merchant, and the boy who had charge of the hall, these four and no more.

A gentleman in a country town where there was a little neighborhood of persons, was much interested and quite successful in cultivating a vegetable garden, but was obliged to perform the labor outside of his regular business hours. His garden became a central point where these few neighbors gathered for friendly chat and gossip after their day's work. They watched the progress of the work, and from time to time expressed deep interest in this garden in particular, and for gardening in general, and each solemnly avowed that they would like a garden and would have one of their own, if they only had time to attend to it; but I suppose that to this day they have not been able to apprehend the fact that the garden in question was cultivated in the spare moments which they suffered to run to waste.

I will also tell you of a farmer neighbor of mine, a kind, genial man, but narrow in his views. His wants were simple, and his land being remarkable fertile, he made a comfortable living. I remember distinctly a conversation we had in regard to farming. After dwelling at some length upon the degeneracy of the times, and the new fangled notions about farming, to give a point to his moral, he said with a tone and expression in which contempt for the system and pity for his misguided neighbors seemed struggling for the mastery, "There are the Roberts', they are spoiling their farm by putting so much of this *compost* on it."

In our second division we shall present some reasons why agriculture has not taken a more prominent position in this State. The great lumbering interest has absorbed a large amount of the labor and industrial energies of our State, diverting them from other branches of industry. Agriculture has specially suffered in this direction. Let me give you a simple illustration which came under my own observation. For twenty-five years I resided on the line of road leading from the three great manufacturing points on the Saco river to Portland. Before the opening of the York and Cumberland Railroad, the large amounts of lumber manufactured at the places was carried to Portland, a distance of sixteen miles, on teams. A large number of the people on the line of the road, and even three and four miles off the line, were engaged in this work; there seemed to be a deep, almost excited interest with these men to engage in this business; many of them neglected their farms, worked hard, made a comfortable living, but few of them did more, and some less, and in a majority of cases, there was no improvement made in property, and no increase in wealth, as the result of this severe and protracted toil. With the opening of that road, all this passed away; more attention was given to the hitherto neglected farm, and in a few years there was a marked improvement in their financial affairs.

During an excursion made to the lower part of our State a few years since, I was painfully impressed by seeing the workings of this system on a more extended scale. Small homesteads had been cleared, but there was no appearance of interest or heart in the work. The owners were employed in lumbering, not as principals, but in the employment of others, and it was painfully evident that no foundation for present or future wealth was being laid. And it must be borne in mind that the cases of individual success in connection with this branch of industry, which have so dazzled the mind of the masses, have been confined to a small number. A very large proportion of the men engaged in this business occupy subordinate positions, they are simply laborers at so much per day or month. Their is but little opportunity for increase or development. The young man of twenty-five is better able to perform the labor which entitles him to his thirty or forty dollars per month, than the man of fifty years; and if he succeeds in providing a simple home and comfortable support for his family, it is all he can hope for during the best years of his life, while in agriculture the young man who takes up a section of new land, and for ten or twenty years struggles hard to supply the wants of his family, finds a steadily growing compensation, and in many cases a competency in the increased value resulting from the development of his farm.

Another reason is, the generally received opinion that our soil and climate cannot successfully compete with other States. This objection has been so often and so persistently urged, that we have too nearly accepted it with hardly a question of its truthfulness. The result has been a feeling of despondency in regard to this great interest, and the diversion of large numbers of our young men to other callings or driving them to other localities supposed to be more favorable.

This is an evil of so great magnitude, and has done so much to hinder the increase and development of our State, that I ask your careful attention to some facts, collated from the reports of the agricultural departments of the United States for 1870. I have taken the five largest crops, viz: corn, wheat, oats, potatoes and hay, comparing the yield per acre, and the value per acre, with the other New England States, and then with the six States outside of New England which grow the largest amount of each particular crop, with the following results:

CORN.

Maine, average yield per acre......	33 bush.	Value per acre...........	37.62
New Hampshire, " "	36.5 "	" " "	39.78
Vermont, " "	39.6 "	" " "	43 56
Massachusetts, " "	33 "	" " "	32.34
Rhode Island, " "	26 "	" " "	27.56
Connecticut, " "	26.4 "	" " "	30.09
	6)194.5		6)210.95
Average for New England States,	32.4	Av for New England States,	35.16
Maine exceeds the average,	.6	Maine exceeds the average,	2.46
being	33 bush.	being	37.62

Six largest corn growing States outside New England:

Iowa, average yield per acre, ...	32 bush.	Value per acre............	10.88
Ohio, " "	39 "	" " "	18.72
Indiana, " "	39.5 "	" " "	15.01
Illinois, " "	35.2 "	" " "	12.32
Missouri, " "	31.4 "	" " "	13.81
Kentucky, " "	32.1 "	" " "	15.40
	6)209.2		6)86.14
Average yield for six States,	34.9	Average value for six States,	14.36
Maine less than average yield,	1.9	Maine exceeds the av. value,	23.26
	33.0		37.62

WHEAT.

Maine, average yield per acre..........	14 8	Value per acre	26 34
New Hampshire, " "	14.8	" " "	23.53
Vermont, " "	16.8	" " "	27.38
Massachusetts, " "	17.6	" " "	30 80
Rhode Island, " "	17.6	" " "	30 80
Connecticut, " "	17.8	" " "	27.05
	6)99.4		6)165.90
Average for New England States,	16.5	Av. val. per ac. N. E. States,	27.65
Maine less than average yield,	1.7	Maine less than av. value,	1.31
	14.8		26.34

Six largest wheat growing States outside New England:

Pennsylvania, average yield per acre	12.0	Value per acre	15.24
Ohio, " "	13.8	" " "	15.04
Illinois, " "	12.0	" " "	11.28
Indiana, " "	11.0	" " "	11.00
Wisconsin, " "	13.4	" " "	11.73
Iowa, " "	12.5	" " "	9.75
	6)74.7		6)74.04
Average yield for six States,	12.4	Av. value for six States,	12 34
Maine exceeds the average yield,	2.4	Maine exceeds the av. value,	14.00
	14.8		26.34

POTATOES.

Maine, average yield per acre.........	125	Value per acre...........	82.50
New Hampshire, " "	88	" " "	69.52
Vermont, " "	140	" " "	71.40
Massachusetts, " "	88	" " "	84.48
Rhode Island, " "	79	" " "	77.42
Connecticut, " "	73	" " "	72.27
	6)593		6)457 59
Average yield for New England States,	99	Av. per acre N. E. States,	76.26
Maine exceeds average yield,	26	Maine exceeds av. value,	6 24
	125		82.50

Six largest potato growing States outside New England:

New York, average yield per acre...........	98	Value per acre...........	63.70
Pennsylvania, " "	87	" " "	67.86
Illinois, " "	81	" " "	51.84
Ohio, " "	72	" " "	58.32
Michigan, " "	95	" " "	55.10
Iowa, " "	95	" " "	49.40
	6)528		6)346.22
Average yield for six States,	88	Av. value for six States,	57.70
Maine exceeds average yield,	37	Maine exceeds av. value,	24.80
	125		82.50

HAY.

Maine,	average yield per acre.........	.80	Value per acre..........	15.75
New Hampshire,	" "	.96	" " "	19.05
Vermont,	" "	.96	" " "	13.92
Massachusetts,	" "	1.07	" " "	27 96
Rhode Island,	" "	1.09	" " "	26.16
Connecticut,	" "	1.30	" " "	33.28
		6)6.18		6)136 12
Av. yield per acre for New England States,		1.03	Av. val. per ac. N. E. States,	22.69
Maine less than average yield,		.23	Maine less than av. value,	6.94
		.80		15.75

Six largest hay growing States outside New England:

New York,	average yield per acre.........	1.23	Value per acre...........	21 16
Pennsylvania,	" "	1.30	" " "	16.96
Illinois,	" "	1.18	" " "	12.67
Ohio,	" "	1.31	" " "	14.43
Michigan,	" "	1.36	" " "	15.19
Wisconsin,	" "	1.34	" " "	13.97
		6)772		6)94.38
Average yield for six States,		1 28	Av. value for six States,	15.73
Maine less than average yield,		.48	Maine exceeds av. value,	.02
		.80		15.75

OATS.

Maine,	average yield per acre	27 4	Value per acre..........	17.81
New Hampshire,	" "	29.7	" " "	19.60
Vermont,	" "	33.7	" " "	19.88
Massachusetts,	" "	26.4	" " "	19.27
Rhode Island,	" "	32.7	" " "	19.94
Connecticut,	" "	32.4	" " "	22.35
		6)182.3		6)118.85
Av. yield per acre for New England States,		30.4	Average value per acre,	19.81
Maine less than average yield,		3.0	Maine less than av. value,	2 00
		27.4		17.81

Six largest oat growing States outside New England:

New York,	average yield per acre.........	32.4	Value per acre...........	18.79
Pennsylvania,	" "	32.6	" " "	15.64
Illinois,	" "	26.0	" " "	8.32
Ohio,	" "	31.1	" " "	11.81
Wisconsin,	" "	27.9	" " "	10.88
Indiana,	" "	32.9	" " "	8.91
		6)182.9		6)74.35
Average yield per acre for six States,		30.5	Av. value for six States,	12.39
Maine less than average,		3.1	Maine exceeds av. value,	5.42
		27.4		17.81

The average value of the nine principal crops in all the States, viz: corn, wheat, oats, barley, buckwheat, potatoes, tobacco and hay is $18.31, being 84 cents per acre short of the average for Maine.

It will be seen by these comparisons, that Maine is ahead of the other New England States in the yield and value per acre of her corn crop, and that she is but one and nine-tenths of a bushel per acre short of the average yield of the six largest corn growing States in the Union, and exceeds these States in the value of this crop $23.26 per acre.

The wheat crop in Maine falls short of the average for New England, one and seven-tenths bushels in amount, and $1.31 per acre in value, while it exceeds the average yield of the six largest wheat States outside New England two and four-tenths bushels per acre, and $14.00 per acre in the valuation.

The potato crops of Maine exceeds the average for the New England States in both yield and value. It exceeds the average yield of the six largest potato growing States outside of New England, and $24.80 per acre in valuation of crop. She is twenty-three hundredths of a ton per acre short of the New England average in yield of hay, and $6.94 in value, forty-four hundredths of a ton per acre short of average for six largest hay growing States, and exceed these States two cents per acre in value. She is three bushels per acre short of the New England average for oats, and two dollars per acre in value; three bushels per acre short of the average for the six largest oat growing States outside of New England, but exceeds them in the value per acre, $5.42.

In the nine principal crops grown in the United States (leaving out cotton as being more of a local crop), Maine exceeds the average value per acre 84 cents, and by the returns for 1870 exceeds twenty-six States in the average per acre of her crops, and is surpassed by only ten States.

These statistics will probably surprise all who have not previously investigated this subject. It is true we have not taken into account the fertility of the soil, and the greater facilities with which crops may be grown in the western States; nor, on the other hand, have we attempted to estimate the peculiar characteristics which go to make up the glory and beauty of New England life. It should also be remembered that so severe have been the drafts upon the native fertility of that Western soil, that its occupants will be driven from necessity to adopt more laborious forms of cultivation and more costly fertilization, thus repeating the experience of the farmers of New York and Ohio, who formerly looked upon their soils as inexhaustible, but have since learned their mistake.

A careful consideration of the facts presented must satisfy us that we have been in error in under-estimating our advantages in comparison with other States. We may labor under some disadvantages, but these in some form are common to all. The great law of compensation applies to this as well as in other directions. These statistics deserve the most careful attention from agriculturists in our State. Especially should they be studied by those who contemplate leaving Maine for other localities supposed to be more favorable.

To one point in this connection I would call your special attention. I suppose the most inveterate grumbler would hardly think of objecting to our soil and climate as not being adapted to the cultivation of grass, the importance of which may be seen from the fact that for a series of years the hay crop alone has been about two-thirds the value of the entire crops of the State, exclusive of the important interest of grazing, on which the products of the dairy and the growth and improvement of stock is very largely based. And yet the statistics presented show that Maine is not only short of the average for New England, but all the largest hay growing States. There is, it seems to me, no necessity for this. With skill and energy equal to that which the mercantile and manufacturing classes bring to bear upon their business, this crop may be doubled, and when this is accomplished you have placed Maine in the very front rank of agricultural States.

A third reason may be very briefly stated. Agriculturists as a class do not sufficiently respect themselves and their calling, and do not make that preparation for its duties which their importance demands. The natural result is, the failure to sustain so high a position in the social, financial and political world as members of the mercantile and learned professions, for neither individuals, nor classes of men, can command the respect of others if they fail to respect themselves.

In the third and last division, I shall speak of the position that agriculture should assume as one of life's callings, and how that position is to be secured. As already shown, the investment in farms and farming implements, is one half the total valuation of the whole State, and the number of persons engaged in agriculture, is nearly equal to that of all other professions united. The number engaged and the amount of capital employed entitles them, all things being equal, to the highest position in the social, financial and political world.

There is no necessity because a man is a farmer, that he should be an ignoramus; the boy who is to be trained for agricultural pursuits is entitled to as careful and thorough an education, as in the case of other professions. And the very nature of his calling is favorable to life-long investigations and attainments in scholarship. I do not wish to be understood, that all boys designed for this profession can and must be "liberally" educated, in the common acceptation of the term, but I do most earnestly protest against the prevalent idea that they, of all others, can afford to be ignorant. There is no necessity because a man is a farmer, that he should be coarse and vulgar in his tastes, with no love for the grand and beautiful. Is not the study of nature better adapted than other studies to develop our tastes, and enable us to discern beauty, order, proportion and symmetry? And who is brought into such intimate communion with nature in all her visible forms as the farmer? With no sympathy with any sickly sentimentality in this connection, I protest against the farmers ignoring taste and beauty and the cultivation of his finer faculties. If he would develop these powers, if he would surround his home with trees and flowers, and cultivate in his children the spirit of gladness and beauty, how richly would he be repaid by the blessings which would be showered upon him, and how precious would be the remembrance which his children would carry with them from such homes as these.

There is no necessity because a man is a farmer that he should be poor. It will not be in his power to amass such immense wealth as individuals in other pursuits have occasionally done. But it is within their reach, as a class, to become more generally independent and wealthy than any other professions. As an illustration of what can be accomplished with only common advantages, I had marked some cases given in the United States agricultural reports to be used in this connection, but finding my lecture extending to such length, they are omitted.

There is no necessity because a man is a farmer that he should occupy an inferior position in social and political life; but, on the contrary, there are the strongest reasons why, as a class, they should be a power in these directions. If to numbers they add intelligence and enterprise, how can it be otherwise, and where does social influence and political power so properly belong, as with those who own and cultivate the soil? If true to themselves this class may become, in the noblest and truest sense, the aristocracy of the land, the conservatives of the liberties and highest interests of the people. In treating of the position which this calling should occupy, and how that position can be secured, I have merely hinted at what should properly be elaborated in a lecture by itself.

The necessity laid upon us, if we would lift this calling to a higher plane than it now occupies, calls for a higher standard of general intelligence, and for the awakening of professional pride and enthusiasm. It calls for business enterprise and a greater earnestness of purpose; for a more courageous and reliant spirit, for stronger faith in its possibilities, and for a deeper sense of the honor and dignity pertaining to it.

PRES. ALLEN. I can only speak in the highest commendation of the lecture, because it brings before our minds these great truths of the importance of the calling of agriculture, and the necessity of intelligence in this department. One cause why agriculture as a calling has not assumed its true position, and the influence and respectability which is due to the calling, is this simple fact: Men have influence not according to their usefulness, but according to their intelligence. A person may be good but, comparatively, without influence, for goodness is one thing and influence is another. Now that influence will depend upon intelligence, and intelligence demands culture. Brain power will not be developed without use of the brain, nor will the brain be used effectually unless it is educated. And the thought, the falsity that there is no special intelligence required to make a good farmer, no special brain culture, no education to develop mental power is required to make one successful in agricultural pursuits, has been one of the great reasons which has depressed farming in Maine. Suppose you had a flock, or herd, and should sell off all the choicest young from that flock or from that herd, I ask, how long would it be before you would have a poor flock and a poor herd? And I ask, if you drive away from the shepherds all the noblest young men, how long will it be before you will have a poor parcel of shepherds? Now just as sure as you put such a seal of disapprobation upon agricultural pursuits as to imagine that it does not require intelligence, you drive every enterprising young man out of the employment. They will not engage in an employment that does not require intelligence and superior mental power; but let the impression once prevail in the community that intelligence, culture, educated mind, is just as necessary for success in agriculture as it is in law, in medicine and theology, then the farmer will have just the influence which he deserves in the community.

Adjourned.

SECOND DAY.

The Board assembled at 10 A. M.

THE PRESIDENT. I am happy to know that there is present with us a member of the New Hampshire Board of Agriculture. We would be glad to hear from Mr. Lawrence of Rockingham County.

MR. J. F. LAWRENCE. It would be in vain for me to attempt fully to express the pleasure I enjoy in being able to attend your session. I know well the arduous character of the labors which surround you from my own experience as a member of a similar Board in a neighboring State; and that the unfortunate circumstances preventing a larger attendance at this time must be very depressing.

I desire especially to express my satisfaction at the part which your Agricultural College students take at your sessions; and my gratification with their proficiency and the excellence of their training. But the contrast to me, as an inhabitant of the Granite State, with our own, was not pleasant. I have never seen the students of our college except once when we had a meeting at Hanover, and then they were as dumb as the cattle in our fields, and for the sake of arousing them I said I hoped I should never come to the town of Hanover again to join with them in holding a farmers' festival unless the boys should take part with us; that it did seem, if there was any knowledge to emanate from that college for the benefit of the agriculturists of the State, we were entitled to it, and the boys were the medium through which it should come. I said to them, "Now when we shall come here again and commence holding meetings over the State of New Hampshire, let me suggest this as a topic upon which the college boys shall give an essay, and I will give a premium for the best, and that is, 'The producing power of the soil and how to increase it.'" And now it does seem, after the exhibition I saw of your boys, that you are not hereafter to depend alone upon your farmers, old and young, but that at your future meetings these boys come up from that institution, learned enough to instruct the farmers of the State, who shall tell us how to make the soil of Maine produce more than it has in the past. There is one other topic to which I will allude, that is in regard to the feeling of despondency which has prevailed. When we organized our State Board of Agriculture in New Hampshire, we issued an address to the people of the State, and prominent in that address was this idea: we must commence the work of making the farmers of New Hampshire stick to their hillsides, and I was the only member of our Board who refused to sign that address, and I refused because I did not believe in it then, and my experience has not led me to believe in it to-day; because I have learned this, that farming on good land pays, but farming on poor land never did pay and never will pay. And now if you will go over New England, you shall see what you will see still further developed, the good land being divided and subdivided, and homes made there more thickly, and the poor, sterile portions of New England given up to forests, which is its best use, as they are becoming more and more valuable. As I have travelled over some sections of your State and many of my own, and have seen homes being erected upon land so poor that they never should have been erected, it has filled me with sorrow, because I know, from their distance from markets, from their poor soil, steep hillsides and rocks, and from all the disadvantages under which they labor, they can only stay there; they cannot live, and they cannot enjoy the advantages that they should enjoy. They will be poor themselves and raise up children poorer than they are. If I need to bring anything in proof of this, I would take some favored section of my own State, where agriculture is the principal business, where every town gives evidence of thrift and wealth, yet where the people are agriculturists to-day and have been made prosperous from the fertility of the soil and the advantages of location. In that fertile soil they have been able to raise fifty bushels of corn to the acre, while the man I first depicted has been unable with the same exertions to raise more than fifteen; and this has made one set rich, and growing richer, and the other poor and growing poorer. I submit, if there is any duty which this Board of Agriculture owes to this State, it is this: to urge your farmers to stay in Maine, because it is a noble State, and you have enough good land here to maintain, not only your present population, but twice that. But, sir, policy and good sense dictates, that your fertile valleys and beautiful lands, of which you have plenty all over your State, shall be divided and subdivided and filled with happy homes; and it is also part of your duty to urge your people to cultivate only such land as will pay for cultivation.

Mr. Lucas. I feel that there is great force in the last remarks of the gentleman. I have seen much of the evil, and will mention a single instance in illustration: In 1847, a friend of mine moved into the town where I lived and bought a farm which he purchased for three hundred dollars, including land, a comfortable house and an ordinary barn. It was very stony. When you removed the first tier of rocks a second just like it lay beneath, and when that was removed there was a third. It was much like a portion of the land in eastern New Hampshire with which I am acquainted. I told him that he might work there year in and year out, and although he might not grow any poorer, he never could grow any richer there. Finally I went so far as to say to him, (from the fact that he was a connection, and what I was going to give him was only giving to another part of my family,) that if he would sell it and quit, I would make up his loss. He did so and put himself on an average farm where he succeeded well and made himself considerably better off than the average of farmers. If he had remained there he never, probably, could have been worth a dollar made from the farm. Too many of our farmers are of that character.

Another thing; too many farmers are content with poor horses and too poor stock generally. Only a small proportion of the horses pay a profit on their keeping and raising; one third of them are worth more than all the rest; and we keep more than we ought to. As for their cattle, our farmers, or too many of them, grow them of such appearance, character and size, and put them into the market at such an age, as to lose the greater part of their cost; whereas another grade of cattle, treated differently and matured properly, might have been put into the market at paying prices. There is another thing that our farmers ought to understand; that is, that they do not cut their hay early enough by two or three weeks. I was in Aroostook county this Fall; I left Orono the 7th of August, and when I got up there they were just in the middle of haying, and they continued it until the 23d of August;—and there were hundreds of tons to be cut then. You all know what that is worth. That accounts for the amount of seed we get from there. It falls off, and they cleanse it, get out the seed and give it to us. That is their mode of farming to a great extent. Another idea that people ought to learn is in regard to pastures, that they overstock them. And another, that highland grass for pasturage is worth more than lowland grass. It produces more growth, more milk, butter and cheese. They ought to learn that grass and hay *cured properly* is worth as much to them as any possible feed they can get. I make the assertion that all kinds of neat stock will grow as rapidly and fat as well and as fast upon the right kind of hay as upon any feed that can be given, corn and grain included. Every thing suffers in the same ratio that hay does by not being harvested at the proper time. For instance, grain made after it is out of the field produces flour worth fifteen dollars; when the same grain stands two weeks later it produces flour that is worth only eight dollars. In these things our farmers are verily faulty. What can we say, and what can we do, to induce them to do better?

MR. FOLSOM. We hear a great deal said about the raising of stock and what to do with it; the raising of different crops and what to do with them; and these are important considerations. You do well to consider them, but there is one other subject I would like to suggest for consideration; and that is, How to raise farmers' sons and what to do with them? I think it worth while for you to make some suggestions to farmers in regard to the manner of rearing sons and what they should do with them and how to induce them to remain on the farm. In my own training a great mistake was made. I was nearly broken down in constitution, when I was a boy, prior to the age of eighteen years. Although I was the son of a kind father he was not always considerate, and the result was, I was driven from the profession of the farmer for which I was intended and which I might have loved. It was the design of my father that I should remain with him, but I had to seek some lighter occupation in which I might succeed; being satisfied that I never could succeed if I remained where only bone and muscle and sinew were called into requisition. I make the suggestion that this Board, if they should see fit, might take it into consideration, and that it might be considered at farmers' clubs. I am glad that it has engaged the attention of some of the wisest and best minds, and that they have provided the Agricultural College, and that you have seen an exhibition, to some extent, of the farmers' sons, and what is being done with them. I think that the subject is worthy of as serious consideration as the rearing of horses and crops and what to do with them.

PRES. ALLEN. There is a single point which might be alluded to in this connection—the culture of small fruits. One little incident may serve as an illustration. Visiting, not long since, an old friend, the remark was made by the lady of the house, "I wish my boy could go to your college, but we cannot raise the money." Said my wife, in reply, "you might cultivate strawberries and send your boy." That remark the woman treasured up, because she wanted her boy to go to the college. She had pride in him, and she had confidence in me as an old friend. This Fall, that boy made his appearance, and the mother told me, "the money that sends that boy this term is all secured by the sale of strawberries, the cultivation of which your wife suggested."

THE PRESIDENT. Those present would be glad to hear from Mr. Lawrence some further remarks, more especially in relation to his own methods of grass culture. Will the gentleman favor us with his views?

MR. LAWRENCE. I should have some hesitation in relating the details of my own practice and its results so far from home were it not that one of your Board has visited my farm and will corroborate what I may have to say. Since being here, an intelligent and observing farmer from Waldo county, has told me that in that county potatoes and hay have been raised extensively for sale, and that many farms have paid for themselves several times over by the growth and sale of both these commodities. He tells me also, that to-day the farms which had been devoted to raising hay for sale are in much better condition than those from which potatoes have been extensively sold. This was exceedingly gratifying information to me inasmuch as it corroborates my own opinion in regard to the exhausting character of the potato crop, and also that grass is the natural product of the soil. It was my fortune at the age of twenty-four years, to come in possession of a very good farm, by my father retiring to another. At that time I had some ideas of farming, because I had always worked upon a farm, and, although my father had acquired a competency, either himself or through his father before him, I was satisfied he had not acquired it at the present prices of labor, nor even at the prices paid eight, ten, or twelve years ago; and having strong convictions in regard to that matter, I decided upon taking charge of the farm and to manage it in an entirely different way. My first step was to sell from the farm, at least two-thirds of the stock; and I have annually sold since, two-thirds of the hay grown on the farm. That course might not do so well here, because you may not be so favorably situated to sell hay as I was then; but the raising of grass will do as well for you here, and if the grass does not sell you can feed it to your stock. In adopting this course I had any quantity of advice from the citizens of the vicinity in which I lived, and I had most decided warning from my father, that such a course would result in running the farm out. At that time we had one field of fifty acres; another of seventeen acres, and another of eight acres. The small fields my father kept to cut for his horse and cow. The seventeen acres were sold, and there was left to me the field of fifty acres. After continuing my course of selling most of my hay for six years, and never buying a cord of barnyard manure, and never but one car load of ashes, I am proud to say that I succeeded in raising more hay from that single field than my father ever raised in one year from all his fields together. The last year I owned it our county society offered a premium of fifty dollars for the best cultivated farm in the county, I am proud to say further, that after continuing the system of farming which I have related to you, I received that premium. In arriving at this condition of things I say also that I had made the farm profitable, because I avoided paying out much for labor. I had been over the country considerably, and I had come to the conclusion that our brothers in the West could raise corn and wheat there much easier than we could here; and that our position as the manufacturing section of the republic indicated the raising of grass as the most profitable style of farming for us, and I turned my attention to that.

My practice is to do most of my farming in the fall. I have raised hardly a bushel of corn in my field, and have never raised anything in my pastures Immediately after cutting the grass, and it is cut very early, in July if possible, I commence plowing, beginning on my low land first and turn it over, and if it is very low (as I have never underdrained) I plow it up in beds, harrow and seed it down with an application of bone, Peruvian guano or superphosphate. On my first farm, the one to which I more particularly alluded, I have never brought any manure and never but one car load of ashes and nothing else but ground bone, Peruvian guano and superphosphate. My endeavor has been to practice economy and to make money in this way. In cultivating the first field and another farm of which I propose to speak, no man has ever got on to a mowing machine or rake of mine but myself; and of the plowing, first and last, seven-eigths has been done by myself as plowman, and with a single teamster.

I have arrived at the conclusion, after pursuing this course, that with three hundred dollars judiciously expended in labor and fertilizers in August and early in September I can improve my farm more and better than I can by consuming fifteen hundred dollars worth of hay (at the price it has been for the last few years) and applying the resulting manure in the ordinary course of farming. That might be conclusive in regard to the first farm, if you accept that. But after I received this premium it operated as it might have done elsewhere. I put that farm into the market and sold it at a round price and then I took another situated about two miles distant, which I knew to be a good one, although it was in worse condition than my first one. It had been treated as my father's farm had been, by consuming all the hay and raising hoed crops, until about ten years before I took it. At that time the gentleman who owned it died and left it to his grandson who tried to farm it. Four years before I bought it some men purchased it to make money. They sold every pound of the hay and did not turn a furrow or do anything except run the farm down. When I first took that farm, four years ago, I put all the hay in four mows, I think not more than sixteen or eighteen tons. The same system that I practiced on my old farm has been practiced on this, except that since the first year I have sold nearly all the hay cut upon it. I have not received any premium upon this farm yet, but this year I inaugurated a system of holding field days in New Hampshire, and asked the farmers to come and see my results upon the farm, and they came, and we had a good, old-fashioned time, which I hope will be kept up by the farmers there, and which I hope will be inaugurated in this State. When my friends of the Board of Agriculture and of the State Agricultural Society, and the agricultural editors with whom I am acquainted, came and saw, they said, "Mr. Lawrence, we have heard your statements. We thought sometimes you exaggerated a little, but you have more than sustained yourself by the exhibition of the farm to us to-day." I assure you that if I ever was proud in all my life it was when taking these friends over the field, and then showing them a barn of a hundred feet in length as full as it could comfortably be with hay.

And having tried this experiment and proved its results upon the soil of New Hampshire, which is not so good as some that I have seen in many parts of your State, I believe, in these days of high priced labor, the same system will do well for you. There is one thing that I had for my advantage and which you must have for yours. In both cases I farmed upon naturally good land, and if I have any advice to give it is this: never attempt to farm as I have related *unless upon good land.*

If you have poor land let it grow up to wood—at any rate don't try to cultivate it with any expectation of making farming in Maine profitable. You have good land enough, and that you may have success with, if you will treat it as I have done.

The pith and substance of all I can say upon this matter can be put in very few words—MANURE IS CHEAPER THAN LABOR—and in saying this I wish it to be distinctly understood that I am not now speaking in the interest of any manufacturer of commercial manures. I simply give you my experience, as a farmer, in the treatment of grass lands.

One thing more I must mention which has been a wonderful aid to me, and which may create a smile, but my story would be only half told without it. I have placed great reliance upon the fertility resulting from the decomposition of the sod turned over, and which is the natural result of having the land full of witch-grass! In some investigations made in western Massachusetts upon land much like mine, there was found in no acre of a large field less than thirteen tons of vegetable organic matter, such as roots and the matter pertaining to the sod, which, if turned under would be equivalent to manure and help enrich the soil.

My low ground is naturally herds-grass land; upon that I generally put twelve quarts of herds-grass seed in the fall, and in spring perhaps four quarts more. Observation would show if it was needed and where to put it. But upon my high land I put none at all. Year before last, the very first of August I plowed four pieces of the highest land in my field, and a few days later Hon. J. B. Lyman came up to see me with his family. He said, "You have not seeded this piece." "No, I have fertilized it, but don't intend to put any seed on it." "What do you expect to get?" "Grass, and I expect it from the witch-grass roots underneath." Five or six weeks afterwards he came up again and went out to see this piece and had to hunt some time to find it.

QUESTION. What amount of superphosphate do you apply to the acre?

MR. LAWRENCE. A man should use judgment in regard to that. If the main object is to get a catch, and the land was low and rich enough to send the grass along after it was cut, I would put three or four hundred pounds. If it was high land and not so rich, I would put double that amount. I have experimented with Peruvian guano and ground bone, and while I have got the best results from the superphosphate, I have had also good results from both the others. I plow the witch-grass land six inches deep.

QUESTION. Is your grass mainly witch-grass?

MR. LAWRENCE. My high land is all witch-grass land.

QUESTION. You sow no seed?

MR. LAWRENCE. None upon the witch-grass land. It is a fact that superphosphate and bone will bring in clover somewhat, but I sow no seed on the high land. I think any one who has had witch-grass during the last two or three years of extreme drouth, will incline to the opinion that he don't want it out of his grass field. I will further remark, that as you have listened to my statement, it is my intention, if I live until another year, to continue having farmers' field days upon my farm. And I assure you, in return for the courtesy which your Board has extended to me, when I have another field day I shall invite the members of the Maine Board of Agriculture to be among my guests.

Secretary Goodale delivered the following address on

THE CHANGES IN FARMING; WHICH HAVE TAKEN PLACE, AND WHICH SHOULD BE MADE.

We live amid constant changes. No truer utterance was ever made than that, "the fashion of this world passeth away." Each generation in its turn witnesses new conditions of life; and, on the whole—I am happy to believe—there is progress, and progress everywhere. Agriculture shares in it; and if in agriculture progress seems to be slower than in some minor pursuits, is it not easily accounted for on the well known principle that large bodies move slowly? Agriculture embraces a larger body of men than any other. Its fields of labor occupy greater breadths than any other, and to a considerable extent its votaries are isolated from one another, and hitherto, at least, have received less mutual benefit from each other's knowledge and assistance than those engaged in other pursuits.

Yet progress is plainly visible. Progress towards knowledge, which properly used, is power; progress towards mental elevation, and toward relief from *exhausting* toil. Labor is desirable, as well as honorable, for man is so constituted that he can neither secure the highest enjoyment nor the greatest usefulness without full and fitting occupation for both body and mind. It is no curse to earn one's bread in the sweat of the brow, by healthful, productive labor;—rather is it an inestimable privilege and blessing. It is only the toil which is so protracted and severe as to weary the mind and unfit it for active exercise and healthy development to higher uses, which is a curse.

There is progress towards means and methods of fertilization, and thus, toward better farm practice which must assist in restoring a higher fertility to large breadths of land from which, in years gone by, we have taken too much, or have restored too little.

There is remarkable progress towards economy of force.. Witness the improved implements of to-day and contrast them with those of twenty or fifty years ago. How much more easily is the hay crop secured with the help of mower and tedder and rake and fork all moved by brute power, than when the hand scythe the hand rake and hand pitchfork alone aided human muscles! And how great also is the saving of value in the crop as a consequence of the ability thus furnished to have the work done just when it needs to be done!

Viewed from this standpoint there is a great deal which is encouraging in what we see of agriculture in Maine; and, were there no other side—no other considerations to be taken into account—we might possibly be content to have it go along at a similar rate in time to come.

But there are other sides to the picture, and some which present, on the surface, at least, a less flattering aspect. We see our larger towns and cities increasing in wealth and population, while at the same time, the rural districts are diminishing in numbers, and their wealth, if not diminishing, does not keep equal pace. With all the advantages which agriculture now possesses which it did not formerly enjoy we see no rush into it. These advantages—and they are both real and great—have not succeeded in making the pursuit popular and attractive. Young men—sons of farmers, brought up on the farm, and familiar with its labors and its profits, in large numbers, prefer to leave the old home—and not to make a new one like it, but to engage in other pursuits; and of those actually engaged upon farms, not only in

Maine but throughout New England, we find a wholly undue proportion above fifty or below twenty years of age.

No other feature of New England agriculture more attracts the attention of thinking men at the present time than this depopulation of our farming districts, and deservedly too, for it is worthy of full investigation; and its proper understanding I believe to be fraught with deeply instructive lessons.

Not a few see in it evidence of the rapid decline of the agricultural interests. Such are ready to conclude that if we would avoid extinction as a people, we must in the future, look solely to our ice and our granite and other rocks, and to the utilization of our water power by artizans who shall be fed upon western grown food transported hither by railroads, and permit our fields to revert to the production of wood and timber.

The press occasionally utters lamentations over this fact as sad in their tone as those of the doleful prophet of old, and if they are not quite so long drawn it may be only because, in this fast age, people will not stop long enough to read editorials of tedious length, but bolt their mental food after the style of a railroad dinner—"Ten minutes for refreshments!"

The fact is not to be denied, that, as a general rule, the population of agricultural districts throughout New England has been diminishing rather than increasing for the past ten years. The census returns testify to it, and we can see it for ourselves.

But, for one, I do honestly believe that there is something in it besides cause for despondency, and that good reasons exist why the popular interpretation of this phenomenon should be greatly modified.

Let us pause here for a moment in order to ascertain if the diminished numbers in these districts is accompanied with a corresponding diminution of yield, and by depreciation in the value of farm property. If we examine and compare the figures given us in the eighth and ninth census returns (for 1860 and 1870 respectively) relative to agriculture in Maine, we shall find that the number of *so-called* "improved" acres, (though I think many of them would "improve" faster if allowed to grow up to wood and timber) has *increased* during the past ten years about eight per cent. and while I cannot deem this to be matter for so great congratulation as it would be to learn that fewer acres were more highly improved, it may yet be taken as an indication that our farming lands *are not being deserted.* If we compare the cash valuation of the farms of this State we find a much larger increase—not less than thirty per cent. This is an advance more than twice as great as the premium on gold, and therefore indicates an increase not due to depreciation of currency. If we compare crops we find differences which may be partly due to differences in seasons and therefore less conclusive. There is some falling off in oats, corn and barley, with increase of hay, potatoes, peas and beans, wheat and buckwheat, and a large increase of market garden products. If we look at domestic animals we find fewer working oxen and more horses,—and it is worthy of note here that the substitution of horse for ox labor has everywhere been taken to indicate advance in practical agriculture. We find about six per cent. fewer milch cows, in numbers, but if we could get at the facts, we should doubtless find an increase in the milk yielded by them. We find somewhat fewer sheep but more wool—more in the aggregate and more per head; and if we could know the whole truth we should undoubtedly find a much larger increase in their money yield from mutton and lambs for the table. This is strongly indicated by the fact that, notwithstanding western competition, these same ten years witness an increase in the value of slaughtered animals of no less than 86 per cent. I therefore aver, upon the best evidence which is attainable, that the diminished numbers engaged in agricultural pursuits among us during these years, is not followed by diminished production nor by diminished value of farm property.

Rightly interpreted, then, what does this abandonment of the farm by young men mean? How came it to be?—and what are its lessons? Are they led away by visionary hopes, destined never to be realized but leading only to disappointment? or is it for reasonable cause? Surely they are entitled to perfect freedom in the pursuit of happiness, competence and wealth. If it is really better for some of them to leave the farm, we should bid them God speed;—if it is better for them to stay, we should do all in our power to enlighten their views, and to disabuse their minds of illusory hopes.

To arrive at an intelligent understanding of this matter we need to inquire into its causes, to trace its rise and progress, to notice whither these young men go and what they do. It is necessary also that we clearly comprehend what is, and what is not requisite to successful agriculture, and this opens up an immense field for investigation. Neither its culture nor its harvest is the work of an hour; it would require a series of hours to lay before you *results* after they were fairly garnered.

My aim now is a far humbler one. It is simply to call your attention to some of the salient points in the case and to offer a few suggestions which you can follow into detail at your leisure.

At the outset I would remark that probably very few of us realize sufficiently *how* great are the changes which have passed upon us—as a community—within the last dozen years. Although not so upturning and radical throughout the North as they are at the South, where besides many others, the status of the laborer has changed from that of an unpaid chattel slave to that of a wage-receiving freeman, these changes are nevertheless *very* great and they have effected astonishing results.

With the advent of war large numbers of able-bodied men were called from peaceful pursuits to take up arms. The ranks of producers were thus greatly thinned; but consumption of food was not only maintained but increased by all the waste and loss incident to war. It was inevitable that the price of products should be rapidly enhanced. The wonder is that the demand should have been met at any price by the few producers who remained to labor. How was it accomplished? In very large measure that demand was supplied by the aid of labor-saving implements. In four years time old ones were perfected, new ones were invented, and both old and new were manufactured and bought and introduced to use in aid of production in unparalleled numbers and to an extent which could only have been accomplished during many years of peace. By their aid men past bearing arms, or otherwise not "able-bodied" with the help of lads as yet unripe for the hardships of warfare were enabled to feed their families at home and their kinsmen in the field. After a time the war ended, and with returning peace many returned to their homes, but they returned to find the demand for farm products pretty fully supplied; and more production without increased demand, and with abated loss and waste, necessarily brought about a fall in prices. Thus we see that the very instrumentality upon which we have prided ourselves as the greatest help in practical agriculture has been the means of rendering unnecessary, for production, the labor of a vast army of able-bodied men.

Meanwhile an enormous amount of money, or what passed for money, had come into circulation. It was possessed, not only by a few in large amounts, but in sums of a magnitude wholly unaccustomed before that epoch, by immense numbers of the people. The possession of the means ed to the gratification of numerous wants, and to indulgence in numberless luxuries never before thought of. The demand for these, including, as they did, the products of the whole circle of industrial and artistic pursuits, enabled the men who suppled those wants and those luxuries to pay rates of wages to all who assisted them altogether beyond what the farmer could afford to pay for work at the diminished prices which his products commanded. Thus it was that wages, greatly enhanced as they were during the war, did not fall off with the cessation of war's demand. They were sustained by new demands called into being by the simple fact that the war gave means to thousands upon thousands to pay for what they never before dreamed of owning or indulging in. The element in this unprecedented condition of things which is to be regretted is, that the new demand came to exist in consequence of an abnormal abundance of money, or of a substitute for money, to buy with; because it did not come by a more gradual and healthy development of productive industry. The *sad* truth is that it came of borrowing, it came about by anticipating future earnings, by spending to-day what must be earned to-morrow—and pay day must come and will come—some time.

Far be it from me to intimate that it was wrong or impolitic to do as we did in incurring the debt, or that we did not get our full money's worth for all which was spent, and what is of greater value than any amount of money besides, a united country, together with the establishment of the principle of national sovereignty in all its scope and force. In the emergency that was upon us there was no help for it, and it is, beyond all calculation, better for us to-day than if we had done otherwise, but it is well for us, nevertheless, while enjoying the priceless blessings which we do, to remember that the bills are not all paid yet.

But with such unlimited call for labor all around us, is it to be wondered at that our young men should seek avocations and employments which yield larger remuneration than does the farm under existing circumstances? I can neither see in it anything surprising, nor, in this aspect, anything to be regretted. For the *very first requisite of a successful agriculture*, in an advanced state of civilization, *is markets*. What it wants, most of all, is *demand* for what it produces. Not a feeble call for a little to be paid for from lean purses, not a loud call from peoples so distant that the half or three-fourths or nine-tenths (as has sometimes happened) must needs to go to pay freights, commissions and greeds of middle-men, leaving only a small fraction to the producer, but a *home demand*—from full feeding artizans—a call followed up by a tender of the products of a day's industry in the shop or the factory for the products of a day's labor on the farm. It is to Home markets—to meeting the demands of other home industries—both supplying mutual wants, that the farmers of Maine must look for temporal prosperity. In this way alone can we reap the full benefits of division of labor where each works to advantage, at the pursuit which he best understands, is best fitted for, loves best, and is most successful in.

Let us never forget that increase of consumers creates demand, that increase of production beyond demand reduces the prices of products. Who among traders or mechanics desires an increase in the number of his competitors in the same business? Not one. Why should farmers desire it?

It is matter for hearty congratulation that this pressing need of agriculture has come to be generally recognized among us, and that efforts are not wanting to create *Home Markets*. The "dog in the manger" policy which prevailed in this State a generation ago, when the cold shoulder was given to those who were then willing and anxious to come in, and bring capital, and develop our natural resources, has gone by, let us hope forever. Our predecessors seemed to be *afraid* of capital, looking upon it as a monstrous engine by which they might be reduced to vassalage. They little realized that capital is simply the accumulated fruit of labor, or perhaps more properly *labor preserved*, labor concentrated, packed up or salted down and put in a form in which it can be kept and moved from place to place and used where the needful amount of fresh labor could not be had. It bears some analogy to the hay which you store up in your barns to use when and where green, undried grass cannot be had. We now see that if capitalists will come among us for the purpose of making their money grow and yield satisfactory returns for themselves, the same money *must* be productive for *our* uses, as well as for theirs. Capital cannot be utilized and made productive without additional labor—fresh labor—and this labor *we* furnish and reap the benefits of. If our noble water powers are to be harnessed and put to service, more stone must be quarried, more brick must be made and burnt, more buildings for working in, more for storage, more to live in and more to trade in, must be erected. More mechanics must be permanently as well as temporarily employed; and all these are the *customers* of the farmer—not his competitors.

If we can have plenty of such customers what matters it if the Western States continue to supply them with a portion of their corn and flour and meat? Can we not sell enough of potatoes and beets and onions and cabbages and turnips and hay and milk and butter and cheese and fresh beef and fat mutton and lambs and poultry and eggs and garden vegetables and fruits and a thousand things, which, if those beyond our borders attempt to compete in at all, it must be at such disadvantage that we are sure of fair returns for home productions? There are not a few articles, and they embrace nearly all the most remunerative farm and garden products, which our farmers can always furnish, if they will set themselves to do it, any of which find, in their weight, or bulk or perishable nature, protection enough to insure reasonable profits from their judicious culture. They are protected by an enactment of the Most High in his providential arrangements—a tariff which neither Parliament, nor Congress, nor the People themselves can repeal, nullify or tamper with.

A diversified agriculture and horticulture, such as large home markets would create, would furnish far greater security against bad seasons than does our present method, for it would necessitate a higher and deeper, a better and richer culture, and this of itself is a pretty good insurance against such casualties. How was it last year and the year before when the drought pinched severely? Was it the deeply cultivated, well enriched fields which suffered most? Nay, verily!

It is by virtue of *home markets* that the agriculture of Great Britain has come to be what it is—the best in the world;—and not mainly by reason of naturally rich land, not because of the possession of great breadths of unexhausted prairies, ready to give up their virgin riches to little and careless culture, with no thought for manure. Not at all. It is her home markets which enables her to expend abundant labor, and to send to the ends of the earth for fertilizing substances, and not only for what is to be directly applied to the land as manure, either before or after undergoing a process of manufacture; she imports also vast quantities of concentrated cattle foods, primarily for the manufacture of milk and meat, and incidentally to increase fertilization.

Englishmen, of all men, are most eloquent in setting forth the beauties and benefits of free trade. When they attained to such great light does not appear so clearly as that zeal in disseminating it began to appear after so great progress had been made in manufactures as induced a feeling of security against all competition. If any doubt whether we are quite ready for it, let them ask the farmers about Lewiston, Saco, or some other centre of industries, if they would prefer to direct their energies to the growth of agricultural products for the British markets, and take for pay so much manufactured cotton or iron as would remain after all charges attending shipment and transportation both ways were paid for out of the proceeds of sale there! Free trade is delightful in theory, and it would be equally expedient in practice *provided* that nothing was out of joint anywhere. If all men were in place, and what they ought to be, making the Golden Rule their uniform rule of action, tariffs would fade out of existence as naturally and inevitably as would the War Department as a branch of Government were the Gospel proclamation of "Peace on earth and good will to men" heartily accepted by all. But as things are, it is possible that both may be of service for a while longer.

To return for a moment to the subject of leaving the farm for other avocations. Let me not be misunderstood. I have spoken of the benefits arising to the agricultural community from abundant markets, and of the evils of too great competition. What is not to be regretted is, for a proper number of food producers to enter other pursuits where they become consumers of food which they pay for by well directed, productive labor, so that the buyer and the seller, and the community at large are actually richer and better served than if both remained producers of food. I am not blind to the fact that those who thus leave the farm are not the only ones who leave it. What is to be deplored, and deeply deplored, and what we are bound to combat by all proper means, to the full extent of our ability is, the sad delusion which leads too many young men to abandon the farm in the false and cheating hope of amassing wealth or fame *without* labor, or with less labor than the farm demands. In an age like this when fortunes are *sometimes*, and oftener than formerly, accumulated, as it were, by a throw of the die,—we cannot be surprised, however deeply we may regret the fact, that some should be led astray by the brilliant but delusive halo which surrounds, and magnifies, and multiplies these really isolated and comparatively very rare cases. They see the dazzling, gaudy side of the few, so called, successes. They see not that for every one such there are scores, nay hundreds who sink into darkness and misery. They see not the numberless pitfalls of city life into which they sink, nor the terribleness of the wreck to both body and soul of the great majority of the unfortunate young men who are thus deceived.

It is our duty to do all that in us lies to undeceive them. Every consideration of Humanity and of Christianity urges us to set before them the real facts. We can prove by statistics that in such cases the failures greatly outnumber the successes, that of a thousand who quit the farm for an easier life in mercantile pursuits a very small fraction succeeds, while of those who remain on the farm it is only the small fraction who make disastrous failure. We can show that the chances for health and competence and all that makes life desirable are vastly greater in the country than in the town. Nor do we faithfully discharge our duty to such unless we endeavor to show them the hollowness and emptiness and unsatisfying nature of wealth of mushroom growth; and that, in the very instances which have most dazzled them, the money bags have brought more of real misfortune and discomfort than of any rational enjoyment whatever.

Let me now turn from this digression which seemed possibly needful to prevent misapprehension; for as yet I have scarcely touched upon what chiefly occupied my thoughts when I sat down to arrange them in order for presentation, but have taken up your time with saying what, for the moment, crowded to the front.

Occupying the trust which, by your flattering preference, has been held for a series of years, it has often been a puzzling question for me to decide, whether to hammer away continuously upon any given point felt to be of great importance, until its force seemed to be appreciated, to iterate and reiterate the same truth, to follow line with the same line, and precept with the same precept; or, to say *once* what seemed to be needful to be said, as clearly and forcibly as might be, and quietly and hopefully wait for its germination and growth and fruitage while busy with setting forth other truths which might be later still in being accepted and acted upon.

The thought most prominent in my mind in connection with one leading theme of our discussions at this session was, the need of introducing correct *business* principles into the prosecution of agriculture; in other words, of pursuing agriculture *as a business*, which should yield profits, in distinction from pursuing it as an occupation by means of which a man might *earn* a living. It is a matter to which attention was called in the first report which I had the honor to present as your Secretary, and has been alluded to in others; but I felt that some remarks upon it might not be out of place at this time, even though it be a twice or thrice told tale. It would seem to be of greater importance, now that wages are so high, than when they were lower.

It is one thing to pursue farming as a calling whereby to EARN a living—to get the simple worth of the labor bestowed—such as one would get if he sold the same labor to another for wages; and it is a very different thing to conduct farming *as a business* which shall yield a *profit* upon its operations over and above *actual cost*, which includes the value of the labor together with a fair return for interest on the value invested in lands, buildings, implements and animals, and for depreciation, taxes, risks and all other outgoes.

My observations constrain the belief that a great many farmers do *not* reap larger returns from their methods of conducting their pursuit than they would if what they have thus invested was in money at interest, and to this income was added the current money value of their labor; and if this opinion be correct they are doing what they cannot afford to do, for whether they desire it or not they are compelled to assume the risks of business, of poor crops in bad seasons, of low prices, and the various drawbacks which naturally attach to farming operations. They cannot afford to assume risks without fair prospect of an equivalent therefor. Insurance companies demand round premiums for assuming risks, and why should farmers assume risks with no prospect of suitable returns?

Among the requisites for conducting business successfully a few may be mentioned—such as:

One should be well acquainted both with the principles and with the practical details of the business engaged in.

He should undertake a business for which he is naturally adapted, one which he loves and is deeply interested in.

He should have capital enough to carry it on to advantage, both of fixed capital invested, and of active, floating capital, that is to to say, money in pocket, ready for use whenever opportunity offers.

He must adapt his wares to the market, to the wants and the tastes of his customers.

He should carry out *well digested* and *systematic plans* covering a period of sufficient length to accomplish the ends in view.

He must not attempt to carry on too many different branches of business so as to divide and fritter away his energies.

He should know the cost of his wares and where and how to obtain or produce them cheapest.

He should have a reasonable certainty that he is pursuing the most judicious methods and avoid all needless losses.

If a manufacturer, he should know the *comparative* cost of all the different products which he manufactures.

The business of the farmer resembles that of a manufacturer more than that of a trader or a merchant. Have we thought sufficiently of the close analogy which exists between farming and manufacturing? and of the useful practical lessons which may be drawn from it? Let me mention two or three points of resemblance. In the first place both use raw materials, to which labor and skill are to be added. One uses—perhaps cotton, or wool, or leather, or iron—each naturally adapted to certain well known uses and requiring definite and peculiar machinery and processes of manufacture. No man attempts to manufacture cotton goods *and* woollen goods *and* leather goods *and* iron wares. The farmer's raw materials are soils and seeds, and of these he has a wide variety. His soils differ in natural qualities, in adaptation to different crops and in natural fertility. His business is necessarily more complicated and intricate, and demands greater skill for its best execution than that of any other manufacturer on the face of the earth. Hence the greater necessity for the introduction of correct business principles as well as of knowledge into its conduct.

Both employ machinery in the manufacture of their products. The men who work in cotton and iron study earnestly and perseveringly, and go to great expense to procure such as will accomplish the desired end in the best manner and with the least expenditure of power. They know full well, and they realize the fact, that any heedlessness in so vital a matter would bring failure. But if my observations are correct, the farmers of Maine, as a whole, are decidedly behind other manufacturers in the State in selecting skillfully, and with an eye to profit, such machinery as will serve some of their purposes best and do some of their manufacturing most cheaply.

In saying this, after what has already been said, it is perhaps unnecessary to add that I do not now refer to farm implements. The degree of interest felt by Maine farmers generally in obtaining the best implements, if not all that it might be and should be, is yet exceedingly gratifying. The census returns show an increase in their value during the last ten years far greater, proportionately, than the increase in the value of farms. As has already been remarked, improved implements have been so extensively introduced that much hand labor formerly required is now dispensed with, and as a consequence, production has been greatly facilitated, and lower prices prevail than otherwise would. My reference now is to a wholly different class of machinery from farm implements, namely, to that which is employed for the conversion of the grosser, bulkier, low-priced products of vegetable growth into such as command higher prices—into milk and meat and wool and butter and cheese. Nor, in saying this, do I ignore the fact that considerable improvement in domestic animals has been effected; but it has not been so great as it should be, nor so extensive nor so great as it might and would be were its importance properly appreciated, *and* if correct business principles were brought to bear upon it.

I select this point in farm practice chiefly for the purpose of illustrating what I mean by the introduction of business principles into farm operations, and to show, if I can, that such introduction would lead to far greater and more persistent efforts to improve our stock husbandry than have yet been made.

Let us state the problem. You have as a part of the apparatus of the farm a certain class of machinery which you employ to make milk and meat. It differs from the mower and rake and other lifeless tools in that it must be kept running, at large cost all the time, day and night, summer and winter without cessation so long as you employ it. A large portion of the food consumed, that is to say, of the raw material upon which that machinery works, is completely used up in sustaining the necessary animal heat, in carrying on the operations of life and in repairing daily waste. To make a clear distinction, so much as is thus used, we will call THE FOOD OF SUPPORT;—and it is an unavoidable and a continuous expense. It is only that portion of food consumed *over and above this food of support which produces* what you desire, and this portion we will call the FOOD OF PRODUCTION. In this light nothing can be plainer than that, the more you can safely increase the Food of Production in proportion to the Food of Support the greater will be the profit. If you give only the Food of Support that machinery affords no profit, but, on the other hand, involves continued loss with no compensation but that of the manure yielded. Let me ask here, do the farmers of Maine generally look at it in this business like manner of considering *net profits?* What proportion of these 80,000 men make it their uniform endeavor to keep running on their farms *as few* of these expensive machines as can convert their forage crops into what they want manufactured by them? How many strive to run these machines fully up to the safe maximum of speed and efficiency? On the other hand with how many is it the habitual thought and care to give out as little raw material as they can and make a show of business; or do "middling well?"

If your animals possessed unlimited powers of digestion and assimilation, so that one cow could manufacture all the milk, and one beeve all the meat which your grass, hay and provender was capable of making, the food of support would be comparatively a trivial matter, and might receive little thought; but such is very far from being the fact. The truth is, that the limits of production are quite narrow at the best.

From such data as I have been able to obtain there appears to be required, with the average of good animals, not far from two per cent of their live weight of good hay daily, (or the equivalent in other food) as the food of support. So that, if your steer or farrow cow weighs 1000 lbs. they each require twenty pounds daily of hay to sustain it in such condition that the scales would show neither gain nor loss, but just "hold their own." The food of support is a tolerably uniform amount, and is as much for an inferior animal as for a superior one. But the food of production varies much with different animals. Some can convert into meat or milk a tenth part as much as is required for support, some a sixth, some a fifth, some a fourth, some a third, some half as much and some more than that. If your animal is a good feeder and has ability to secrete milk abundantly, or to lay on flesh and fat rapidly, it may digest and assimilate twice as much food as is necessary for its support alone, and in such a case a full half of what is consumed would be converted into flesh or milk. In other cases you get only a third, a quarter, a fifth, a sixth, an eight or a tenth according to their ability to do *profitable* work. THEIR VALUE AS CONVERTERS OF FORAGE INTO MORE VALUABLE PRODUCTS IS EXACTLY AS THE RATIO WHICH THE FOOD OF PRODUCTION THAT THEY CONSUME BEARS TO THE FOOD OF SUPPORT; and if this be so, very little arithmetic is required to prove that if you have the equivalent of fifty tons of hay and twenty cows to consume it, and they use forty of it for support and ten for production, you realize only one-half as much product from it as you would if you had fifteen animals which could more profitably consume the whole by devoting thirty of it to support and twenty to production. The fifteen would be worth to you twice as much as the twenty, and this because they doubled the value of your crops. To sell—to kill off —*to get rid of*—twenty animals may bring more than fifteen of the same weight; but *to keep*, to manufacture forage into meat or milk, ten profitable animals are worth more than ten thousand unprofitable ones. But I ask again, is that the way in which the majority of farmers look at this matter? How would men trained in accurate business principles look at it? Try and think how such a man would work out a similar problem.

To illustrate, let us suppose an analogous case. We will assume that a man owning an eligibly situated privilege wants to start some manufactory. He goes to a maker of water wheels and says to him: "I want a wheel to run a mill. I have water which in amount and fall is equal to 100 horse power, if it could be fully utilized. I do not expect to realize the whole, but I want to come as near to it as possible. How nearly will your wheel do what I desire, and what is the price? The reply is, "I will warrant my wheel to utilize three-fifths or sixty per cent. of the actual power, and the price is $1000." "That is not satisfactory, too much waste, I must have more. Make me one which will utilize seventy per cent. (instead of sixty) and I will pay what more is right or needful even up to $2000 for it; for each horse power is worth to me more than $100, and I had better pay double for seventy than take sixty at your price; or make it utilize eighty per cent. and I will pay, if need be, even up to $3000; or if you can make it utilize ninety per cent. even up to $4000—and it need cost you but little if any more to make the one than the other—*if you know how to do it.*

The case with cattle machinery is closely parallel with this. It costs only a trifle more to raise and to feed a cow which yields a hundred dollars a year than one which yields fifty, but the actual difference in value is great, it is fifty dollars clean profit, fifty dollars net gain, every year, so long as she lasts. And that which will pay you fifty dollars clear profit, annually, for a term of years as long as a cow may be expected to be serviceable, *is worth more* than what is commonly considered the difference in price or value between a very good and a middling good cow.

This improvement is within the reach of every farmer. It needs only care and skill in breeding, and care and skill in treatment. There are men who have made the science and practice of breeding a life-long study, and this for generation after generation, until the desired qualities are fixed in certain breeds of cattle and sure to be inherited; and animals possessing these fixed qualities can be had at a price very moderate compared with their value.

To those who take pride in keeping as many cattle as they can and not have their ribs become too prominent, another illustration may be offered. We will suppose such a man, living near the line of some railroad, should offer advice to the Superintendent or Master of Transportation after this fashion: "Sir, I notice that you run only one freight train daily over your road. It seems to me that is rather small doing, considering what a nice road it is, and how much it cost. Why not run three or four and do a larger business?" If any reply at all is deigned to such a suggestion, would it not likely be something in this style? "I am not so anxious to do what you call a large business as I am to make what I do *profitable*, so as to have some net gains to divide among the stockholders. There is only so much freight to carry, and what good would come of running trains half loaded or quarter loaded? Running expenses are heavy enough when we carry full loads. It costs fuel and wages of engineer and fireman and conductor and attendants and oil and wear and tear of rolling stock and of rails. When I send out an engine and tender and train of twenty cars loaded full, the rolling stock weighs so much that we have to carry two tons for every one ton which earns freight money; and sometimes we have to furnish power to bring them back empty, so as to carry again. We are not ambitious to make a *show* of business; our lookout is for *net earnings*. But in return for your good intentions in advising me, I will tell you what some of us outsiders think of the practice of some farmers, and give you a bit of advice. You spend a great deal of time and labor and manure to make hay, and when you get a large crop you think yourselves very fortunate. And that hay you use up, for the most part, in running your cattle through the winter, and if they come out in spring no worse than they went to the barn you think it is something to brag on. It seems a good deal like our running empty cars to where freight is ready to be carried. It is something which has to be done for the sake of earning profits by and by. But I have noticed that when spring and summer come, which is the time for your cattle to produce the returns which constitute your profits, they don't always find enough to fill them. They sometimes go less than half loaded, and taking the whole year together, they don't gain so very much above their running expenses. My advice is that you go directly home, and mightily improve your pastures forthwith, or else reduce your trains of four-legged cars enough so that what are left will carry full freights for half the year at least."

It would be easy to go on multiplying illustrations, but my sole object is to draw attention to the importance of studying out and learning what crops and what products can be produced *at least relative cost,* and by what methods, so as to secure the largest *net* returns. Grass and hay were selected for an illustration because, to my mind, there is no more humiliating fact connected with the agriculture of Maine than that—in *the* crop for which this State is popularly supposed to be especially adapted, and on which Maine farmers most pride themselves, we are beaten by most other States in acreage amount. Truly there is great need of improvement in the amount grown per acre, and no less need of having it consumed in a way which shall yield much larger net returns than have been obtained; *and it can be done!*

In going about the past season I learned of an instance where the hay consumed by a herd of cows paid their owner thirty-five dollars per ton, in cash, besides the manure yielded. This was no guess work. The hay was carefully weighed and accurate accounts kept. How many can show as good a record?

There is one other matter upon which a word should be added. There are customs and practices among us which, however well they were suited to the conditions of life one, or two, or three generations ago, are unsuited to the changed conditions which surround us at this day. It is well for the pioneer to be a jack at all trades; to build his own shelter, to pound his own corn, to tan skins and make his shoes. It is well for the distant country settlement to have a single trader who deals out all the store goods which find a sale there, one man who sells dry goods and wet goods, hard wares and soft wares, blankets and plows, saltfish and ribbons, calicoes and molasses, pills and tapes, nails, bullets, castor oil and crackers; but, as civilization progresses *division of labor* keeps even step. The carpenter, the shoemaker, the blacksmith, the mason, can be more useful to the community in which they live, and employ their labor with more profit to themselves by confining that labor to their several occupations than if each were to attempt to do a little of all kinds of work. So too, just in proportion as traffic increases, we find dealers to confine themselves to a more limited range of goods to deal in. For a first division the "dry goods" part from "groceries" and miscellaneous wares, and these by degrees severally split up into as many branches as will furnish a livelihood to the persons pursuing them, each pursuing that branch which he can carry on to the best advantage.

It is by no means easy to say to what extent the various branches of farming may now be, or may by and by be separated one from another with increase of profit. It is very certain that our farming is "mixed," and not only properly mixed but excessively mixed; hardly less so than when every man was obliged to have it so in order to supply the wants of his household. But what need exists now of continuing customs adapted only to primitive times and to the wants of pioneers?

I would not advise a change which would involve need to buy anything which can be grown or produced on the farm as cheaply as it can be purchased, but beyond that I would advocate the direction of the energies of the man *mainly* towards that branch of agriculture in which he is most likely to succeed;—toward the crop or the product for which his lands are best adapted naturally, or can easily be fitted, and so will yield most cheaply and most profitably; and that he make all his labor subsidiary to that. If your qualifications are for eminence in growing fruit, and your lands are fruit lands more than grass lands, why not make fruit your leading aim? If your love is for domestic animals, and your lands grazing lands, why putter about fruit any more than to raise what the family may consume?

The most successful farmers are those who do this. Sometimes it has seemed to one accustomed to our mixed farming, that they carried the matter to excess. I have known highly successful dairymen, not in Maine but in other States, who told me that they bought every pound of butter which went on to their tables; and others who bought all the cheese consumed by the family; each alleging that they could not afford to make the other, they could buy cheaper; and this because each was eminent in his own specialty. He could make either after a fashion, but one poorly compared with the other; and they severally felt and realized the fact that their profits came not so much from butter making and cheese making as from excelling in what they did. The profits consisted mainly, if not wholly, in the margin of difference in price between a common and a "gilt-edged" or superior article. Eminent superiority cannot be obtained by rambling practice at all branches. The field is too broad for one man to master the whole art and science of agriculture. The principle of division of labor can be applied in agriculture to as real advantage as in any other branch of manufacture whatever. How far it may be carried no one can tell until the problem is worked out. The principle is right, therefore let us tend thitherward, not with blind rush, but with such speed as may attend safe and sure-footed steps.

Suppose a man had predicted, twenty years ago, the changes which we have seen pass over shoemaking—which we then thought a very simple branch of manufacture; and very simple it is, compared with almost any branch of agriculture—who would have believed him? Then, little ten-foot shops dotted the country, each with a workman or two, doing all the work upon a a boot or shoe by hand labor. Now, large factories, great numbers of workmen, steam power and elaborate machinery!

And the tendency in agriculture is away from small farming; and the sooner we look this fact squarely in the face the better. If any farms are being abandoned they are the small ones; small either in area or in production. "A little farm well tilled" is pretty enough to talk about, but the little farm, if ever so well tilled, unless it be situated where a large amount of manual labor can be profitably bestowed (as in market gardening), won't pay.

If you would have work economically performed in the country there must be expensive implements and costly power to do it with; and if you would have it done profitably, there must be scope enough to enable both implements and power to yield a profit upon their use. And when a profit cannot be had it is better to be content with earning good wages.

The cost of keeping a single pair of good farm horses, including interest on the value, care and feeding, deterioration, harnesses, shoeing, and other incidentals is not less than four hundred, some say five hundred, dollars per year. Now unless they can earn, of clean money, more than two dollars per day for two hundred to two hundred and fifty days in the year, they are not kept at any profit, and the small farm does not furnish so much work.

As things are, the small farm needs more outlay in proportion to its size and productive power than the large one, and this disproportion promises to increase rather than decrease. A tendency to it is very plain. Therefore the more need of introducing business principles into the practice of farming, and to keep a sharp outlook upon all the bearings of what is going on.

Let me put a question here which may strike you strangely: How has it happened that in a business like farming, which almost invariably *needs* more capital than the farmer can command; one which takes in so wide a range of methods and processes,—tillage, involving need of knowledge of soils, manures and rotations; stock raising, requiring experience; knowledge and judgment in breeding and feeding and buying and selling; requiring also skill and judgment in planning general arrangements and facility in performing many mechanical processes,—how is it that farms are almost invariably carried on single handed? Why has never the idea of partnership been thought of as in other business operations? It can hardly be because farmers are more intelligent, or better educated, or more specially trained, or naturally more apt to master the details, and better able than other business men to carry on a complicated business without aid. And where is the impossibility? Union of capital would be a good thing. The plan of having several partners, each attending to different branches of the same business, certainly works well in other kinds of business, for one can do and do well what another cannot do at all, or very poorly if at all. This point is mentioned not so much to recommend its immediate adoption as for suggestion. Let it furnish food for thought, and whether the suggestion be ever acted upon or not, there is one practice which is very common among all business men, whether partners or not, except farmers, which is recommended without any hesitation whatever, for it is a necessity of all business operations, and if generally neglected a lack of profitable results must be generally expected, Book-Keeping. Keep accounts, charge all outgoes, whether dimes or dollars, hours work or days labor of man or beast or implements. Know what they go for and what they produce, for *by this method alone can you know* what your products cost, and whether profit or loss attaches to this or that. If there be profit anywhere, endeavor to increase it—if loss anywhere, try to stop the leak at once.

You can surely make all the needful first entries with very little difficulty. All that is required for these is a plain statement of facts as they daily occur. If you find it a difficult task to post every entry to the proper account, and to produce a fair balance sheet at the end of the year, accept the lesson which such an experience is calculated to teach, namely, that our farming is *too much* mixed farming, and that after being simplified as much as possible, it will be still quite as complicated as any one man should attempt.

To sum up with brief conclusion, I would say, that of all the changes needed in the agriculture of Maine none is more imperative than the introduction of *business principles into its practice.* By conducting it in this way, at the same time bringing to bear upon it an equal degree of zeal, energy and intelligence as men in other pursuits bestow upon their business, a revolution would be effected and a most beneficial one.

Let this be done and it would quickly appear, and a conviction of the fact would force itself upon everyone, that poor farming does not pay, no branch of it, nor anywhere, neither poor nor middling crops pay, neither poor nor middling animals pay, poor or middling feeding and treatment of crops or animals won't pay. It is only the well fed and well treated animals which pay, and these pay well, in an average of years. It is the *abundant* crops and the *superior* products—whatever they be—which alone yield good profits. Such an introduction would lead to earnest study regarding the best rotations, the best and cheapest methods of creating and sustaining a higher fertility in lands—whether under the plow or in grass,—to improving the hereditary characteristics of domestic animals, and to the most profitable methods of feeding and treatment. It would lead to a conviction that our children require, in order to be *good farmers*, more and higher and better education, and more special training for this profession than we ourselves had the means of obtaining. It will lead to division of labor, and to associated effort, so far as these can be brought to bear in aid of this pursuit. It will lead to a freer use of capital in farming, both for permanent improvements and for floating use. It will lead to a firm faith in *good* farming as both a safe and remunerative occupation.

FRIEND TAYLOR. I have been much interested in what my friend Goodale has said, but he came so near to finishing up the subject as to leave but little for others to say. I am an old man,—more than seventy-five years of age, and my principal business has been farming, in a rather loose, unmethodical way, some as other folks do. So far as I have noticed, in this State and in other States, farming is rather a haphazard, scrambling business. A man plants a few potatoes, sows some barley, plants some corn, and if he has any land fit tries a little wheat; keeps about as many cows as he can starve through the winter, and when he comes to pay his taxes and his help, finds he is minus. A great many people get on, or don't get on in that way. I want to relate a little of my experience this present season. I live in the neighborhood where sweet corn is canned. I have kept a pretty close account of the profit of raising sweet corn for this purpose. I planted this season, four acres of sweet corn. I used all the manure I had and got some sixty dollars' worth of the Cumberland Superphosphate to help it out. I have just closed up the operation. The capacity for canning was not equal to the amount of corn raised, and hence we lost considerable. It got too ripe to can well, but I have received, to say nothing about the fodder, which is very valuable to keep cows upon, three hundred and seventy-five dollars for the corn raised on four acres. It costs no more to cultivate and grow sweet corn than it does the common yellow corn. It costs no more to break off the ears and haul them to market than it does to cut up and husk it and crib it. It is a great mistake to spread manure over so large a piece of ground as many farmers do. A small piece of land well manured will return a much larger profit than a large piece with insufficient manure. I know of a small piece of good land on which, by proper cultivation and use of sufficient manure, three thousand cans of corn were raised this year. That will be one hundred and twenty dollars.

In raising this sweet corn I kept an account, and know what it cost for the seed, for the manure, for the labor, and I find a very good profit. If we could all cultivate sweet corn and have it taken care of at the proper time and get the customary price for it, we could all grow rich. I have a considerably large farm. I am old and cannot do an hour's work a day, and don't pretend to. I hire two young men, and with the exception of ten days in cutting hay and perhaps a week in harvesting grain, I have not hired a day's work, except that of those two young men. I have raised this year one hundred and twenty bushels of barley; seven hundred of oats; cut about thirty tons of hay. We all know that the grasshoppers destroyed our mowing land last year, and I was apprehensive that we should not get much, but the season has been wet and warm and we got a pretty fair crop of hay.

I have tried some other business, but I think that farmers, if they will pay strict attention to their business, can make a comfortable living and educate their children properly and get rich enough. I do not believe it to be true that a great property is desirable. A farmer who is worth five to ten thousand dollars is as well off as anybody in the world; he is well enough off, and if he aspires for more, he sometimes does that which is not right. If we could be content with a farm of one to two hundred acres and cultivate it properly and make use of our means on the farm —not letting our minds run after fine carriages, and stylish horses and horse racing—attending strictly to our business, the farmers of Maine will be as happy, and as independent, and as good Christian people as any in the world. I have travelled extensively over the Western and Southern States; I know they raise a great deal of corn and many cattle there, but you will find, in travelling over those States as I have—Illinois, and Indiana, Missouri, and Arkansas, Kansas, and Kentucky—that the people don't live as well, don't have as many of the comforts of life, nor as good houses, as they do in Maine. I advise our young men to content themselves with living nearer home, and applying all their energies and industry to their farms. If they do this, they will get rich enough, and enjoy all needful comforts and preserve their health and be useful. Let our young men live honestly and be industrious, and they will succeed.

The greatest drawback that I know of, is the trouble of getting suitable domestics. Our women are too severely taxed and die prematurely in consequence of hard work. Our girls are growing up but unwilling to be domestics, or to help their mothers. They don't do quite as well as they ought to do. If the speaker had told us how to supply this great want and remedy this great evil, he would have done even better service than he has. Every man that has a family realizes the want. My wife was trained to make butter and cheese when she was a girl. I married her when she was twenty-two, and there has not been a year when she has not made all our butter and cheese, and as good as can be made; and she makes it now at seventy-three years of age. I see young students here who are learning agriculture, and I want to whisper a word to then. When you choose a wife, select one that has been brought up with domestic habits and that will help you very much.

PROF. FERNALD. We have listened to an excellent address; one that is very suggestive, and that will afford food for profitable thought for a long time. Mr. Goodale suggested one very excellent point, in what he has stated in regard to special farming, that the farmers of Maine need to direct their attention to specialties, more and more, rather than carry on very mixed farming. It is undoubtedly desirable to carry on general farming to some extent. It cannot be disguised, that for all young men looking forward to pursuits in life, the money question is one that has great influence upon them. If farming is to bring remunerative returns it must be by conducting a farm as the speaker said, upon business principles. It must be by the farmer preparing himself for some special line of agriculture that he can carry on successfully, and he may then hope for returns that will compare well with the returns which may be secured in other business. I remember, some years ago, of having to look for a microscope, and on going to New York, I inquired out a maker of microscopes, and went to see him, and I found that he knew little else than the microscope. He knew how to make a good lens, and his microscopes sold at high prices, all because every lens he made represented a large degree of skill. It was the skill that was paid for mainly. He devoted himself to that specialty and he could get large returns for his labor. If he had attempted to carry on several kinds of business, it would have been a failure; but in making what he understood thoroughly he reaped large returns. I remember a few years ago of going into the glass works in Cambridge, Massachusetts, and there I found a man who was ornamenting globes for lamps. This was done by holding the globes to be ground, and thus the figures were made. I learned this fact: that he worked four years in England to learn how to do that single operation, and it was done to perfection and he commanded large pay. What was paid for? It was the skill of the workman.

Now in agriculture, if a man wants to get returns, he must put skill into his work. And it is pretty clear that a man can master certain forms of agricultural labor so that he can carry on the work more skillfully and hence more successfully, and get larger returns than if he undertook to cover the whole ground. So while it may be necessary to carry on general farming to a certain extent, it seems to me that the farmers must devote themselves more to specialties than they have hitherto done. Let a man who can carry on a market garden successfully and wishes to devote himself to that, learn all he can in regard to it and select his position accordingly, near a large town, where he can convert his products into money, and confine himself principally to that. Numerous examples might be quoted where men devoting themselves to this pursuit have reaped very large returns. Another may find that his tastes lead him to the culture of small fruits, and by devoting himself to this will make the business successful. Another may prefer to raise cattle or stock for the market, and by confining himself to this will succeed and reap large returns. Another may choose to adopt dairying or some other form of farming, and if he but puts in the skill which the artizan, which the manufacturer puts into his business, there is no question but that, by special farming, returns that should be regarded as ample can be secured, and that the success of our farming operations in the future must depend more largely upon attending to some branches of special farming than has heretofore been the case, and more upon special farming than upon general culture.

AFTERNOON.

The attendance at this stage of the session being thin, a suggestion was made to adjourn.

MR. GOODALE. It is true that we have not, at this moment, a large audience, but I see before me some who are able to impart instructive information upon points of interest to Maine farmers. For one I would be glad to hear from Mr. Coburn, formerly a member of this Board, in relation to the practicability of uniting beef making and dairy qualities in the same animals by growing Shorthorns and their grades of the character which prevailed more generally fifty years ago than they do at this time, when for the most part, milking qualities have either been neglected, or intentionally bred out for the purpose of favoring their meat making qualities. You may remember at the last session of this Board, at Paris, after Mr. Gold of Connecticut, had stated the prevalent characteristics of the Shorthorns, I asked him if he took into consideration the fact that dairy qualities inhered in the animals of this breed in Maine to a greater extent than was generally the case elsewhere; a fact which, as it proved, he was not aware of at the time.

It is true that we cannot compete with the West in the production of beef, but we need dairy cows and working oxen, and if we can have both in a satisfactory degree from one breed, it would result to the advantage of many small farmers, who cannot well keep distinct breeds, to know the fact, and to avail themselves of its benefits.

Mr. S. W. Coburn of Skowhegan. I am unable, in consequence of ill-health, if from no other cause, to do justice to this subject, but I will offer a few remarks on the importance and practicability of uniting, in an eminent degree, fat and beef qualities, with dairy or milk qualities in the same breed. I am satisfied that this is not ordinarily done, that is to say, that there are separate breeds for milk and for beef, such as the Ayrshires for milk and the Herefords for beef; even the Durhams are divided into milk producing and beef producing animals.

Having occasion to purchase Durham cattle some years ago, —after fixing upon this breed as the best to take to California,— I was recommended to Mr. Lathrop of South Hadley, a gentleman of prominence in breeding successfully this stock. His opinion I deemed of great value, because it was based upon long experience. He had sold these cattle for forty years to go to different States of the Union and some places out of the Union, and was familiar with the objects most desirable to be obtained and the methods of obtaining them. His fixed opinion, based upon experience was, that beef and dairy qualities could be eminently combined in the same breed, and it had been his purpose to accomplish that object; that while in Kentucky and in some other parts of the West it was not a great object for them to cultivate milk properties, and they could be indifferent to that question, in New England, it was inconvenient to have a number of breeds for different purposes, and it was highly desirable to have but one kind of stock and to get a variety of uses from that one. As our farming was mixed, as we raised some beef cattle, some heifers for the dairy, and some oxen for work, and as these were ultimately to culminate in beef, it was important that both objects should be attained if possible by one breed. His argument was this: That the capacity of a cow to make a good amount of milk, of good quality, rich in butter and in cheese, would, when the cow dried up, readily be transferred, and that the cow would make a good use of food in packing fat; and if she would raise a good butter producing heifer, that she would raise a good beef producing steer; and as there was no trouble in getting symmetry and size and early maturity in the milk or beef producing animals, equally or nearly equally, so that there would be no disadvantage in trying to combine the two. I put a good deal of confidence in his opinion, because it was based upon experience, which is the best teacher. Nevertheless, I think that something must be sacrificed to the combination; that there is a thinness of shoulder and an openness of joint in the milk producing stock that is not most conducive to the shape of oxen for great hardiness or weight. In other words, there is a looseness of build about the eminent milk family that would not constitute the most valuable characteristic for merely beef oxen. The fact that a cow used for dairy purposes would be milked for a greater length of time than would conduce to the health of her stock, if that stock was to be converted into oxen for labor and beef, shows that you must impair the one in order to strengthen the other. If you allow a cow to go dry half a year, you would not be cultivating her milk qualities, nor if you allow her to go dry from three to six months in order that she might produce the best oxen or steers, and give the best constitution and the greatest hardiness, so that, if at any time they were equally adapted to both purposes, they would lose equal adaptation if cultivated exclusively for either purpose alone. But I have been led to doubt whether the cows that run most exclusively to milk, in quality and quantity, were, on the whole, the most desirable. Such an animal is a very active machine. I have seen cows that required to be handled and managed with the utmost care to keep the machinery in order when moving up to the highest speed of her capacity, and so I have been led to believe that something intermediate, something approximating to the highest, would be more desirable on the whole to most persons.

Mr. Secretary desires me to relate some facts which would amount to a rehash of an article that I sent to the Maine Farmer some year and a half ago. I would remark before doing so, that where a breed or family runs excessively to milk, there may not be much advantage in having a large proportion of them do so. It would be dangerous to manage them. It would be difficult to keep up the health and vigor of the animal in our cold winters, if run exclusively to milk and to reduction of fat in the system. I had a cow bought of Mr. Lothrop, some years ago, that was an eminent milch cow. She was a full blood Shorthorn, of Duchess and Princess families mixed. While the Booth and some other families are eminently adapted to beef, the Duchess and Princess are eminently adapted to milk, and when these two families were combined they made the Grand Duchess which is considered the highest perfection of combined milking stock of this breed. This cow, in August 1856, a month after calving, running in the pasture, gave sixty pounds of milk on a trial of one half of her udder at a time, sidewise and crosswise, leaving the other half to the calf. As close a test as I could make showed sixty pounds a day while running in pasture, without any extra feed. The next March, the cream from five and a half quarts of her milk made a pound of butter in three minutes of churning with a spoon. With a churning that amounted to four pounds and a half of butter, I had scarcely exceeding a pint of buttermilk. In the first test the cream was stirred in a three-quart pot for three minutes with a spoon. The character of the cream you can judge. It was more than eighty per cent. butter. Of course the milk would have to be handled very carefully or else it would form butter. This cow required extra keep or else she would run down in the winter. Cold seemed to strike through her. If she calved in the summer, or fall, she would run down in the cold weather without extra feed. She would not give milk remarkable in quality and quantity without good feed, and it is unreasonable to expect that she should. Something cannot be made out of nothing, which is an important fact in practical farming that many have failed to learn, strange as it may seem.

An important question is, whether milk producing and beef producing tendencies, separate or combined, can be propagated, and it was in reference to this point that I brought to the attention of the farmers an account of a half blood heifer sired by one of the calves of the cow which I spoke of, raised in Massachusetts. This half blood heifer was four years old. She brought a calf in Waterville where she was sent to be kept through the spring and the first part of the summer, She was brought to this town and her calf was taken off when a month old. The fourth day of August she was put into the barn and kept on hay. It was pretty dry. She was allowed to bait an hour at night by the side of the road part of the time, and in a small enclosure part of the time. She did not give an excessive flow of milk. After the second or third day from her driving she gave thirteen quarts, (milk measure). She held along through the warm weather with only hay and baiting for an hour or two, sometimes pretty good, and sometimes pretty scanty, at thirteen quarts. As the weather began to grow cold she was fed with a little provender and the first of January was giving twelve quarts, milk measure. There were about five months, August, September, October, November and December, when the average was twelve quarts and a half. I set it down at twelve quarts as I didn't wish to stretch the matter. From the first of January to the twenty-seventh of April, we will call it four months, she fell from twelve quarts to seven quarts. She was giving seven quarts when I turned my attention to her a second time, and got some measurements and made a trial of her butter. The way we knew how much she had given was, a considerable portion of the milk was sold and not converted into butter. The butter test was simply for trial. The average yield up to the time of giving seven quarts would be nine quarts; she was then within forty days of calving and would calve a month earlier than the year before, so that there would be two of the remaining three months to be accounted for in full milk. I call the month she was to go before calving and those two months an average of eight quarts, which anybody can see is low, because two months would be in full milk and the other would be tapering from seven down to any point that she might reach; she should not be milked so long however, if you wish to keep up the stamina of the cow. Assuming those months, to make it a full thing, and thirty days to a month, calling it three hundred and sixty days, I find the average is ten quarts a day or 3,600 quarts.

I was about to say that on the twenty-seventh of April I caused a test to be made of her butter ; there were three pans of milk set, very shallow, already on hand ; they were skimmed and the cream put into an egg beater and churned. In less than three minutes there was a half teacup full of buttermilk and a pound of butter. I weighed it myself, and it weighed a trifle over a pound, and on measuring the skimmed milk, there were three quarts and seven gills, and as the cream was, as near as could be estimated, a pint, so that there were four quarts and three gills milk measure. Estimating the whole milk of the year at that rate, [and this is an estimate, mind; whether the milk would all be as rich in butter, I am not prepared to say. If the time when she was giving twelve or thirteen quarts had been on grass, it would be a clear question, but as it was on hay and not a very large flow, it is not certain, but this is only an estimate] the thirty-six hundred quarts would make something over eight hundred pounds of butter, which at thirty-five cents would amount to two hundred and ninety-six dollars. Any one can made such allowances as tьey see fit.

The expense of keeping this cow, or rather four year old heifer, we know exactly. In nine months she ate a ton and a half of good hay, worth $15 a ton, one ton of low meadow hay worth $7.50, ten bushels of corn meal, $5 worth of shorts and $2.50 worth of roots, making in all $46; to which if we add $10 for the other three months, (a liberal estimate) we have $56, and this deducted from $290 leaves $240 as net income. I mention these details because they came within my own personal knowledge and are exact. The case shows the capabilities of the breed, or grades of the breed in some cases as milkers. In the quality and quantity of milk and cream and readiness of churning, this heifer was very unlike her dam, which gave rather above an average in quantity but her butter was scanty, light colored and difficult to churn. You cannot expect such eminent transmission of dairy qualities in every case ; and for some reason or other the cow has not done so well since. She is a fine cow, and there is now a fair prospect of her doing as well hereafter if properly treated. Like other machinery running at so high speed, there is friction and constant danger of running out of order, unless the greatest caution and good judgment are exercised constantly. I have never heard of any other cow which did so well upon the same feed. She had no name.

Friend Taylor.—The owner of the famous Ingalls cow told me he tried her three consecutive weeks—she run to pasture and had two quarts of oat meal in the morning. The first week she yielded nineteen pounds of butter; the second week twenty; the third week twenty-one pounds. She was a native cow, with pretty long horns and a large belly. He knew nothing about the breed, excepting that he picked her up as a native cow. I should like to ask the opinion of others in regard to selecting cows. I used to think a cow that had a pretty deep bag and large udder was the cow to choose, but I have been very unsuccessful in selecting such cows. They are large milkers and will be likely to give good milk, but I never could keep a cow of that description many years before she would have ulcers in the bag and be ruined. I suppose the great flow of milk causes disease of the udder. I would now select a cow with a bag pretty long on the belly and not very deep nor with very large teats, and such a cow, in my opinion, will hold out longer and not be so liable to be diseased in the bag.

Mr. Weston. I am just commencing farming and have perhaps as good an opportunity for raising stock as any one. I should like to learn upon what basis we should feed stock. Ou· friend Percival has fed Shorthorns a long time and can tell us about them. Suppose we take as a basis good English hay, shall we feed better than that or not? and if so, how much better? Shall we commence when they are young to feed meal, and as they advance in years feed more meal? Or do we need to feed as much meal when they are a year old as when they are three years old? There is a farmer in Anson who has pair of two years old Herefords, and I understand he has spoiled them by over feeding. Where is the point of danger, and what amount of provender is most profitable?

Mr. Percival. Our young friend is asking a great deal. The knowledge which he seeks is valuable, it has cost me fifteen years to attain it, but if he will come to my place I will sit down and give him all I know, but it would require too much time, and weary your patience to do it here and now.

Mr. Coburn. If a calf has milk enough until he is six or eight months old to keep him growing, not too fat, but thriftily, until that time and then you take the milk away gradually and feed a little provender with good, early cut hay, oats, meal or something of the kind for the next six months, he may then be put on to good hay. You must treat him differently from what a certain woman did her boarders, who made a good thing of it. One of her neighbors undertook to run a boarding house and lost. He inquired how she succeeded in making money when he lost. She said, "You have not learned the secret. I find out what they don't like and give them plenty of it." In feeding stock we should find out what they do like and give them plenty of it. All stock like good, early cut, sweet hay. I am perfectly satisfied from observation and experience, that a calf after it is a year old will get all the growth that is necessary on *good, early cut* hay, without any provender, and make a better animal, a better milker and hold out longer. It will do if you want an enormous animal, a great amount of fat and muscle, but I don't believe that it is so good for the animal as to be reared on its natural food. I have had some experience with cows for thirty years past, and as Friend Taylor said, in selecting I formerly picked for a deep bag with large udders, but I have learned that was a mistake. I want the bag to cover a large surface, and the teats far apart, and such have never failed me of making good cows. You will see that style more fully developed in the Ayrshire than in any other breed and I have always found them good milkers.

Mr. Weston. I hope Mr. Percival did not understand me to expect an entire programme of raising Shorthorns; but simply to ask if an animal ought to have better feed than good hay, to raise it most profitably. That information would be of value to others also, for I have heard men who have farmed for sixty years say, if you keep an animal well it is a loss; I want to learn the fact and if the doctrine of these old famers be false, let it be knocked in the head.

Mr. Lucas. Neither Mr. Weston nor Mr. Percival nor anybody else, can devise any possible food that will grow his animals so profitably as first rate early cut hay. It is the best feed you can give them.

Mr. Percival. I will state in brief how I raise my calves. In the first place I tried to get a starting point. I made up my mind what I wanted and went to get it. I got good *seed—thoroughbred.* When my calves come they are small, as thoroughbreds usually are, and not so large as grades. Many have said to me, "I have a calf larger than that." I reply, "Perhaps you have, but we will compare notes at the end of three or four years." As soon as the calf will I let him go to the dam and take all he wants for a few days. I regard this as essential. It is the order of nature to make it a healthy calf. After six or seven days I take the calf from its dam and teach it to drink, making a trough, putting two in a pen if I have two, but if not, only one. Sometimes they will learn quickly, sometimes not. I give them half the milk. They will not always take half, but as a general rule, I give half the milk until they are eight weeks old. Meantime, in order to teach the calf to eat hay or oats or something of the kind I keep a little where they can reach it. If I want to make a heavier calf, I give three-quarters of the milk. If I want to exhibit and take premiums, as those are usually given to fat, I give it all the milk until it is four to six months old, meanwhile offering oats and hay, usually weaning them at that age. First-class grass, either green or dried, is the best adapted to feed young animals for future usefulness. But really first-class hay is a very scarce article, and if I cannot give them that I want to give what is equivalent to it. That is good enough, and if such as I have requires provender I give it, but not for the sake of giving something better than good grass.

You cannot, as Mr. Coburn said, produce something from nothing. You cannot grow a first-class calf, or sheep, or horse, or man or woman from nothing. Exercise judgment. Use common sense, the best sense in the world. Keep an animal thrifty and growing, but not too rapidly for future usefulness. I want to sell young animals to men who will feed as well as I do, and when they come to be two, three and four years old they come up all right. My calves at a year old are from five and one-half feet to six feet. It is only the natural growth. Some of you at the State Fair saw Prince Alfred, raised precisely in that way, and so is every calf on my premises. Any other man can raise them just as well, if he will, but if you never begin to raise good stock you will never have it. You must know how, and you must have the appliances. The idea of raising a nine foot ox upon bog hay, or by turning him out on barren hillsides is absurd. When you get an animal that girts six feet, he may be good, what there is of him, but there is not enough for this fast age. Keep your animal from the time it comes into the world in a healthy condition, but not forced, because if you force growth there will be a reaction. What matures early, decays early.

I cannot endorse the ideas which have been presented in regard to producing good dairy stock. To illustrate: I get a well-bred cow, a remarkably fine milker, and she has one or two calves. The sire of her calves is from a superior dairy stock. Now when you know these facts will you milk that cow up to the last day to make her calves dairy stock? No, but when you know, beyond all question, that it is dairy stock, give the old cow a chance to do herself justice. I say dry off the cow; not use her all up and then expect to raise a great round ox from her. Leave the cow to recruit her strength, so that when the calf comes, if it should be a steer, you can make a nine feet ox of it.

Mr. Gilbert. When I see a man inquiring for information in agricultural matters, I think he should receive all the light possible; and when one who has received the training which this young man has, gets correct ideas, I feel perfectly satisfied that they will develop into the best practice. There should be a clear and definite idea at the outset of what you wish to obtain. He referred to a pair of steers which had been fed until they were spoiled. That does not often occur in the State of Maine, as all are aware. However, such a thing is possible, but only from lack of knowledge. Now then, your object is to grow an animal as fast as possible, (and that is the object of feeders in growing fancy steers and growing them into great oxen ; for beef, we call it, though it is not all beef, because some of it is fancy,) and to rear fancy steers is to grow them as fast as possible and get all the growth in the shortest time. Now here is a definite object in view. You know what you want to do. The question arises, making the best of hay the standard, does it require anything more than the very best of hay? In the first place, bring your feed up to the standard of the very best hay. You have now got pretty good feed. But there are some feeders, the men who raise these fancy steers, who are not satisfied there. And it can be carried beyond that, with due deference to the gentleman who preceded me, and you want, in order to grow this animal most rapidly, to give them all the food which goes to make up their growth which they can be made to digest and assimilate. There is where it comes. You want to make them eat the very greatest amount of feed which rapid growth requires that they shall digest and assimilate. Now grass or hay is of so bulky a nature that they cannot do that on grass or hay alone, consequently some more concentrated food must be fed in connection with that to produce this greatest possible growth. Is there danger in so doing of spoiling your animals? I answer, no, if your feed is the right kind, but it is very different with a young animal from what is required by a mature animal. There is no danger of spoiling an animal by over-feeding if your feed is of the right kind.

The writer of "Walks and Talks" in the American Agriculturist, says he cooks food for pigs in order to make them eat more and digest more. That is why he cooks food. His argument is there is not much gained from cooking for pigs except by increasing their powers of digestion and assimilation. For instance, if you feed only a small quantity they can digest and assimilate that, but if you want them to assimilate a great deal you must perform part of the digestion by artificial cooking If you want any other product besides growth, if you wish milk for instance, you must feed for that, you must feed with that object in view; and I fully believe that the man who feeds the best receives the most for the food given.

This last winter I fought battles frequently in going among the farmers, upon this matter. I heard the question very frequently, "Did you see in the agricultural papers that such and such a farmer had learned a lesson that was going to be of great value to him?" "What was the lesson?" "He learned to keep his stock on a very small amount of feed." That is the very lesson he should not learn. The fact is, you need to learn to give your animal the greatest amount of food that he can consume to advantage. Your profit comes, as was clearly stated in the paper of Mr. Goodale, from the excess of food over that required for support. If you feed only what sustains life, you get nothing but life, but if wish for growth that growth must come from the excess of food over what is required to support life, so that the utmost possible amount of food you can get them to assimilate, returns the greatest profit.

MR. LUCAS. I have seen some experiments tried recently, and the best success attended those who have fed hay *and nothing else,* for the express purpose of making beef. Now, as to wintering stock last winter. One class of farmers kept the papers full of statements of how cheaply they got along with their cattle. Another came out with an article and said that was not his policy; his object was to see *how much* he could make his cattle eat. He contended that it was no object to keep them as cheap as you could, but it was an object to have them eat and assimilate all they possibly could.

A gentleman in Fairfield told me that he had some steers last fall that he could sell for $55, and no more. They lacked about one inch of being six feet in girth. He wintered them, giving twelve and one-half pounds of hay and six quarts of meal apiece daily, four and one-half of oats and one and one-half of corn; and it cost him $110 to winter that pair of steers. In spring, instead of being 5 feet 11 inches, they measured strong 7 feet. In seven months they grew 13 inches to a steer, and then were worth 11½ cents a pound and weighed 1,900 pounds. They weighed 1,100 pounds when he began to feed them. To winter them without gain in weight would have cost $70, according to his estimate, so that the gain in size and weight cost $40. The value in the fall —$55—added to $110, the cost of wintering them as he did, makes $165; and they would sell for $218, leaving him a profit of $53 on the operation: whereas, if he had wintered them so that they would just hold their own, that would cost $70, which, added to $55, the value in the fall, would make their cost in spring $125, and they would only bring $90; the increase in value being only in consequence of the season of the year. Now with a cost of $125 and a value of $90, he would suffer $35 loss; but by more liberal feeding, he actually made a gain of $53, instead of any loss.

So you see how this case proves the truth of what the Secretary tried to impress on our minds, that the cost of support is a pretty heavy expense anyhow, and we get nothing for that, in wintering stock, except the difference in the season of the year, from fall to spring. The profits of feeding come from what we give over and above what they need for support.

That accords exactly with my experience. Last March, I bought a pair of oxen, paying more than any butcher would—$107.50 They measured pretty close to seven feet. I fed them with meal each day, a few potatoes, and what hay they wanted until the 11th of May, or a little more than two months, and then sold them, with reference to their value as beef, although to a farmer, for $230. Did I get pay for feeding them? I am not so sure of that as I am that if I had not fed them *and grown them*, I should have met with a loss.

What I advise farmers is, not to attempt to raise any kind of a creature unless it is good. If not really a good animal, you had better not raise it at all. If it is a good one, keep it growing, and the growing finally will pay the expense. I have never advocated that it will pay to raise cattle, or to fat cattle as a matter of profit in Maine, but what I say is, if you grow them at all, you must grow good ones. You must grow them right along and grow them to maturity, in order to make anything.

MR. COBURN. I think the remark of Mr. Gilbert in reference to giving animals all they can possibly eat is open to criticism, and needs some qualification. If a man is raising horses, as they do in this section to a considerable extent, and should apply that principle, he would find his practice hostile to his interest. A horse may be made a hay mill, running through the whole twenty-four hours, as he would eat most of the time, to the great disadvantage of his growth and health. It is so with a mature horse and so with a colt. If I wanted to stunt a colt, or impair the working capacity of a horse, the most effectual way would be to keep them constantly eating hay. The strongest qualification would be in reference to horses. Cattle are ruminating animals, and when they stuff themselves full, they have to chew the cud, and that takes time, and they are less liable to eat to excess, but even for them, the greatest amount that they could eat would be somewhat beyond the best amount. The same is true of swine;

a little short of the utmost possible amount they could consume would be the point at which they would thrive best.

MR. PERCIVAL. The lessons we learned last winter, although very costly, are worth all they cost, and, and if I live long enough I mean to make them pay me a profit over their cost. The truth is, that by our former methods of feeding, about a quarter or a third of our feed has been lost for want of knowing how to feed. If we are feeding animals for future usefulness, the method used should be very different from what it would if the object was to make beef in the shortest time and at the smallest cost. If the latter be the object, after the structure is properly formed and the foundation of the animal is properly secured, if you want to get it into money as soon as possible, instead of turning him out to gather his food in the pasture, put all the concentrated food into him that you can make him consume, and get him into the market as quick as you can. If you can do by concentrated food in one month what would take a year of ordinary keep, you will save eleven months support of the animal.

You must decide what you want to feed for and feed accordingly. We need to know a great deal more than we do about the nature and character and effects of the different kinds of food which we use. We need to know which kind or kinds and what proportions will make the most bone, or muscle, or fat, or milk, or yield the most strength for labor; and all these things we are too ignorant of. We do not honor our calling; do not properly prepare ourselves for it. Look at the time and money and study that is expended to make an average lawyer, an average doctor, or average clergyman, and compare them with what is expended to make an average farmer! But the farmer needs more than either of them, and we shall never fully understand our business nor command the position and influence in the world which our calling ought to have, until we are educated up to our real needs.

MR. GILBERT. There can be no doubt, as I before remarked, that the first necessity of the feeder is to understand clearly what he is aiming at. If we are feeding for re-production, that is one thing; if to obtain the greatest amount of growth in the least time, that is another; if we are feeding for milk, that is still another. If a man has a herd of thoroughbred cattle which he is feeding for re-production, of course it is not best for that man to give the greatest possible amount of feed that those animals can digest and assimilate. It is not necessary; it is not profitable.

What he wants is re-production, and good, fair, healthy, average growth answers his purpose and is better than the most rapid growth; but when the object is to obtain the greatest growth in the least time, that is another thing. Then he must feed the largest possible amount of the right kind of food which these animals can digest and assimilate. So with milk, but mind, the same feed that produces the most rapid growth, will not be precisely the same which would most probably produce the greatest amount of milk. There is where knowledge and judgment must be used; here are questions which must be first settled; these are the doubtful points in practice, the very questions upon which we need more light, more scientific knowledge, more practical knowledge and more skillful practice. One word in reference to the question of hay being the best possible feed. The gentleman who last spoke says he learned a valuable lesson last winter. I have no doubt of it, but it was no part of that lesson to keep stock on short feed. He learned from an unusual course of feeding, from using a different kind of feed from what he had before used. My statement was that the best quality of hay was not sufficient; that on the best grass we have you could not obtain the greatest amount possible of growth. He obtained his satisfactory results last winter by using unusually large quantities of concentrated food in connection with hay. By combining the two he learned his lesson; but never has a man learned that short feed will produce the best possible results.

Mr. Lucas. There are very few farmers who ever use first rate hay in feeding their cattle. It is nearly all cut too late. Another thing, what farmers estimate to be twenty tons will almost invariably prove to be not more than fifteen tons; and they think they are feeding out more than they really do.

I will state how I wintered some colts last winter. My first feed in the morning was two quarts of dry corn, the next at noon, three quarts of oats; at night, about six quarts of Indian meal mixed with cold water, and what straw they would eat. They all came out as well as any I ever had. Now comes the question whether that feed was any better than good, early cut hay, cured out of the sun, kept green, and fed in proper quantities, and nothing else with it; whether it will grow them better, or keep them in a better condition. If we give a horse or cow or calf just as much as they will eat, we can grow them very fast; we can give them a less quantity and make them hold their own, and that is what we should ordinarily do when we feed to colts and horses, otherwise they would eat too much and fatten.

Mr. Gilbert. It is not an easy thing to say what constitutes really first-rate hay. In my judgment, no hay, if cut ever so early and made ever so well, from old fields, is first-rate in its adaptation to young animals. I think we have drawn out the phosphates so much that it would be necessary to prescribe that the hay should be cut on comparatively new ground, unless the old field had been treated with manure that had a large supply of the phosphatic element in it. There is but a limited amount that can be called first-rate and the practical question then is, what shall be added to make the balance equal to first-rate hay? If the man that spoiled his Hereford steers had fed them upon oats, corn or shorts, with turnips or potatoes, in connexion with hay, he would not have spoiled them. He would have got good growth without injury.

Mr. Coburn. The amount of very early cut hay is quite small, partly because of scanty growth and partly because the weather rarely gets fairly settled until July so as to favor the making of it. The practical question is, with what aids shall we make up the quality of that cut in July to what is meant by "first-rate, early cut hay." It must be by means of substances capable of making bone and muscle for young animals and for making milk and fat for mature animals. I consider shorts better for bone and muscle than Indian meal.

Col. Swett read the following paper:

Advice to Young Farmers—Success a Duty.

In looking at this subject, we must apprehend the fact that the sure road to success is by a good education and thorough application. There is, perhaps, no other sphere of life which requires more thorough knowledge, both general and specific, than the pursuit of agriculture. It is important that this knowledge should be garnered not only at our schools and colleges, but by observation and experience, by associating with practical men, and by making yourselves familiar with the best works on agriculture extant. In the preparation for professional life, the student is required to apply himself diligently to the task before him, and thus a foundation is laid, one broad and deep; and when he graduates, he has the truth that success comes only through long continued effort firmly impressed on his mind. And let this principle be firmly rooted in the minds of all young men, and we should see the road to the goal of success becoming broader and broader, as is made necessary, by the addition to its travellers, of young men who are acting on this principle.

Agriculture stands at the head of all other pursuits in point of usefulness and importance, and thus occupying the position of chief corner stone. The young man who enters any profession should be thoroughly prepared, both physically and intellectually for the successful prosecution of the calling of his choice. Even upon your entrance to your profession, you will be met by a most earnest demand, for all the experience, learning and judgment which you possess. Fit yourself, therefore, that you may pursue intelligently, persistently and systematically your calling, and success will in due time surely crown your efforts. Be careful in the selection and location of your farm. An error made in the selection might render it unprofitable so that you would carry on a losing instead of a gaining business. Throw all your knowledge and judgment into the selection of your farm; view with a critical eye all that present themselves, until you find one which both you, and experienced friends that accompany you, can approve. Let not the prevailing passion for a change, for emigration, affect you after you are once well settled. Let not the tempting offers to "go West" fill your mind and pervert your judgment so that you cannot be satisfied at home. If you once get a good farm, stick to it, and let others less satisfied, accept the offers which you are convinced amount to but little. In viewing the tempting offers made by Western land owners, let us remember the old saying, "Distance lends enchantment to the view." It is also well to take the testimony of our friends and acquaintances that have been there. We can all take advantage of this. The splendid offers and inducements are either shown by western papers or held out by railroad companies that own the land, and whose object is to benefit themselves alone, and who care nothing about the emigrants more than their coming will be of great advantage to themselves. Then allow not the desire for change to affect you; confront boldly apparent or real difficulties at the place rendered doubly dear, perhaps, by the remembrance of childhood's happy hours, and go on in the peaceful and happy way that cannot fail to lead you to success.

In the selection of a farm, a most essential consideration is that you have a good foundation, or in other words, a soil naturally fertile and not run down. Thus you will not have the drawback, at first, of contending with a barren, sterile soil, which might, possibly, discourage you. Another essential thing is, that you have an abundant supply of pure water. Remember that impure water is one of the most fertile causes of disease that physicians have to contend with, and that a supply at once pure and abundant is a thing to be earnestly sought after. Again, a no less essential thing is, ready means of transportation, as it tends greatly to facilitate your progress and lighten your burdens. Good roads, horses and carriages are also among the indispensibles. And, young men, forget not your children, present or prospective, let not a farm with all these advantages be chosen, if good schools are not near at hand. You have felt, in your own career, the advantages of a liberal, practical education, and grudge it not to your children. With schools, come churches, these you all know are indispensible, and this statement needs no enlargement. Forget not the new, improved and labor-saving implements. Go not in the so-called good old way, simply because your fathers and forefathers did. Use your own good common sense, and you will see that these things pay.

Our entire State is full of opportunities, which, if we only take hold of and improve, we can be sure of success. We are surrounded by a climate at once invigorating and health-giving, and we have only intelligently to select and persistently pursue the specialty to which both yoursleves and your farms are naturally adapted, and results most gratifying are sure to come. After the farm is selected, the question arises, what crop or crops shall I begin with? Shall I make one crop a specialty, or shall I grow mixed crops? Let us see. We cannot compete with the West in the production of grain, nor in the production of some mixed crops, and I should therefore advise young men to seek some specialty in farming. Suppose you are situated near a city or manufacturing town, and that your soil is adapted to market gardening, this would be exceedingly profitable. For years the large cities and towns in Maine have been supplied with early garden products from Massachusetts, New York, New Jersey, and points farther South, and this should not be so. Maine is amply able to take care of herself, and those that commence this course the soonest will reap the richest reward. The articles that are brought here and sold at high prices, necessary from the cost of transportation, can all be raised in Maine. They can be sold cheaper at the market, and yet allow a handsome margin of profit to the producer, and the consumer will thus be benefitted also. But it would be entirely useless for a man to attempt to raise garden products and know but little of the business. He must thoroughly understand the nature of his soil, the kinds and quantities of manures to be applied to advantage, combined with a willingness to work early and late for the success of his crops. No doubt is at present entertained that more money can be realized from an acre by market gardening than by any other way. I will give an instance to prove this. The Lewiston Journal of September 12, 1872, contained the statement that Mr. J. Jordan of Cape Elizabeth produced from an acre of land enough strawberries to fill 4,100 boxes, which he sold at an average price of 18 cents a box. Total, $738.00. A gentleman in West Minot this year raised 400 bushels of onions on a quarter acre piece, netting $400.00. Instances can be multiplied, but it is unnecessary. The statement that market gardening pays is believed by all. It is universally admitted that grass is king of crops in New England, especially in Maine. It is estimated on good authority that the grass crop in Maine, annually, (including pasturage) is $30,000,000. This amount of money is of great importance to the farmers of Maine. The great problem of the day is, how best to convert this grass into cash. When one is near a good market, it is well to convert it at once. There are other ways. Mutton and wool-raising is oftentimes profitable, if a person's farm is well calculated for the support of sheep. But, notwithstanding all these, I think that the dairy cow is the best machine for the conversion of grass into cash that we know of. Probably there is no branch of agriculture which Maine farmers can so well make a specialty of as the production of milk and the manufacture of butter and cheese, and there is no branch of agriculture in Maine that needs a more radical reformation than this. Persons that would try dairy farming should be well acquainted with all its particulars. One essential point in dairy farming is the selection of your cows. You seldom get a cow that is good for more than one purpose, not combining in herself the properties necessary for the production of both butter and cheese. A dairyman should be able to judge correctly of the qualities of a cow, and see for himself whether a cow is or is not suited for his business. The cows in Maine have deteriorated the last fifty or sixty years, and why is it? The farmers and breeders of neat stock in Maine have not practiced in the right direction. They have placed their dependence on poor bulls for the production of the cattle which we were to use for butter and cheese. Dr. Ezekiel Holmes once imported into Maine the well-known thoroughbred Durham bull "Young Denton," and charged $2.00 for service. The surrounding farmers ridiculed the idea of paying two dollars for a calf. They would rather drive a cow three or four miles to an inferior bull, merely to save a dollar or so. Who can wonder at the deterioration of our cattle under such treatment? Different breeds must be used for different parts of Maine, and each dairyman should use his judgment in selecting bulls. In dairying, *one* first-class cow is worth *three* middling ones, kept in the way they are generally kept. Let us estimate the profit of a cow that gives sixteen quarts of milk for several weeks in the winter.

Sixteen quarts, at $4\frac{1}{2}$ cents, 72 cents.		
Hay at $30 a ton, 25 lbs....	38 cents.	72
For meal and shorts........	12 "	50
	50 "	22 cts. clear gain.

The question naturally arises, how are we to obtain such cows? Buy a thoroughbred bull bred for dairying. A good, strong ox, cannot be raised from a dairy cow that is milked up to the time at which she drops her calf.

Stock raising can be made to pay in some parts of Maine, where good grazing and grass lands can be obtained cheap. If there is any money to be made in stock raising, it is by judicious management in selecting cows from the best breeds and by feeding them to maturity in the most improved way. If cattle are fed so as not to gain a little each day, you are carrying on a losing business.

Fruit-culture can be made an important branch of farming in Maine, but it needs patient, persistent and unwearied labor. No labor can have a better reward, than that which we devote to the culture of fruit, if we can only perfect ourselves in the art. In other words, it is converting the dust of the earth and the moisture of the air into the most delicious food for man. Fruit growing here is in its infancy. We are behind the times in this. We can make Maine as good a fruit State as almost any, if we will but *work*. Do not go into fruit growing all at once, unless you have money and labor at command. For instance set out one hundred apple trees a year for five years, and you will then have all you can attend to, and also a good profit. We have spent a long time in Maine guessing at what we were made for, and now that we have decided that it is dairying and fruit growing, let us go to work with a will, reclaim our waste lands which can be made excellent for these purposes, and looking to Him who alone can guide us, we will ultimately reach success.

Mr. H. Colburn of Kennebec county read the following paper on the leading topic announced:

On the Changes Made or Required in Farming.

That the farmers of Maine have made great advance in improvement, for ten or twenty years past, is evident from the manner of performing farming operations. Although laboring under disadvantages, by reason of the cheapness of Western products, the farmer of Maine to-day is better able to compete with the Western farmer than he was twenty years ago. There were then no railroads by which he could get a quick return for his products; often they had to remain long on his hands before he could sell, and if grown on borrowed capital, the interest would eat up the profit; but now if a farmer hires means to do his work, he can usually get a sale for his products without storeing, and thereby save a large percentage.

That the practice of farmers in Maine, as a whole, has changed for the better as much as conditions and circumstances have changed, we do not say, but that the majority have adopted better methods, is evident from the improved implements of husbandry now in use. At no very remote day, you might have seen, on some cross road, a farmer plowing with an old-fashioned, wooden, mould-board plow, which required the strength of five or six yoke of oxen to draw it, turning over the soil two or three inches deep, after which he would not allow his team to step foot on the plowed ground, but takes his hoe and holes out the rows, after which he would take a hod, go to the manure heap at the edge of the plowed land, fill it, carry it on to the ground and deposit a certain amount in each hill; and then return and fill it again, and so on. When it came hoeing time, he would not allow a horse to step between the rows, but must have large hills made around his corn and potatoes with a hand hoe, which the boys must not step on, or, if they did, they must go back and smooth them over. Not so with the farmer of to-day. He will have one of the best modern plows and instead of five or six yoke of oxen, not more than two yoke, or three horses, and plows five to eight inches deep, and from one and a half to two acres per day. His dressing is spread broadcast, after which the improved harrow or cultivator, or both, thoroughly pulverizes the soil and mixes it in. He then lines his rows, by a chain, a cultivator tooth, or a small plow, and drops his seed, covering it with a horse hoe. At hoeing, the cultivator is put between the rows and passed back and forth until the ground is as mellow as at planting. It is mere fun; he does not make mountains around the hills, but merely keeps the weeds down and the ground smooth. And so not only has he an improved plow, but a mowing machine, a horse rake and a horse fork, to unload with; and in all that he undertakes, seeks to do with as little manual labor as possible.

Improvements in farm houses and other farm buildings, is quite as great as in implements and methods of conducting farm operations. In place of the ungainly and inconvenient structures formerly used for dwellings, situated at a distance from the other dwellings, we now find houses occupying less space, but containing more room and conveniences so numerous and well arranged that the good housewife is saved half the labor formerly required. Barns and other farm buildings have been improved fully as much as the houses, and contribute as greatly to increased comfort of the animals kept therein as the houses do to their occupants. I do not allege that the improvements have been as great as they ought to be; and I know they are not as great as they might have been if it were not for some other changes which have taken place and which have not contributed to the prosperity of farming. Fifty or sixty years ago, a young man would take a new piece of land, clear an acre or two, put up a log cabin, get married, move into it, and contentedly live and labor, pay for their land, raise a family, educate their children, and in twenty or thirty years would own a good farm, well stocked, and have some cash on hand. They do not do so now. Why? Let me tell you. They do not want to creep before they walk. The young man of fifty years ago, when he went to his new farm, obtained a few sheep, and the wife had her spinning wheel. The sheep and the spinning wheel meant home-made clothing, and this they wore, and their children wore it, and when they grew to be young gentlemen and ladies they wore it, and thought it good enough for meeting, or a party, or any other place.

It required but little cash to run the affair. They lived on the products of their farm, which were good enough for anybody.

They had few of the luxuries of life, but they had all needful comforts; and with their manner of living, were robust and healthy. But the modern young farmer, does he take his pack and axe and start for Aroostook, to take up a farm? No. He gets his father or some friend to furnish him with money and clothes and then takes the next boat, or rather the next train (the boat is too slow) for California. Riches wait for him to gather up, and he must needs take the quickest way to reach them. Does he make as sure a thing of it as the young man of fifty years ago? By no means. One in a great many get rich, but the exceptions are far more numerous. Now why is this change? The young man of former times was not so exceedingly anxious to get rich suddenly, but labored patiently on, with the conviction that it was not so much what a person got, as what he saved, that made him independent. But now, instead of looking to the sheep and the spinning wheel, if they want anything, it must be bought at the city store; cash must be paid, it must be of the finest texture, of the latest fashion, and bear the highest price. Now if everything must be purchased, how is the cash to be raised to pay the bills, and much more to make improvements on the farm? We know well that the farmers of Maine are not rich enough to indulge in foolish extravagances, even if any good to anybody could come of doing so. But if we will be content with comfortable houses and furniture, plain clothing and equipage, and good, wholesome food, we can be as happy as anybody in the world; we can have the means to carry out greater improvements than have yet been made and thus be steadily improving our condition.

Therefore I say, that the change which is most needed is, to emancipate ourselves from slavish imitation of those who, by honest means or otherwise, have become possessed of money which they lavishly squander in foolish fashions. Let us live upon and within our means and be independent.

Mr. Hawes of Knox county read the following:

I do not propose to enter upon the subject of general improvement by any extended remarks, as I am aware there are many members of this Board more capable of doing justice to the subject. But though I may say but little, I feel a deep interest in the prosperity of our noble State.

That great improvements have been made during the past fifty years, perhaps greater than during the same number of years in any previous period of its history, I presume none will deny. I consider the cultivation of fruit trees of as great importance to the farmers of this State as any other branch of agriculture. That it has been too much neglected in the past, none will deny, although within the past few years a good degree of interest has been manifested. If the soil in this State is so well adapted to fruit culture as is generally conceded, why is it not equally well adapted to rearing young trees in nurseries? As we cannot compete with the great West in raising some articles of consumption, is it not wise and proper to interest ourselves and engage in the culture of those things in which we can succeed? Thousands and scores of thousands of dollars have been carried out of the State which might have been retained, had she been awake to her interest. I have seen as handsome and as productive trees, laden with as choice, delicious fruit, from our own nurseries, as from trees coming from other sources. I do not complain that trees are brought from other sources, for it may prove money well invested, although time alone will settle the differences of opinion among us. That we can raise as handsome and delicious fruit in Knox county as can be raised elsewhere, the samples exhibited at our Fairs fully prove. But too often we rob our soil with hoed crops and grass, and wonder why we are not blest with a bountiful harvest. It is evident that Maine grown fruit will keep as long, or longer, than that grown in any other State, therefore I think it wisdom to grow a large share of hardy, winter fruit, for market.

Another important subject worthy of more serious consideration is stock raising. That great improvement has been made in the domestic animals of some sections of the State is evident, but in some sections it has been and is still neglected. That we can raise stock to compete with the great Texas we do not claim, but we are obliged and will be obliged to keep more or less stock in order to keep our farms in a high state of cultivation. Experience has taught me that it costs but a trifle more to raise good stock than poor. A pair of calves can be as easily grown to seven feet in girth as to six feet. It is a source of regret that so many farmers take but little interest in so important a subject or consider it in its true light.

The farmer should remember the soil is his source of income and what he can grow upon it with least impoverishment, and not how he shall rob Peter to pay Paul. The hay crop, especially for the last few years, has borne a high market price, and many farmers have reduced their stock and sold their hay, thereby impoverishing their farms. It is true the sale has yielded ready money, but in too many instances barren fields. It has been said, you may cheat your neighbor and escape the penalty, but your farm and stock never. I have noticed several instances in my own vicinity where the farmer thought it economy to sell stock and hay in the fall and replace the stock in the spring, but almost invariably in a very few years he has not been able to keep so much stock if he was so disposed. A farm is a good bank where investments are perfectly safe. Contrast two men and their farms, the one who has made ample restoration to mother earth, and the other who has robbed her, and you will find an instructive lesson. It is very burdensome to pay taxes and acquire a comfortable living on a farm thus sapped, and experience has taught too many the great cost of restoring the soil to its primitive goodness.

What products can be sold off the farm with the least detriment to its fertility, is a very important question. It is evident to every reflecting mind that the manure made upon the farm is the only reliable fertilizer upon which we as common farmers may depend, therefore hay, corn and grain should not be sold in any other way than in the form of animals and animal products. Fruit, wool, butter and cheese in our section we consider profitable to the farmer and without detriment to the soil. Which crops pay best is a question of great importance to the farming community.

This is a world of change, but if we adhere to nature's indications we shall not be likely to go far astray. The Great Creator has made the soil capable of producing a great many crops, and it seems to me to be most profitable to raise a variety. We sometimes go to extremes, but it is not safe to push anything to an extreme. Swing the pendulum of a clock farther than its accustomed place and in return it goes as far in the opposite direction. There is a vast amount of speculation in this matter. I have observed that if the potato crop is successful one year, thousands trust their all to the same the next, when perhaps it proves a failure, and so it is with all others. In going to extremes some become rich while others become bankrupt. We should try to follow safe methods in matters of great importance. The almighty dollar should not alone be our single aim but that which secures to us comfort and trust. In past history we read of famines and we find these occurred chiefly where the people trusted to some special crop; therefore I say let us plant and sow such as our soil is best adapted to produce and we shall have enough and some to spare.

I can see no way that we can successfully compete with the west in regard to some products. The very nature of their soil, producing almost spontaneously, while ours requires so much care and dressing, gives an advantage in their favor. The railroads which now encompass and intersect almost our whole country we believe on the whole work general good, but they are a great leveller. During the past two years with the scarcity of stock it must have been much dearer here had it not been for railroad transportation. Considering the advantages of other States, I do not think we can select any one branch that we may safely pursue to the exclusion of all others.

Adjourned.

EVENING SESSION.

THE PRESIDENT. It has been suggested that before the regular exercises of the evening, we might learn somewhat of the success attending the establishment of associated efforts in cheese making in this State, from gentlemen present who reside in or near the localities where factories have been put into operation. May we hear from Hon. Hannibal Belcher of Farmington?

MR. BELCHER. I did not expect to be called upon for information in relation to this matter and am not prepared with any statistical facts regarding it. I can only say in general terms that after the session of your Board at Farmington, at which Mr. Willard gave a very interesting and instructive address upon the subject, and where others also spoke very freely and in a very able manner upon it, there was much interest felt and some efforts made to put the plan into actual trial. There was an attempt in our town but it rather dropped through. In Strong, however, some farmers got together and fairly started the enterprise, with the help of some practical mechanics. Only comparatively few took hold at first, but they found they could make good cheese and found a ready sale for it at good prices. They found they could sell a great deal more than they made. The effort last year was so fully successful in all respects that almost every farmer in the neighborhood has gone into it the present year. The whole of their product was contracted for early in the season, at a good price. So far as I can judge all feel more than satisfied. They tell me there is more interest felt now in farming than before the establishment of the factory, more care taken in the selection of cows, more care in feeding and treatment and that the movement is likely to enhance the value of real estate. Good cows, as I am informed, pay a clear profit of $25 to $50 during the season.

I was told by a gentleman residing in Barre, Worcester County, Mass., and president of the Association there, that the result in that vicinity was an increase in the value of farming lands from $25 per acre to $75. I have never had a doubt of the expediency and profitableness of both butter and cheese factories in Maine. Mr. Goodale has expressed the opinion that large sections in Franklin County, and several other counties in this State have as pure water, as abundant, cold, and clear springs, and as good grazing and other needful facilities for this business as any sections elsewhere. He has visited the principal dairy regions of the United States repeatedly with reference to this subject and he gave us his views upon it as long ago as 1862 and 1863, in his reports. I regret very much that our farmers did not engage in the business years ago, as he recommended, but better late than never. It is certain that we can make cheese of superior quality. It seems equally certain that any amount can be sold at good prices. If not wanted here we can ship it to Europe.

I feel perfectly warranted in saying that no enterprise in our county has been more successful, and it has given a general start to other industries. All the people feel more courage to take hold of other things. It was not started by capitalists but by plain farmers of moderate means. They erected buildings of moderate cost but furnished with the best conveniences and arrangements, and they got the best skill to be had to start it right. I see no reason why most of the towns in Franklin and Somerset and some other counties cannot do fully as well.

The President. The Chair will call upon Mr. Simpson to tell us what he can of cheese making near Bangor.

Mr. Simpson. I can only say as Mr. Belcher has, that I have no statistical information to impart. Several times, and once in company with our Secretary, Mr. Goodale, I have visited the factory at Six Mile Falls—six miles from Bangor, and saw their operations and their cheese, and have conversed with those in charge and also with some of the stockholders and others interested in it. All the indications are of satisfaction with its working and of prosperity in the enterprise. They find a market near by and obtain a good price. It nets them about fourteen cents per pound at the factory, which is more than cheese of the same quality would bring in New York or Vermont, or even in Massachusetts, probably by a cent or two cents per pound. This advantage they have by reason of making it here over what they could realize there.

Col. Swett. I have felt much interest in the subject of associated dairying for some years, and have been in hopes that we could get a factory started in our vicinity. Week before last I went to the Cattle Show at Dixfield, and took the opportunity to visit a cheese factory which had been put into operation there this season—about the first of July. I was informed that its capacity was for the milk of 300 cows; and that its cost was $1550. The man who built it told me we could build a good one large enough for the milk of 400 cows for $2500, and perhaps for something less; including all the necessary apparatus and fixtures ready to go to work.

I spent half a day in looking about the place, examining the cheeses, of which five hundred or more were in the drying room. They were as fine as I ever saw, and tasted as well. They had lately begun to sell, not many of them being ripe enough for market. The price obtained was fifteen cents per pound. Their weight was from 35 to 50 pounds. I conversed with the farmers there about it, and I found no one who did not intend to increase his number of cows next season.

From what I have seen and heard and read, I am convinced that there is no branch of farming which promises such prosperity for us as cheese making in factories. The cow is the best machine to convert hay and grass into cash that has ever been discovered, and the factory system relieves our wives and daughters of severe hard work. I believe they are a great thing for Maine farmers.

Mr. Goodale. With your leave I will read from a letter lately received from Mr. Norton of Avon, formerly a member of the Board from Franklin County, and one of the farmers concerned in the cheese factory at Strong. He says, "We are having a favorable season and shall make about thirty tons from two hundred cows; and I believe we shall realize double the profit from the milk made into cheese by factory which we could get from the same in butter made in the families. I have two cows which have given milk enough to make one hundred pounds of cheese per month, each, for four months past. We shall run the factory till the first of November, or a week over five months. Good cows make 500 pounds in the course of the season. We are selling at 15 cents per pound. It costs a cent and a half to manufacture. So you can see what we are doing."

I have but a word to add, and that is to say that, this is an excellent record. Sixty thousand pounds from two hundred cows, is three hundred pounds each, in five months and one week, and they probably yielded some milk before and after, and perhaps during these months which was used at home.

When I visited the dairy sections of the principal dairy States, I found occasional instances of cows giving five, six and even seven hundred pounds of cheese per annum, but the average did not exceed the amount stated to be obtained at Strong, and this, be it remembered, in a section where the business has just been begun, and we may presume where attention has not yet been very much directed to the selection of cows especially for this purpose, nor to feeding specially with a view to production of milk. I regard these facts as confirming the opinion long held that the manufacture of cheese may be made a very remunerative pursuit in our good grazing districts.

Mr. J. W. Lang of Waldo county then read the following, on

The Curse of Human Parasites.

By parasites here, we do not wish to be understood to mean those lesser tribes of insects and worms internal or external, for an abler pen than mine has thoroughly canvassed that subject, and if you will take the pains to consult the Report of the Secretary of the Connecticut Board of Agriculture, for 1870, you will find an excellent paper therein, by Prof. A. E. Verill of Yale College, entitled, "Internal and External Parasites of Man and Domestic Animals." This paper is full and exhaustive, and is illustrated with cuts, an accomplishment I despair of, except such cuts and pen and ink portraits I may be enabled to present. Such as I have are at your service.

The human parasites that I design to treat somewhat upon, are in the form and semblance of men, that subsist upon the varied forms of industry and upon the producing classes, without aiding them, very much as the eagle feeds upon the fish-hawk's prey. These parasites are to be found everywhere, and almost every-neighborhood has them. You all know them; they all have the same stripe and general semblance that identifies them at once, and in scaliness exceed anything yet investigated.

Why wonder that this is so; has it not always been so? Shall it always be so? Unless in new countries and under new governments, it has always been the same. Are we, by their appearance and existence among us, outgrowing our equality? Are we assuming the conditions that have belonged to all other plundered nations? There were always a few who have withstood the current; but never enough to save justice, honor or liberty. Parasites will feed on producers and industry so long as the producing classes are ignorant—so long as they are not qualified for the position they ought to occupy. I regard the calling of the class that feeds and clothes the world as a very high one indeed, and entitled to the highest honors; but its history is that it has always been kept down, as a whole, to the lowest levels. All-deserving, holding the elements of strength and prestige, it never yet learned to wear them for its own advantage. Its brains were never yet cultivated enough, nor its heart sufficiently refined. It has not sought to grace its bronzed features and plain apparel with manners sufficiently noble and elevated; nor taught its lips to speak on all occasions becomingly of the rights which belong to those for whom the earth was made and first given.

Of all classes, producers should be the most independent, upright and accomplished; nor should they be alive with political parasites or professional vermin. The fruits of their industry should not be distributed *for* them, but *by* them, and after a princely style, with due appreciation of what belongs to every other interest, in society and government. When they enter a city, they should be as much at home and as welcome in the tradesman's parlors as in their shops. They who have made the landscape should be a good judge of a painting of it. They who live on the soil and among plants and trees, should be at home in the green-house or hanging garden, which are, at least, but poor apologies for the spontaneous productions of the country. They who have in charge the tilling and fertilizing of the ground, ought not to be mere gaping spectators in the laboratory of the chemist; nor should they who live out of doors and in close proximity with all the glorious works of nature, suffer some closet student from the city to teach them about natural history, geology, or any of the natural sciences. More than a king should the producer be able to speak "Of the trees, from the cedar that is in Lebanon, even unto the hyssop that springeth out of the wall; also of beasts and of fowls, and of creeping things, and of fishes." (1 Kings, 4:33.)

The lesson taught in the command to Adam has never been heeded by the laborer. He is, and always has been, ignorant, not only of the names, but the nature of things. This profound ignorance of the laboring classes is the reason why they do not enjoy the honors and exemptions which other classes have appropriated. Hear what a practical writer says: "We cannot but consider the general tendency, becoming yet more common, to bring up children without regular, thorough mechanical employment, and without regular, thorough agricultural training, as one of the mistakes of the times. Our hearers will naturally inquire what we would recommend as the most perfect safeguard against so lamentable a state of affairs. Unhesitatingly we respond, scientific agriculture; for there is not a quality of the mind which in its far reachings it will not wake up and energize; for, to be properly and profitably pursued, it makes almost every other science subservient to it. Thus followed, it is the most ennobling of human pursuits, because it perfects the body and refines the mind. The healthiest of all callings, and which, when intelligently prosecuted, involves a large share of bodily vigor and activities, with a wide range of intellectual and scientific enquiry, deserves more attention than the present age accords it. One of the greatest mistakes of the times is, that anybody has sense enough to be a farmer; that it is a pursuit which can be taken up and successfully prosecuted without pre-culture."

There is medicine enough in the above to exterminate the last parasite and to cure the complaint. It is safe to handle and beneficial to everything it touches. It is cheap and effectual. Let every young man and woman who expects to live by labor, get a botany, chemistry, a natural history, and geology. Let them begin by taking small doses of each, increasing as they may be able to bear, each day and regularly, at home evenings and all spare moments. Let them experiment with well considered prescriptions upon themselves and others, anointing and being anointed, till they have become wide awake to beauty and dignity of labor, and of life in this world. It is lost time to wait for agricultural colleges. This is the way to get them, to aid them, and to permanently establish them. These preparatory studies should be commenced at once; and when an education is obtained, it should not be thought a misuse and abuse to enter the ranks of mechanics and farmers.

It is not a matter of satisfaction to call up the short-comings of our farmers and mechanics, or to find fault with the agriculturist and laborer. But when complaint is loud and deep that they can but keep soul and body together on account of the parasites that feed upon their labor, it is fair that they take upon themselves the degree of blame that properly attaches to them. Let them first qualify themselves to adorn a higher position, let them take the requisite steps and work for desired results, let them defend their rights and immunities in society and government, then they will no longer be treated as *mud-sills*.

The large grant of land by Congress, conditional upon further appropriations by the different States, for the purpose of giving them a better education, is a tardy but real acknowledgment of what belongs to their class, and of what they need. The discussions and deliberations, in various quarters, which this measure has awakened, has led, as yet, to no special interest among a great majority of those for whose benefit the appropriation was made. Politicians, speculators and managers of bankrupt literary institutions, seconded by a few farmers, who are not the best representatives of their class, hovered around the bequest and threatened to swallow it up. The laborer is asleep and dreaming. If he goes to vote annually, and receives a little flattery for what he has done, he seems to think that it is about all he is entitled to. He scratches hard at the vermin that infest him and feed upon his labor, and puts the best face he can upon his condition, all the while inwardly praying that something will turn up to take him and his out of and above the calling of laborer. He is so accustomed to hard usage and robbery that he expects nothing; and even doubts the sincerity of the government. He has given up looking for fortune in farming, luxury in labor, or a life of fame in years of toil and fatigue. He considers education not suited to his lot, and has learned to laugh at "Book Farming," and science in the field, and refinement in farm life. *This is a terrible fault.*

That we are as well situated, all things considered,—including parasites—as those of other places, I quote from a leading agricultural paper, published not far from the "Hub." "Taking all things into consideration, we think the farmers of New England are about as well off where they are as they could reasonably expect to be anywhere on the face of the earth. Let us, therefore, adorn our homesteads, improve our farms, and beautify the country about us, make better roads, build more for the future and seek comfort for advancing age among our own people."

Add to the above "Let us weed out the parasites that prey upon us" and the picture and inducement is complete. Emigration, the remedy thousands seek, will not help us; for go where we will, we shall find the parasite thriving as though "native to the manor born." There he is ready to take root and grow, ready to bite and to bleed, ready to sap labor and industry, as here.

Good men and true men are laboring for the advancement of the laborer, socially and intellectually, but he heeds not their well-meant efforts too often. And here the parasite comes in and diverts the benefits to other channels, or renders them of no effect. It is stated that two-fifths of the Ohio Agricultural Reports, published and sent out mainly at expense of farmers of the State, are lying among the rubbish of stores and offices, where they have been sent with somebody's compliments. The same authority says very few of the Geological Reports of the same State will ever grace the farmer's library. If it is said they would be no better appreciated in the homes of the farmers and laborers, the claim is yet good that they would then be where they were designed to be and among proper owners. And being there, involuntary combustion or chance may strike a light, sometime, which will make it unpleasant for the broods that are fastened and pensioned upon the labor of the land.

A far better record can be shown of our valuable State Reports. We know, and thousands bear witness to the growing demand for these annual volumes. The people are after them, not because they are gratis, but for intrinsic worth and merit. They have created a demand for themselves by helping elevate in the mind of the farmer and laborer his appreciation of his calling. We note it as a pleasing sign of healthy growth in the right direction, and also as a move to rid themselves of the human parasites that are, and have been, preying too long upon them.

Our duty is to make the laborer appreciate his worth and rights and not only cultivate the beneficial and useful products of nature, but the beautiful also, that our rural districts may bloom and blossom, and gladden the hearts of our fair country women, and elevate both men and women. Our duty is not only to make farmers and farmers' wives better understand their worth and wants, to make farming an intellectual profession—to give labor a just reward—but it is our duty to make it a profession of honor and influence in our social and political system. We must have a basis of political stability and prosperity, not only agricultural skill and mechanical invention, but also diffusion of that kind of knowledge which makes our farmers and their families honor their pursuit, and love the rural scenes amid which they are carried on.

Said a farmer to us, not long since, "How is it we allow middlemen to make such profits? Farmers sell their beef at seven dollars a cwt.; then what they buy back to use in their families, they pay from 16 to 20 cents per pound. It is so with every thing we have to sell. We sell our milk about Boston for four cents a quart, and the people in the city pay eight cents for it after it has been topped for cream, and the residue watered at that." Unless the cans are topped for cream, where are the numerous cans of cream sold in the market obtained? Echo answers, *where?*

A suburban farmer asked the other day, "How is it that I give twelve cents a pound for shin beef and thirty-five for sirloin?" So it is whether it be milk, eggs, beef, butter or aught else. Let there be fewer shopmen, less profit to them; better remuneration to producers, lower prices to the consumers; then all parties but non-producing middlemen will be benefitted. It is time producers should have their share of the profits of labor and capital invested by them. Why should men of no more natural ability than they, be suffered to grow rich from off the products of labor, while laborers struggle hard to make a bare subsistence. Is it not so everywhere? Are not parasites feeding upon industry and the producing classes in all places? How shall the remedy be applied—what shall the remedy be—is there any effectual remedy? Any means that shall bring the producer and consumer together, at proper times, will render middle-men unnecessary.

The parasite who ranges the country picking up products the farmer might just as well market himself, and save toll thereby, is of no real benefit to society. Say you, this dealer in truck is handy? So he is; let's consider a moment and see. He purchases a lamb of one farmer for four dollars, kills and markets him, with half a dozen others, for eight dollars. Handy to take four dollars from the farmer's pockets on every lamb marketed, which the farmers themselves could just as well do. So with eggs, poultry, calves, and all the products of field and flock. He scours the country and buys at his own prices very often, and reaps a big percentage. But, say you, he don't *make* every time. Allowed. But who must make up his losses think you?

Bring the producer and consumer together and the one gets more, while the other pays less for the same product, than now. They divide the parasite's profit between them; they are both benefitted. When the producer sees his interest in its true light he will establish market days and attend personally to the sales of his products, or by an agent who represents and is one of an association of producers. The consumer will meet the producer on market days and at market places. Their interests concentrate here, and will bring both together. Even railroads are in a measure in the hands of these parasites and pressed into service against the producer. On authority of the *Massachusetts Ploughman*, I find that "The Milk Producer's Association of Massachusetts and New Hampshire, in the course of their investigations, have found that the contractors (middlemen) have made contracts with the railroads, by which they are enabled virtually to control the means of transportation. The consumer pays in the city twice as much as the farmer twenty-five miles off receives for pure milk at his door, and the railroad freight is only one cent per quart; it will be seen that the interest of all other parties are now sacrificed to middlemen."

Farmers' clubs, market days, cheap, untrammeled transportation, diffusion of knowledge and coöperation, are among the most potent means of ridding productive industry of these parasites, now sapping its life blood. Agricultural colleges, associations, the Press, and the unbiased common sense of an educated people, will work this out, if it ever is worked out, to practical utility and blessing.

As now exists, the producer receives the minimum price and profit, the parasite the maximum; very often this profit exceeds the price received by the producer. The producer, content through ignorance or powerless through apathy, lies passive in the hands of middlemen. Prices are established by the dealer, on products bought and sold, of and to, the farmer. The dealer has both ends of the trade; the producer is at his mercy. Demand and supply have far less to do with regulating prices than ought to be the case. The parasite grows rich, the producer poor.

One thing is cheering from this standpoint: There is a growing intimacy between city and country. They are not so far apart socially and practically as formerly. This is as it ought to be, and a move in the right direction. The barriers of our social caste are being broken down by the agencies of education and internal improvements. The inhabitant of city and country are being thrown more and more together; the one learns he can buy cheaper and get better products, the other better prices, by dispensing with the parasite, that has fed from both hitherto. Let farmers and consumers cherish this intimacy, cultivate this direct exchange, pursue this avenue of promise, walk this path devoid of vermin, and it shall be one great aid to desired results.

The Farmers' Club we recognize as an efficient and powerful aid toward ridding industry of parasitical pests. In the club we see the same capabilities for educating farmers and mechanics, as in the common school to educate children. They are, in fact, the common schools of agriculture. No town can afford to be without them. No community is so advanced as not to need their aid. Success to them! may their numbers increase, and attendance double.

But I must close; fruitful as is the subject under consideration, fraught as it is with interest to the masses, I feel that I have but poorly treated some of its many points. It is a subject that demands our earnest thoughts as artizans and producers. It demands individual action and united effort.

Let me close by repeating the words of another, when he says of true life: "The mere lapse of years is not life. To eat and drink, sleep and wake, to be exposed to darkness and light, to pace round in the mill of habit, and turn the thought into implements of trade—that is not life. In all this but a poor fraction of the consciousness of humanity is awakened, and the sanctities will slumber which make it worth while to be. Knowledge, truth, love, beauty, goodness, faith alone can give vitality to the mechanism of existence. The laugh of mirth that vibrates through the heart; the tears that freshen the dry waters within; the music that brings childhood back; the prayer that calls the future near; the doubt which makes us meditate; the death which startles us with mystery; the hardship which forces us to struggle; the anxiety that ends in trust, are the true nourishment of our natural being."

And let us work together for elevation and progress toward that happy "Coming Time,"

> "When men forget their love of gold,
> And love their honor more;
> When truth is only current coin,
> And counted o'er and o'er;
> When men love freedom for its sake—
> For all as well as one—
> And, for the greatest good, their work,
> From day to day, is done:
> When men throw self aside and live
> For some just purpose high,
> Then will the glorious era come
> When parasites shall die."

MR. S. L. BOARDMAN, a member at large, also editor of the Maine Farmer, read the following on

POWER AND INFLUENCE OF THE AGRICULTURAL PRESS.

I am accustomed to speak to a larger audience than I see before me this evening,—but it is an audience that I have never seen, and that has never heard my voice. Week after week for years, it has been my pleasure and my task as well, to hold direct but silent communication with a very large proportion of the farmers of our State. And, as week after week in one continuous round, I see go out from our office the thousands upon thousands of copies of the MAINE FARMER, I not unfrequently amuse myself by watching in imagination these sheets of printed paper as they come fresh and bright from the press and go out through the numberless avenues of transportation into every nook and corner of the land. On publication days the mail cars of the trains are burdened with this freight of thought—and all along the main line of travel smaller parcels are sent out by stage coach and mail wagon, and over the narrow, grassy roads in the far off corners of the State, among hills and woods, small villages and quiet farms—the freshly printed paper with its seasonable advice and latest prices current is hurried along to its destination. And the farmer who has some errand at the corner post office or the village store, always goes on the day his paper comes, that he may keep up with the latest communications from the outside world, and know the highest quotation for eggs and beans. This errand is never forgotten—for what would the children and good wife at home do if the paper did not come? And, reaching home, the newspaper—the farmer's paper—is thrown in at the window, or handed to Charley who comes out for it, and while the farmer puts up his horse for the night, the young people, ever eager to read their part, gallop over the children's column, and after the evening meal is partaken the farmer or his wife or perhaps the oldest boy or girl, read the paper aloud to the family circle. The news is commented upon, the opinions of the paper criticised—for such is the general intelligence of our farming community, and honor to the press for it—that men, and women too, have thoughts of their own upon almost every leading topic of the day, and are free to express them. And I sometimes think, that for once I should like to enter in person and simultaneously, each of these thousands of Maine homes where I do now enter in reality, and see for myself the reception I should meet. But after all it is better that it is impossible. What reproofs I escape, probably—what applause, perhaps I never hear; how many disputes I avoid, how many enemies I never meet, how many friends I have now who might be disappointed should they see me as I am. And so I live in the pleasant delusion that all my readers are generous critics, and do my best week after week, to make my budget of thought attractive to some; conveying information to some, suggesting useful inquiry to some, and producing no feelings but those of good will in the mind of a single reader. Turning these things over in my mind, and knowing I was to meet many of my family of readers face to face at this time, it occurred to me to present some of my own thoughts,—which may not be wholly new, or particularly different from your own—upon the power and influence of the press, and its connection with agricultural progress.

Now, I do not propose to go back to the days of antiquity to show the condition of agriculture before the operations of the farm were governed by thought and mind; when the implements of husbandry were the rudest contrivances possible, and the work of tilling the soil was limited to the mere labor required to produce sufficient to maintain life in its simplest forms—the investigation would be somewhat foreign to my subject. But I do want you to consider that only fifty years ago—and there are many men who can remember that—the only agricultural society in New England, and almost the only one in the country, voted, in a public meeting, that two of its members should become subscribers to the "public paper printed in Boston called the *New England Farmer*," and after unanimously passing this vote, went on to designate who the men should be. And every farmer in the State to-day, who is worthy the name, and who is enjoying the benefits of improved implements and an intelligent system of culture, should be proud of the fact that that society was a Maine organization, and those men thus drafted, to become in the grand future of our agricultural history, so truly representative farmers, were Maine men. And as I mention the names of Samuel Wood and William Richards of Winthrop as the first known subscribers in our State to a farmer's newspaper, let us lift our hats to their memories, that they were willing to be thus drafted, and above all that they were willing to pay their subscription dues—for the records of this ancient society, the second association of the kind formed in the United States, and which I have minutely examined with the deepest interest—while giving place to votes of the most trivial and often of the most amusing nature, nowhere mention that these men ever failed to pay the printer. By this action the first agricultural society of New England recognized the power and influence of the press, as a direct and potent agency in the work of "improving the art of husbandry, and elevating the calling of the farmer," the primary objects for which it was organized.

But to come down to a more recent date. It is but little more than thirty years—and many here can remember further back than that—when the members of this pioneer agricultural society of New England, feeling the need of a farmer's paper of their own, set about obtaining subscribers for a Maine agricultural journal. It was started in 1833, and it would be quite amusing had I time to tell you what opposition it met with, how many subscribers it had, and how they paid for it. I may say in brief however, that for ten years the MAINE FARMER, originally called the KENNEBEC FARMER, did not have above three hundred subscribers, and more than half of these paid for it in beans and potatoes! You will smile at this, I have no doubt, but I have the statement from the original publisher of the paper himself. There was no money in circulation, and farmers could not get money for anything they sold. Trade was all barter; and for years the standing announcement in the paper was: "all kinds of country produce taken in payment"—and the poor, lean, hollow-bellied editors were mighty glad to get it.

Reflect for a moment upon the condition of farmers and farming in our State when the first farmer's newspaper was established.

Roads were poor and the country was but thinly settled. The general means of communication was on foot, by horseback, or with an ox-team; no such thing as a spring carriage had been thought of. Farm houses were unpainted, there were no carpets on the floors, no curtains at the windows. Cooking was done by the open fire place, water was drawn with the well sweep, and the wool cards, spinning wheel and loom were found in almost every house. The clothing was all home manufactured, and women were contented to wear one dress at a time. Farmers plowed their ground with a wooden plow, the mould-board of which was covered with strips of sheet iron, and harrowed it with a harrow, the teeth of which were of wood. The scythe, and fork and hoe were made by the village blacksmith, and fitted into handles from the farmer's wood-pile—the scythe snath being a crooked stick from the forest. Grain was reaped with the sickle, threshed by the flail, and winnowed by the original winnowing machine of the Creator. It was carried to mill on the back or by means of an ox-team, often a distance of thirty miles. In autumn the shoemaker with his kit of tools went from house to house to make up shoes for the children, who had been barefooted during the summer. The farmer's stock of reading was limited to the Bible and almanac; while the privations and hardships of farmers generally, in felling the trees, clearing their farms and maintaining their families, thirty or forty years ago, were such as the present generation can obtain no real conception of.

Before comparing this condition of farm life in Maine with that we have now, let me say that the improvements we now see have been gradual and perhaps slow. They are too as marked in other lines of thought, and in other fields of effort, as in that relating to farming. A combination of agencies have been at work in all directions, to produce the wonderful changes between the present and the past, that we now witness. The application of steam and water power to machinery, has revolutionized all the processes and modes of manufacture; it has transformed the means of transportation and communication, and brought remote places near. The smooth fields admit of different treatment than did those cumbered by log-heaps and stumps, and with a denser population, ready markets yield the farmer ready cash. With this have come in an abundant measure the comforts and often the luxuries of a high civilization. But in all the channels in which these improvements have been going on, through all the past, *the* *press* has been the one grand agency. In politics and the science of government, in mechanics, in the industrial and economic arts, in the sciences, in the homely business of agriculture, the press has been the chief aid to the improvements wrought, the great means of preserving the thought and life of the people. Without it, the existence of many inventions and improvements would never have been known, and but for its influence, the world would have been a waste of mental darkness. Strike the press out of existence and the world would relapse into barbarism; the arts and inventions and discoveries which minister to the enjoyment and happiness of mankind would be forgotten; man would become but a mere mechanical organism. Encourage and support the press, and you continue to advance farther and farther into the clear and unmistakable light of wisdom and knowledge.

Let us now narrow our line of thought down to the business of farming and the influence of the farmer's paper. How slow and cumbersome the means by which useful discoveries in agriculture were disseminated before the days of the farmer's journal! A hard-working man, plodding along with his weary labor, works out with the aid of his own mind and hands some new mode of performing a certain piece of work, or makes some discovery in the pursuit of farming he has not before known, but which he is satisfied, in the light of his weak faith and still weaker knowledge, is to be a benefit to all who take advantage of it. Becoming sure of its value, perhaps only after two or three years' patient trial, he tells it to his neighbors. Following his directions they adopt the method he has practiced, or use the implement he has invented, with the same result. As years go on, other neighbors still more remote, make use of the new practice, and thus the good results of one man's study and invention travel slowly until perhaps in twenty years, possibly a hundred men may be following his new found methods. As there are no means of communicating this improvement or discovery but by the slow process of neighbor talking with neighbor, and as personal intercourse between distant points is not frequent, the thing makes very slow progress. But in time it comes to be universally adopted, although the man who originally gave the new and better method to the world may have long been forgotten. In contrast, look at the agency of the farmer's journal in diffusing, not merely a knowledge of those inventions for which their originators require a consideration, but the ordinary discoveries and experiences of practical men, willingly disseminated for the good of all.

In 1824, the editor of the *New England Farmer* went out to Jamaica Plain, "with a view," as he gravely states in his paper at the time, "of obtaining information concerning the worms called borers, said to be infesting the apple trees on the farm of Mr. John Prince." He then goes on to describe these "worms," which is done very minutely, tells what the neighbors know of their habits and depredations, and concludes by saying that the best method of getting rid of them is to "cut them out of the tree by means of a knife, chisel or gouge, and killing them." And from that time to this has any thing better been devised, except the flexible wire in place of the gouge? A year later, Mr. Leonard W. Briggs, writing to the same paper from Bristol, R. I., describes a horse rake which he says has been in use two or three years in that State, and in urging farmers to make and use it he says—"it is confidently believed that it only requires the experiment to be made to show its utility and bring it into general use." He then goes on and tells how to make it, describing very exactly a large rake similar to the hand "drag rake's" of the present day. When this rake is full the horse is stopped, backed, the rake lifted over the winrow, and then driven on until again filled. By gradual stages, the revolving horse rake grew out of this improvement which Mr. Briggs describes with so much confidence; and even now there are men who believe the old revolving horse rake as good as any; and I am inclined to think them about right. These two instances are sufficient to show how powerful an agent the press has been in making known not only the more important inventions in agriculture, but in disseminating for the general good, the practices and experiences and discoveries of the best farmers in all the past.

The farmer is no longer obliged to talk with his neighbor in order to make known to him what he has learned—and wait for the same slow method to be repeated over again and put in practice by other neighbors, and yet to others still, before he can see that his thoughts or his practices are of benefit and advantage to the world. This primitive arrangement is played out. The farmer of to-day communicates his thoughts to the agricultural journal; and embodied in type, duplicated to the extent of the entire edition of the paper, sent out into every school district of the land, the farmer who employs this means of disseminating his thoughts and practices—and what a heap these practical farmers know when you get at it—is at one and the same time holding communication with the best farmers in the country, is talking to an audience the magnitude of which would frighten him did he see it around his fireside, and spreading knowledge and information in a way that is sure to be like good seed sown on good ground. And I urge every farmer who wishes to benefit his fellow workmen, and at the same time acquire a discipline that will be of immense advantage to himself, to make a constant practice of communicating his thoughts to some agricultural journal. It has been by the accumulation of such articles that our positive agricultural knowledge has widened and deepened. Experiences recorded by practical men have been of great assistance in aiding the establishment of some fact of great importance in our agriculture, and the common observation of close students of nature have assisted the patient investigations of men learned in the sciences, who by elaborating these isolated statements and notes of experience concerning the practical matters of farm life, have been able to produce treatises that have been of vast benefit to the world, and of special use to reading, thinking farmers. And, speaking with a pretty close knowledge of the agricultural papers of this country and England, I am led to declare that the department of correspondence in our farming journals is generally the most interesting feature of these papers, and usually the portion first read. Few readers, I imagine, care little about the opinions of an editor, and when they do ask his advice or seek his counsel it seems to me it is because they like to have their opinions backed up by some one else, even if he don't know any more than they—but there is a real interest in what a farmer says himself, that somehow has a greater value to farming readers than the most brilliant leader—if brilliant leaders are ever found in an agricultural paper. That farmer who places on record in a farmer's paper one useful fact gained in his own experience, or by a single failure in any particular operation saves another from meeting the same result—is as truly a public benefactor, in kind if not in degree, as those whose names illuminate the pages of history for their benevolent deeds.

When the KENNEBEC FARMER was established—a little seven by nine sheet as you see it—there was but one other agricultural paper in New England and but six in all North America. The united circulation of these papers could not possibly have been over three thousand copies, and very likely not that. There was then but one agricultural society in Maine, and but three or four in the United States. The names of those who were early connected with the agricultural press of the country may sound like the names of strangers to many of you—but let me call them, for I love to honor their memories: Fessenden, Skinner, Buel, Bement, Cole, Hill, Colman, Holmes—the last for thirty years in the chaffing, editorial harness, a pioneer in the diffusion of knowledge, ever watchful of the interests of Maine men and constant in his useful suggestiveness, to which many of you are indebted for your present high position as intelligent, influential farmers. Although these names may be forgotten, they have perpetual monuments in the fine farms, good buildings and improved husbandry of our country, which they did so much in establishing; and in passing, I cannot neglect to mention them, for their names should appear in any paper treating of our early agricultural history. To these men are we indebted for the correct shapings of our agricultural literature, and for the early direction of the thought of farmers in the channels of intelligence and enlightened practices.

Just forty years since this little paper was first printed in a small Kennebec village—the cradle of improved farming in Maine—with its edition of three hundred copies going out on missionary duty among a small number of thinking farmers, groping after a higher intelligence in their business—and what is now the result? New England alone has eight agricultural papers with a circulation each week of fifty-nine thousand copies; while the circulation of such journals within our own State, at the lowest possible estimate, reaches the number of twenty-six thousand five hundred copies weekly—a united circulation of more than four million four hundred thousand copies per annum, one million three hundred and seventy-eight thousand copies of which are confined to our own State alone. Taking the entire country with its ninety-eight agricultural newspapers, and we have a grand circulation of more than nine hundred and eighty thousand copies each week, at the very moderate estimate of ten thousand copies to each paper, a total yearly circulation of fifty millions nine hundred and sixty thousand copies. And what significance there is in these figures! They are full of life and intelligence, and represent a greater mind power than one would at first think. They mean that the agricultural newspaper finds its way into almost every farm house in the country; that week after week it is educating the people by its silent, effective teachings; that not only the diffusion of correct principles, and accurate knowledge is being made, but that it is also carrying to the most humble home the latest intelligence from all parts of the world, the discoveries and inventions that are being made in science and the arts, and furnishing to the masses the most direct and ready means for obtaining an acquaintance with the world, a familiarity with the sciences, and forming a stepping stone to still higher intelligence, a broader culture and a truer refinement. And when I reflect upon the narrow influence of the pulpit and rostrum—giving them fullest praise for their immense power and great achievements in enlightening and christianizing the world—and the limited sphere of our colleges, useful and grand as they are—when I see so many instances of this seeming indifference of farmers to attend upon the means within their reach of listening to great teachers in agriculture, I rejoice that the newspaper which comes within the reach of all, so that those who run may read, and which seldom forces itself upon or bores a single reader—for if they don't like what it says they have only to throw it down and no one takes offence—I rejoice, I say, that it carries to all the best thoughts of the best farmers of the times, and gathers up and preserves the golden truths of those who speak to empty seats.

To realize fully the correct foundation which the first agricultural papers laid for the education of the people—the working people of our country—it is necessary to know something of their contents. Forty years ago there were few writers for the press from among the people. Occasionally a farmer communicated his views to the public, but in such cases the writer, if part farmer, was also part clergyman, or doctor or schoolmaster. Consequently the articles in the early agricultural papers were elaborate treatises published by installments; and in looking them over one finds the reproduction of leading English works on domestic animals on general husbandry, on fruit culture, on veterinary practice, and other fundamental subjects. From this source our farmers of thirty years ago obtained a correct education in the principles and practices of the most approved systems of the time. The paper was in fact the farmer's library and the farmer's college. It furnished him with thoughts and ideas; and the farmer who carefully read the *New England Farmer* of forty years ago was a man of note in his day—a prominent citizen of his town, and very likely representative to the General Court. The farmer of to-day demands that his newspaper should be not a text-book, but a repository of the experiences and practices of our best farmers and farm writers; not a guide to be implicitly followed, but a storehouse of models where farmers of different views engaged in different specialties may find copies or plans upon which they can improve; not a vehicle for trundling the pet theories of an editor, but for carrying to its readers the views and opinions of practical men engaged in the various industrial pursuits; not a body of formal essays, but a record of progress in agricultural matters, a bulletin of what is going on among farmers, of what they are doing to elevate and improve their occupation, and a medium of communication between them. Nor should any agricultural paper ever attempt to *teach* farming. For the editor of any paper to set himself up as a schoolmaster and say to his readers just what they shall do and how they shall do it, is the veriest nonsense. Every intelligent, reading, observing farmer would distrust such teaching the moment it was attempted. He would say; "A pretty fellow this editor, to tell me what I must do; don't I know how to plant corn, and dig muck and make beef?" And true enough, don't he? Such are the men who comprehend at once what a farmer's paper should be, and are those most likely to be benefitted by it. The richer a paper is in hints and suggestions, the less it attempts to teach, and the more it endeavors to draw out from its readers what they know, the more successful it will become, and the more completely will it fill its appropriate place.

Men who have ample leisure to write in a learned, exhaustive manner, who investigate a subject for weeks and it may be months before attempting to arrange their material in proper form for publication—have frequently underrated the labors of editors and correspondents of the press by characterizing their efforts as diffuse, erroneous or hastily prepared. But it seems to me the objection cannot be sustained. The editorial articles in the leading agricultural journals will compare favorably in point of value and ability with any treatise on any branch of agriculture by any American or foreign writer with which I am acquainted. Indeed, I claim for those in my profession, in this country—with few exceptions—that they are men of acknowledged ability, of scientific attainments, and writers of considerable prominence. Moreover, I maintain that the labor involved in editing a good farm journal is as creditable as that involved in the preparation of an elaborate treatise or exhaustive report. And if an editor does not possess the leisure to produce a ponderous work that will rank among the tomes in a library, he certainly deserves a good share of praise for making up a sound, readable, suggestive paper, which carries with it, week after week, into every school district in the land, fresh, seasonable and instructive reading. He also performs a good service for the very writers, whose elaborate productions would seldom be read by the masses in their original form, by condensing their works, and presenting them in a manner to be easily comprehended by common readers. In this way, the works of Liebig, and Voelcker and Bousingault, and Johnson, become of practical value to men who would never be benefitted by their investigations did they seek acquaintance with them in their original forms; while to present articles of seasonable worth, which practical farmers can take advantage of for their own profit, is a labor deserving of as much commendation as the preparation of a volume demanding a years' time. The opportunities of benefitting his readers are certainly in favor of the newspaper writer. He has a larger audience than the bookmaker, for where one man reads a book, fifty read the papers. A newspaper in a family is better than three months schooling in a year, and for the small sum of four cents a week, annually, a man can obtain reading and information which in book form would cost twenty-five dollars, and perhaps be beyond his reach. We can never fully appreciate the blessings of cheap newspapers for the people, and never overrate the services of those who have been foremost in establishing them. The farmer can better dispense with his plow than his paper.

Consider the work that has been accomplished by the agricultural newspaper press during the past forty years. What ignorance it has dispelled from the common mind—what a rich store of information it has carried to millions of homes, many of which, but for the agency of a cheap press, must have long remained a stranger to the ennobling influences of intelligence and culture—what incentives it has given young men to rise above condition or place and reach out after the high prizes in life—what social and intellectual elevation it has wrought for working people—what increase in the value of all farm products it has effected by diffusing a knowledge of their most economical production—what large areas of worthless land it has made valuable by giving information as to draining, subsoiling and the different processes of renovation—what useful inventions for the aid of the farmer it has been the means of suggesting—what an avalanche of bugs, of various kinds and with various sorts of hums, it has saved men from, and what imposition, of one kind or another, by sharpers and practitioners of different degrees, it has guarded them against. More than all this: it has placed the mowing machine, and horse rake, the horse hoe, the seed drill and the power fork upon almost every farm—it has given the sewing machine to the women of the world—it has multiplied our apples, and grapes, and pears, our grains, and seeds, and vegetables, until the varieties of each are many times greater than they were forty years ago, and especially adapted for the different locations and latitudes of our country—it has placed thoroughbred stock, or improved stock, the direct results of thorough-breeding, upon every farm—it has formed agricultural societies in every State and county, and almost every town, in the land—it has established an agricultural college in half the States of the Union—it has rendered chemistry, and botany, and entomology and nearly all the sciences subservient to the needs and uses of the farmer—it has —— but stop, I hear you say, has the agricultural press done all this? I answer, yes, all this; and it has accomplished it too by being in itself the grand central power in the diffusion of knowledge and intelligence; the prime agency that has acted upon individuals and communities to bring about the changes I have pictured. And am I claiming for the press more than belongs to it?

But, grand as have been the results that may be traced to the agricultural press—and I beg you to understand that in what I have said I limit the word to the agricultnral journal and newspaper, leaving entirely out of the question the thousand upon thousands of agricultural books—and powerful as has been its influence in bringing agriculture from a low and menial occupation, one regarded as fit only for blockheads and dunces, to the dignified position of a profession demanding for its successful prosecution high and noble qualities, there are yet grander results for it to achieve in the future. Its mission is not yet completed, nor its work finished. It will continue to wield its silent, effective force until all the work of the farm shall be performed by mechanical agency, until our crops shall be doubled, and every inferior animal regarded as not worth raising. Its work will not cease so long as an acre of unproductive land remains to be renovated or an insect enemy to be routed. It shall see our land teem with a busy population, and by the side of every river and stream, where now only the idle waters make idle music, ponderour wheels shall make the music of industry—an industry which draws its vitality from fertile fields. From every hilltop the farmer shall see signals warning him of approaching storms in harvest; and the telegraph, day by day, will acquaint him with the prices in the great markets of the world. By the side of every farmhouse in the land shall be seen delicate flowers—the fairest things in God's lower creation—and their silent and blessed influence shall be felt upon the hearts and minds of all. Neighbor shall be at peace with neighbor, the plowshare and pruning hook shall reigh triumphant, and in the delightful summer evenings the farmer shall recline under the shade of the trees and vines his own hands have planted, and read with satisfaction his daily agricultural paper.

LAST DAY OF THE SESSION.

The last day of the session was devoted to the subject of fruit. It had previously been announced that the expediency of forming a State association for the promotion of fruit culture would be discussed at this time, and if thought best, a society might be organized. Owing to the small attendance it was thought best, after discussion, to leave the subject in the hands of a committee and Messrs. Gilbert, Varney and Simpson were appointed as such committee.

A. L. Simpson of Bangor, presented the following paper on

Fruits and Flowers.

Gentlemen:—We are taught that in the days of antiquity, man was innocent and good, and dwelt in a garden, the Garden of Eden,—that in it grew perennial fruit and ever blooming flowers,—that in it grew no weeds, briars, thorns or thistles; that in this Garden he might have lived forever if he had not eaten of the forbidden fruit, that he did eat thereof, and discovered his nakedness. We infer therefore that in those days, man possessed the same selfish faculties that he does now, and that he permitted those faculties to get dominion over him, and to retain it; for this cause he has lived for self and endeavored to appropriate everything to himself, thereby continuing to eat the forbidden fruit. For eating this fruit he is sent forth from the garden, "so he drove out the man." Since then, man has been seeking good from himself, and has been reaping the reward of his hands, has continued to labor among thorns and thistles, and to eat his bread by the sweat of his brow, of which man cannot live alone. He was not driven from this Garden by any arbitrary decree of the Creator, his own selfishness drove him out. Good and evil could not dwell together. He saw no utility in the beauties of God's creations. To him there was no enjoyment in the cultivation of fruit and flowers. There was nothing in them that satisfied his greedy thirst for gain. Riches being his God, at its shrine he worshipped, and devoted his time to raising flocks and herds and to the cultivation of cereals and roots. Feeding upon these alone his nature grew cold and sterile, the earth yielded to his influence and instead of producing fruits and flowers it brought forth thorns and thistles.

To bring man back to his original goodness and the earth to its pristine state should command our best efforts. We should learn that whatever God created was for a good purpose, that all the bad results are caused by the acts of man, that there is utility in fruit and flowers as well as in flocks and herds, cereals and roots, that while the production of the latter alone, hardens man's nature and makes him cold and indifferent to the wants of others, combined with the former his nature becomes softened, he is made generous and benevolent, and mindful of others' needs. Fruit and flowers exert a marvelous influence. Some ancient writer has said, "No man can live among music and flowers without being made better." He might well have added fruit. While music charms the ear, and flowers delight the eye, fruit satisfies the taste; and man cannot help being made better by the combined enjoyment of them all. What felicitous enjoyment there is in partaking of a delicious fruit supper, among friends, in the midst of flowers, listening to sweet music. After such a gratification of the senses one might well in retirement dream of living in Elysian Gardens and awake in a state of cheerfulness and christian benevolence, yet how few will give proper attention to their cultivation. We are informed that it was through the influence of woman that man ate of the forbidden fruit and that by his eating a great curse has fallen upon all mankind; and she as well as man often complains very seriously because father Adam was so weak-minded as to be tempted by woman; forgetting that woman is now every day tempting man as did mother Eve, to eat of the forbidden fruit, and man as easily yields to the temptation now as then. There is no end to woman's selfish desires for riches. She tempts man to procure them and he yields not unwillingly. She incites man to acquire the means to adorn her person, thinking thereby to make herself beautiful—like mother Eve sewing together leaves to cover her nakedness. If, instead of this fatiguing employment alone, she would consent to live in the garden amidst fruit and flowers, and by healthful exercise bring out the beauties of the soul, she would make herself much more charming in her simplicity, than she would be in all the embellishment that wealth can procure.

As woman tempted man so that he was driven from the Garden, she should now endeavor to bring him back into it again; to do this she must first return herself, for where woman is there man will be also. If she will do this, man will begin to live for others instead of for self alone, and will find utility in the cultivation of fruit and flowers, and his evil passions will give place to the better qualities of his nature, and the earth instead of producing thorns and thistles, will yield nothing but what is good, beautiful and useful. If all mankind would live a good and pure life, then the earth would produce no weeds, briars or noxious fruits, and there would no destructive fires or tornadoes and nothing to destroy our crops, no pestilential air to breathe, and man would live without disease and pain, and his dissolution would not take place until he became fully ripe with age. Suffering and sorrow would cease upon the earth. This may seem imaginary, yet it must be a reality. God created man for a good and wise purpose, and his desire is that all men should be happy. The time is coming when all will be provided for. Within the last half century more progress has been made in the arts and sciences, agriculture and horticulture, institutions of charity and benevolence, asylums for the deaf and dumb and blind, and for homes for the poor and unfortunate, than in all time previous. Man is being lifted up into a higher and purer state. Vice is giving way to virtue and poverty to plenty. Wherever you find the most attention given to scientific agriculture and horticulture, you will find the greatest advancement made in these benevolent institutions and more especially where much attention is given to the culture of fruit and flowers. The time spent in their cultivation is recreation rather than labor. It improves the health and elevates the spirits.

No one who has sufficient land can afford to do without a well arranged garden. He should raise a full supply of vegetables, fruit and flowers. Every person who owns one-half acre of land can raise all the green corn, peas, beans, cucumbers, and all the other varieties of garden vegetables, all the stawberries, raspberries, currants, gooseberries, and apples to supply his family, besides he can have his pear trees, cherry trees, plum trees and grape vines, and his flower garden. All these luxuries can be produced from one-half acre of land when well cultivated. The poor as well as the rich may have them all. If every person in Maine owning one-half an acre of land would place it under such a state of cultivation, one might well exclaim in passing through our northeastern portion of New England, "This truly is the garden of Eden, the Paradise of America." How beautiful and useful might our cities and villages be made if every land owner would but cultivate one-half an acre with all these varieties. The whole State would be vastly improved in prosperity, beauty and in happiness. The *farmer* cannot afford to be without his strawberry bed and his raspberry patch. It will cost him less to cultivate them than it will to gather the wild. Picture to yourself, in imagination, a more delicious or tempting dish, than a saucer of the Wilson strawberry, half hidden in the rich cream from the dairy of the farmer. Fuller, I think it was, in speaking of the strawberry, once said, "God might have made a more delicious fruit, but it was quite certain he never did." They are the first in the season. They come after the long and dreary winter to delight our taste and sharpen our appetites. In their order and adapted to our wants and for the preservation of our health, come the raspberry, currant, gooseberry, blackberry, cranberry and the other varieties of small fruit, and with them the cherries and plums, and then come the pears and the apples, if not the most delicious the most useful of all.

These have all been provided by a wise Providence in their season for our use and health, and we should not fail to do our part to obtain them. The best varieties and mode of cultivation I will leave for the discussion which may follow this paper, as my purpose is to encourage their production. All who have children should do something towards their cultivation; for fruit and flowers are especially attractive to children, and if we commence by example it will be very easy to teach them. Once interested in the work they will find it a pleasure rather than labor.

The boys and girls should be taught to work together. The boys can prepare the ground, put out the trees, bushes and vines. The girls can plant the seeds, attend to their cultivation, and to watering and weeding the flower beds.

Yes, they all have a natural fondness for fruit and they love flowers. This all orchardists and gardeners know, by the depredations made upon their premises. It is also known by the eagerness with which the boys and girls who live in the filthy alleys and dark lanes in our large cities, seize the proffered fruit or flower to take it (it may be) to a sick mother, sister or brother, to gratify and cheer in their dark rooms. If every one did what he could towards cultivating these fruits, which are considered as luxuries and rarities, there would be enough to have them common to all, to satisfy the poor alike with the rich.

It may be said, that there may be utility in cultivating fruit, but what is the benefit of flowers. They may be beautiful to look at but they have no usefulness? We find the birds, butterflies and bees, &c., naturally hovering in close proximity to each other, and who can say how great an influence the bright and varied blossoms may have in drawing to our gardens the birds which feed upon the insects which destroy our fruit, trees and shrubs.

It will be remembered that Raphael painted his immortal frescoes where thrones could be lifted in thought and feeling, by them, and Michael Angelo hung the dome over St. Peter's so that the far off peasants on the Campagna could see it, and the maiden kneeling by the shrine in the Albian hills. These had their influence and performed their uses, and so will the flower gardens filled with the beautiful flowers. Go into the flower garden with some fair young lady who has made herself beautiful and healthful by working among the flowers, and witness the pleasure she takes in pointing out to you the beauties of one, the fragrance of another, the frailty of a third, and so on, repeating the name of each; then go to the public halls, places of entertainment, parlors and boudoirs decorated with tasteful bouquets, festoons and wreaths. Go also into the chambers of the sick, of the poor as well as the rich, where the room is made pleasant by them, and to the chamber of death where lie the remains of a loved friend surrounded by the snowy buds and blossoms, looking more beautiful even than in life, and then ask if flowers have no use.

Not long since I visited a neighboring village; while there I took the opportunity of looking among the gardens. I saw one far more beautiful than all the rest. In it grew a variety of fine fruit and beautiful flowers. While leaning over the fence I was accosted by a passer-by, who inquired how Deacon Clark was, I replied that I was a stranger there. He said Mr. C. lived in the house adjoining that garden, and was very sick. While waiting for the boat to return home, I walked out into the cemetery. There were mounds overgrown with weeds and briars, with nothing to tell whose remains had been lain beneath. There were some, at the head and feet of which were stones with the names and ages of those upon them, in whose remembrance they had been placed there. Upon other stones were lines of sacred poetry expressive of the feelings of those who had been left behind. Others displayed rich and costly slabs and monuments marking the spot where rested the remains of some loved one. There was also the soldiers' monument, upon which were chiseled the names of the honored dead. Clouding them all, was a sadness which made me feel, Oh! how lonely is death! I could not tell which caused the saddest feelings, the unmarked mounds overgrown with weeds and briars, the lonely grave, the cold white marble or the soldiers' monument; but as I moved about I came upon one bright spot; it was like an oasis in a desert. Upon a smooth white marble I read the name "Clark," with the name and age of a deceased daughter. This spot was surrounded with flowers of various kinds. Their beauty and appropriateness dispelled all sadness; and while I stood there my thoughts followed the spirit of the one in whose remembrance that spot had been decorated, up into that garden where perennial flowers ever grow, in the midst of vines and trees bearing delicious fruit. Such is the influence of flowers.

This Board since its organization, by its efficiency and the good management of its Secretary, has done much to encourage the cultivation of fruit and flowers as well as to encourage scientific agriculture, and have added much to the wealth, the prosperity and beauty of the State, and if the Legislature will give it the encouragement it deserves, it will do much to bring about the day when the crooked shall be made straight, and the rough ways smooth, and when the lion and the lamb shall lie down together, and when briars and thorns shall give place to the box and myrtle, and when all the land shall again bloom as the Garden of Eden, and when man shall find his happiness in being useful to others.

Discussion on Varieties.

Several tables were covered with a good display of apples and pears, embracing most of the standard fruits grown in the State, as well as a considerable number of newer sorts less disseminated. There were also some seedlings which attracted attention from their fine appearance, among which may be named a pear grown by Mr. H. G. Williams of Sidney, from a seed of Louise Bonne de Jersey, closely resembling the parent in outward appearance, rather larger and handsomer, but decidedly inferior in quality.

An apple called Smith's Favorite, which originated in Winthrop, was also very attractive in appearance, and the note accompanying the specimens spoke of it as productive and profitable as a market fruit. The Committee reported that although of good quality there was not evidence of sufficient superiority to warrant recommending it over other well known sorts of the same season, and the same remark applied equally to several others which were shown.

With a view of facilitating the objects designed to be reached by the discussion, a circular had been previously prepared and issued, inquiring of cultivators their preferances as to the three best apples for Summer, Autumn and Winter use, as well as some other questions. A committee having been appointed to examine and collate the answers received, reported that a much smaller number of replies had been made than was expected. There was, however, a considerable degree of uniformity in the lists which had been sent in, and a considerable majority of the suffrages indicated as the favorite sorts. For Summer—Red Astrachan, Williams and Early Sweet Bough. For Autumn—Porter, Gravenstein and Nodhead. For Winter—Baldwin, R. I. Greening and Roxbury Russet.

The committee stated that other varieties had been named, some of which, although less generally known, and as yet little disseminated in this State, they believed to be worthy of more extensive culture, and of displacing some now commonly cultivated. They recommended that these be taken up severally for discussion, and that the experience of those present be solicited in relation to their value, either for home use or for market purposes; which was accordingly done.

Primate. Friend Taylor had raised a few from scions procured from Western New York and deemed it the most delicious apple of its season. The tree is thrifty, hardy and of spreading habit.

MR. VARNEY. I have raised a few but am not prepared to speak of its value for extensive culture.

SEC. GOODALE. The first trees I had of the Primate were dwarfs, and, as usual, I expected them to fruit early; but I got fruit from scions cut from these dwarfs and set in large trees several years before the dwarf trees bore. It has proved with me hardy, vigorous and productive. In quality it exceeds any other as early. It ripens in August and is in eating for some weeks. Size rather above medium, light colored, rather a greenish white in the shade and more straw colored on the outside of the tree and frequently with a blush next the sun. Exceedingly tender, juicy and rich. Every year I have fruited it increases the estimation in which it is held. It should ripen on the tree.

Garden Royal. SEC. GOODALE. A small early apple of the very highest quality. It is so good that no family orchard should be without it. The tree, especially when young, is a slow grower; you will not be likely to find trees of it for sale by nurserymen, as very few buyers would pay the cost of growing them to the usual size. Consequently, if you want it, procure scions and graft into some vigorous stock. I was much surprised, some years ago, to find the fruit for sale in considerable quantity in Portland, but not at all surprised at the estimation in which it was held, nor that they brought a high price. The appearance was that somebody had found it to be a profitable market fruit. It is hardy and productive.

Moses Wood. MR. C. SPAULDING. That is a native of Winthrop and a great favorite with many; early, very rich, very handsome, excellent for cooking as well as for eating. Somewhat liable to fall from the trees.

Foundling. SEC. GOODALE. A native of Groton, Mass. So far as I can judge from twenty years experience and some observation of it in other parts of the State, it is an apple which has few, if any superiors in August and through September, either in quality, productiveness or hardiness. After I had disseminated it as a new variety recently obtained and proved, I found it in an orchard in Cumberland county where it had been grown during many years previously.

Cole's Quince. MR. ADAMS of Wilton. This came into full bearing with me for the first time the present year. It is of superior quality and very productive. It sold this fall for double what other good sorts brought, when apples were plenty.

Mr. Brackett. Extraordinarily productive and bears every year; of fair quality.

Sec. Goodale. There seems some doubt whether it be, or not, the apple described by Coxe many years ago, as the Quince Apple. There is at least a close resemblance between them. Mr. Cole claimed it as a native of Cornish, York county, in this State.

Duchess of Oldenburgh. Mr. Varney. In my opinion this is of only third-rate quality. It sold in Portland for $3.00 when really good apples brought only $1.50. I should put it the other way. It is quite tart, coarse and harsh, but very handsome.

Mr. Simpson. About Bangor it is considered one of the most profitable. It is not first-rate but good enough to sell well.

Mr. Moore It is very good with us.

Mr. Brackett. It is mostly grown in gardens, and with high culture is very large and very handsome.

Sec. Goodale. It is an apple specially adapted to northern latitudes The quality improves as we go north; south of us it is quite poor, in Central Maine it is hardly to be recommended, even for its beauty, but north of Bangor and in New Brunswick its combination of great productiveness, fine appearance, extreme hardiness and fair quality render it one of the most worthy of cultivation. I never saw trees of any variety, in any other locality, present such a splendid show of fruit as the Duchess in Woodstock, N. B., in a well cultivated orchard.

Starkey. Mr. Varney. In the town of Vassalboro' I saw the original tree yesterday. It is very fair, a handsome grower and the finest apple that we know of for its season. It is in eating from November until January; we had them in the stores last year as late as February. It is a strong grower, and if I were to set 500 trees to-day for an orchard, I would put 250 of them Starkey's. It has not been propagated outside of the Kennebec valley to any great extent. Last year they sold for $4.00 while other apples were worth $2.50 or $3.00. The old tree stands now on the farm of Warren Stark of Vassalboro'.

Sec. Goodale. I have learned more of this apple from the specimens shown here than I knew before, although I have heard it highly spoken of. It is certainly of superior quality, and its appearance and flavor suggests a probability that it may be a seedling of Ribston Pippin, which is certainly one of our best apples although very capricious about bearing.

Jefferis. Sec. Goodale. The tree is quite hardy, of moderate vigor, very productive and the fruit of superior quality. It comes in eating soon after Garden Royal, and although of unlike flavor is scarcely inferior to it. Of Pennsylvania origin, medium size, yellow, splashed with red, very tender, juicy and rich. I would hardly recommend it for a market fruit, but would very strongly for home use.

Sarah. MR. ADAMS of East Wilton. I have been acquainted with this for twenty years but have grown it myself only lately. It is very large, very handsome, of good quality, and one of the most saleable The original tree stands near the corner of the house, where it receives the slops on washing days. It covers a large surface and has borne seventy bushels in a year. The fruit is remarkably fair, smooth and free from all blemishes, as well as very large, both on the original tree and on mine, which have lately come to bearing, and for so large a fruit they hold on wonderfully well.

Dean, or Nine Ounce Apple. MR. ADAMS. This is said by some to have originated in Leeds, and by others, in several other places. The tree is of spreading habit, a regular and good bearer, and sells higher where it is known than any other apple I know of. It is decidedly the finest apple of its season which is grown in our vicinity.

SEC. GOODALE. I hope we may be able to get at the facts with regard to the origin of the Dean Apple, and the success attending its culture in different localities. I have not grown the fruit, but have seen it from several sources, and my impression is, that it is worthy of far greater dissemination and more extensive culture than it has received. The fruit reminds one of good specimens of Primate—both in form and color, tenderness and rich flavor. It is, however, considerably later than Primate.

Winthrop Greening. MR. SPAULDING of Hallowell. Originated in Winthrop, is very highly esteemed as a superior fall fruit both for eating and cooking. The tree is a vigorous grower and very hardy, but only moderately productive.

Mr. GILBERT. It is grown by some as the Lincoln Pippin, and was shown under that name at the late State exhibition at Bangor. There is also another apple called Lincoln Pippin quite distinct. There is no more popular apple, when it succeeds, than the Winthrop Greening. It is not excelled by any in flavor or quality.

SEC. GOODALE. Excellent as the Winthrop Greening undoubtedly is where it originated and for a moderate distance around, it does not succeed over a wide range of territory. It fails with me, and it has failed to give satisfaction in many cases where I had sent scions for trial. One of the apples known as "Lincoln Pippin" is one imported by Dr. Vaughan, many years ago, under the name of King's Pocket.

FRIEND TAYLOR. I think the Winthrop Greening needs a soil having some iron or brimstone in it, like a strip of land in Winthrop and adjacent towns where the Roxbury Russet and a few others do so remarkably well, and a great deal better than the same do a few miles on either side of that strip.

Beefsteak. SEC. GOODALE. I do not remember at this moment on whose recommendation this was put on the list for discussion, and so I cannot tell what apple is referred to, as there are several which are grown under that name. The one I have was obtained at West Newbury thirty years ago or more, of large size, red splashed on a yellow-ground, mild, good sub-acid flavor, best in September and October. The tree is very vigorous, moderately hardy, enormously productive in alternate years. Its principal fault as a market fruit is, that it comes in at the same time with many other good apples. I am inclined to think that mine is correctly named, as it corresponds with the Beefsteak of Downing, which he says originated in Amesbury, Mass., and has the habits of the Baldwin. In vigor and general form my trees closely resemble the Baldwin.

President. MR. GILBERT. It is grown extensively in Androscoggin county on account of its productiveness, fair, uniform appearance and large size. A very saleable apple owing to large size and fine appearance, although only second or third-rate in quality.

Mexico. SEC. GOODALE. A superior autumn apple, deep red, medium size, sub-acid, flesh a little stained with red, tender, juicy, and of very good or best quality. Its growth in the nursery is so slow that it should be grafted in the limbs—for that reason if for no other. Deserves more extensive cultivation. September and October. Of Connecticut origin.

Shiawassee Beauty. SEC. GOODALE. The specimens on the table were sent hither by Mr. John Copp of Milton Mills, N. H., who had the scions from me. It is said to be a seedling from the Fameuse, and closely resembles it in the peculiar whiteness of its flesh. It is rather flatter and a larger fruit than its parent, with a rather darker colored skin. It originated in Michigan; the tree is very hardy, and may prove valuable here. It bore with me this year for the first time, and very heavily. Quality good, or very good.

Late Strawberry. SEC. GOODALE. One of the richest flavored apples we have. A good grower in the nursery, but never comes to be a large tree; hardy and productive. An autumn apple, called Late in distinction from the Early Strawberry.

Northern Spy. FRIEND TAYLOR. I had this variety growing a long while without bearing, and was about to graft them over, but friend Goodale being at my place, said "Don't do so by any means, be patient a while longer," and so I waited, and I have since been obliged to prop up the limbs to save from breaking down. It is not an early bearer, and it needs good culture, but the fruit is very excellent, and holds its flavor until very late.

COL. SWETT. Mr. Carter of Paris, had trees of Northern Spy of Mr. Goodale fifteen or twenty years ago, which have been in full bearing now for some years, and he esteems it beyond all others. His Baldwins, planted at the same time, are dying out gradually, but the Spy is much hardier, growing vigorously, and flourishing first-rate. Two years ago last Spring, he set out two hundred of them, as he says, "for the boys." He thought he could leave them nothing better than an orchard of Northern Spy trees. It needs pruning when young to open the top, which grows close and full. After they come to full bearing the top is more open.

MR. ASA MOORE. So far as my observation goes, young trees have not done as well as they would had the knife been used more freely in thinning out the close tops. I have seen the fruit without any red on it for want of any sunshine. With suitable pruning when young, and good cultivation, it is one of the very best we have in all respects.

SEC. GOODALE. I have grown the Spy probably as long as any one in the State, and its merits have been more fully appreciated each year since it came to bearing. The young trees need a judicious, but not excessive thinning of the tops, as full bearing causes the top to become more open. It requires, and will richly pay for good cultivation. There are few apples which show a wider difference in value by reason of good culture or neglect, than this. The good are very good, and bear a very high price; and the poor, small, pale ones, are poor indeed.

MR. VARNEY. I fully endorse all which has been said in favor of the Spy. It ought to be planted very largely, and no orchard should be without it.

Mr. Gilbert. I have only one tree which has borne passably well. I have some very handsome trees, a dozen years planted or more, that came into my possession by having bought the land they grow on. They are what are called New York trees, that is, "root-grafted trees," and I am waiting with what patience I can for them to produce fruit.

Black Oxford. Col. Swett. This apple originated in Oxford county, and has been grown there considerably. It needs high culture to come to good size. The fruit lacks character. The leaves fall early. The limbs are slender and liable to break. It is less cultivated than it was some years ago.

Sec. Goodale. I could never understand how that apple attained so high esteem as it had at one time, for although very productive and good looking, and remarkable for keeping very late, it never became mellow, but began to rot upon the outside while all the rest was hard. This was the case even in June and July.

Mr. Gilbert. It was grafted extensively in Androscoggin county for a number of years, but is becoming unpopular. It is a great bearer, and very liable to overbear. I have some trees which present a splendid appearance, fully laden with handsome fruit. It is not good for cooking, and a late keeping apple should cook well, besides eating well. The fault spoken of by Mr. Goodale always attaches to it.

Jonathan. Sec. Goodale. This I consider one of the finest winter apples we have for home use. It is not large enough to be very popular as a market fruit, but few orchardists who know it would be without it for home consumption, and it would be easy to sell it as soon as its quality was known. The specimens shown by me are under the size they would attain in a good apple soil. Those shown by Mr. Copp are about as large as you can expect, being nearly of medium size. In a note he says, "This is a late keeper, of very fine quality, a great bearer and retains its freshness of flavor until late in spring; rather small for market." I will add that young trees grow rather slowly, and the growth at first is slender but makes a good tree in time. Does best grafted in limbs. Its flavor resembles that of the Esopus Spitzenburg—which is praise enough. It originated at Kingston, N. Y., probably from a seed of Spitzenburg; was introduced to notice by Judge Buel of Albany.

Friend Taylor. I would like to inquire what success attends the Spitzenburg in this State?

Col. Swett. It was grafted extensively in Oxford county thirty years ago by men who came round to graft and brought scions with them from New York. The fruit is of very superior quality, no better winter apple, but the trees are not of vigorous growth, nor very productive. I would not recommend it to be planted for market purposes as others are much more profitable. We keep what we raise for our own use and sell our Baldwins.

Mother. Sec. Goodale. The specimens on the table fairly represent this fruit. Few apples surpass it in excellence, and it keeps till mid-winter. I have grown it for thirty years or more. In my soil the trees are not so healthy or long-lived as I have seen it in better soils for orchard purposes. It originated in Bolton, Mass., has a yellow flesh, is tender and juicy with a rich aromatic flavor.

Milding. Splendid specimens of this large, handsome and excellent fruit were sent by Mr. Copp, including clusters of three or four each. No one present could speak of it from personal experience. Mr. Copp's note says:

"This apple has long been supposed to be a native of Alton, N. H. It is not much known excepting in this town and the neighboring one of Farmington, and there it is esteemed more highly than any other winter-apple. The tree surpasses all other varieties I have ever cultivated, in its strong and rugged growth, and is very productive. It will not keep quite as long as the Baldwin. A gentleman of Farmington sent specimens of the apple to Boston, where some one pronounced them the Beauty of Kent. If it is that variety it seems a little singular that an apple so little known *even now*, should find its way, seventy years ago or more, back into so obscure a locality, and at a time when grafting trees was scarcely thought of. It is probably a native fruit, and I am confident it will prove a very great acquisition."

Smokehouse. Friend Taylor. I have eaten the fruit and have it growing, but not yet in bearing. It is highly esteemed where known.

Sec. Goodale. It originated in Lancaster county, Penn., near a smokehouse; hence its name. I have found it a very regular and abundant bearer for a dozen years or more. The tree is hardy, of very spreading habit, which arises in part from heavy bearing in connection with fruiting at the ends of the preceding year's twigs. The fruit is somewhat flattened, yellow, with some crimson splashes; flesh yellowish, rather firm, crisp, juicy and rich, with a mild acid and somewhat peculiar flavor; greatly prized by some, and less acceptable to others. Season from October to March. I value it very highly, both for eating and cooking.

King, (of Tompkins county.) SEC. GOODALE. This is a fruit which is being extensively introduced into the State, and for various reasons it is very desirable that we learn as much as we can in regard to its value for our uses. No tree can be more cheaply and easily grown to good size and of handsome appearance in the nursery; hence nurserymen are ready to furnish as many as buyers will take. I have grown it perhaps as long as any one in this State, but have not been able to arrive at satisfactory conclusions concerning its value in Maine. Sometimes it has suffered apparently from severity of winters, young trees more than those grafted in limbs, but even those sometimes show injury in the heartwood. The samples before us show its size and fine appearance. In quality it is good enough to sell well, and if the tree is hardy enough and sufficiently productive, and its keeping qualities satisfactory, it will prove a great acquisition, but on these points some doubts exist in my mind.

MR. VARNEY. It is a splendid growing tree, both in the nursery and orchard. I ate my last apple of it so late as the fourth of July. It is not first-rate, but very good, and its bearing quality about medium. They are usually in eating in January and February; but with care, I have kept them later. It is an excellent tree to transplant.

MR. A. MOORE of Anson. My own experience with this variety has not been satisfactory; the trees show disease, and the heartwood becomes rotten; but others not far from me have had pretty good success with it. It is so peculiar in its requirements, failing with some and succeeding with others, that I would be glad to learn what are the necessary conditions of success.

FRIEND TAYLOR. The King (of Tompkins county,) was so highly recommended to me by a friend in Western New York, where it was greatly prized, that I have grafted about a hundred trees with it, and some have come to bearing so that I raised a few barrels this year. It is a fair eating apple, but will not keep so well as the Baldwin or Greening, and should be marketed by the first of February. It is liable to rot before coming to full maturity. It is a very thrifty grower, and productive. I know of several trees among the first set out in our section which bear ten or twelve bushels each; they are probably about fifteen years old My hundred trees which I grafted when I had so great confidence in it will be in bearing soon, but my expectations in respect to them have moderated considerably from what they were when I first learned of the apple.

On motion of Mr. Colburn, member from Kennebec county, the thanks of the Board were tendered, by a unanimous vote, to the people of Skowhegan and vicinity, for their hospitalities and courtesies during the session, and the Board finally adjourned.

Apple Tree Borer.

In this connection I am happy to be able to present the following communication from one of the most critical and patient observers in the State, as well as one of its most skillful fruit growers,* embracing some facts in relation to this insect, which, so far as I am aware of, have not been previously published.

S. L. Goodale, Esq.—*Dear Sir:* You request me to make some statement in regard to the apple Tree Borer and its ravages. I have watched the operations, and studied the habits of this destructive insect pretty closely for many years, but cannot say much in addition to what was given in my paper on fruit culture, published in your report for 1862. I have, however, since then, noticed the exact time of its coming forth from the tree, in its perfect or beetle state. They all seem to come out at the same time, to a day, in the same year, but that time varies in different years, according as the season is forward or otherwise. During the last ten years they have once left the trees as early as the twenty-eighth of June. This is the earliest I have ever known them to leave; and once, the latest, on the eleventh of July, but usually about the fifth of July. Probably the time varies, also, in different latitudes. The length of time they remain in the tree from the laying of the egg till the perfect, winged insect leaves, is about two years and eleven months, running into four

*Among Mr. Currier's contributions to fruit culture may be mentioned the origination of new varieties of Raspberries; Hybrids between the Antwerp and Cap families, including many of high promise. So many are they and so marked are their peculiarities from others, that some years more of careful observation and selection are necessary to prove which are the best of them, before introducing them to the public.

different years. They cease boring in the fall of the third year, and transformation takes place during the months of May and June of the fourth year, so they are ready to leave as stated above.

I do not know how soon they commence laying their eggs after leaving the tree, but I am confident they do so by the latter part of July, for I have seen their mark and destroyed the egg early in August; and by the twentieth of August the young borers are at work. I think it is certain, though not generally believed, that they, or some of them at least, lay a second litter of eggs later in the season. I have frequently been puzzled while hunting for young borers in June, to know why some of them should be very small, apparently just hatched, and close to the outer skin of the bark, while others, much larger, had gone through the bark; and yet both were evidently from eggs of the year previous. I came to the conclusion that there must be two litters of eggs, and that those of the second litter do not hatch till the following spring. At length I was confirmed in that belief by finding a beetle on the trunk of a tree, close to the ground, evidently depositing eggs, on the last day of September. And this year I found another on the twenty-sixth day of August. I could see the mark it made in the bark, and on cutting, carefully, found the egg. At the same time, and in the same tree, I found a young borer, less than a quarter of an inch long. This, doubtless, was from an egg laid early in the season. I have had other, and to my mind conclusive evidence, that the eggs are not all laid early in the season, and that those laid late do not hatch till the following spring.

Then, if eggs are laid as early in the season as July, and as late as the last of September, whatever means are used to prevent their being placed at the collar of the tree, should be applied as early as the middle of July, and kept in good condition till October. Then we have all the rest of the year to hunt the young larvæ and dig them out, before they do serious injury to the trees, though it is a trifling job, requiring but a few moments to a tree, *if attended to properly and in season.*

The best means that I can devise for safety, is to put something round that part of the tree to protect it for several inches above the ground. Almost anything will answer. It may be old rags, old bootlegs, sheathing paper, a plaster made of clay, sods, or even a small mound of earth. The beetle runs down the trunk, and lays its eggs close to the ground. If the ground is dry and shrunk away from the tree, it gives her a chance to go still lower, and when the ground swells on becoming wet, it covers the grubs out of sight; and beside that, they naturally work downward the first year or two. This is why so many trees are ruined by them before the owner is aware of it, when if they were kept up in sight they would be destroyed. Sometimes a very slight obstruction will stop them. I once tied a branch of honeysuckle to the trunk of a mountain ash three feet from the ground, with a piece of twine, and the next year found borers there. At another time I tied a raspberry cane to the trunk of an apple tree, and afterward found borers there. But on no other part of the tree will they prove so destructive as at the collar—close to the surface of the ground, because no where else can they so effectually hide themselves.

Some assert that the rough bark should be scraped off and the tree kept smooth, so that insects may find no harbor for themselves or shelter for their eggs. If such practice is beneficial in any case, (which I very much doubt), I am convinced it is not so in regard to the borer. The beetle chooses a spot where the bark is smooth, green and tender, and prepares a place suitable for the egg, and for the sustenance of the larva. If the surface was completely covered with loose scales of dead bark, probably a borer would never get through it.

But, however much we may write or talk on this subject, persons who are habitually careless and negligent, will allow their trees to be destroyed by this and other pests, while those who are determined to give the needed care and attention, will find a way to prevent so serious a loss.

Yours truly,

JOHN CURRIER.

WALDOBORO', October, 1872.

THE RELATIONS OF BOTANY TO AGRICULTURE.*

BY WILLIAM S. CLARK.

There is much reason for gratitude and encouragement in the fact that the general subject of agricultural education need no longer be discussed at the meetings of this Board. That good mental training, some literary culture and familiarity with the laws and phenomena of nature are useful to the farmer, is no longer denied. That chemistry, by revealing the composition of air, water, soils and manures, as well as of plants and animals, has rendered a rational system of agriculture possible, is universally admitted. The chemical force, however, exerts its influence principally upon dead matter, and is subordinate to that other greater mystery which organizes mineral substances into those varied forms of vegetation which clothe the earth with beauty and furnish the indispensable food of animals.

Baron von Liebig has said: "The scientific basis of agriculture embraces a knowledge of all the conditions of vegetable life, of the origin of the elements of plants, and of the source from which they derive their nourishment." Professor Lindley also asserts that "good agriculture and horticulture are founded upon the laws of vegetable physiology;" and that "no man deserves the name of gardener who is not master of everything known as to the way in which plants feed, breathe, grow, digest, and have their being." How astonishing and humiliating then to every enlightened American must be the fact that while in Europe almost every university and every large city has its botanic garden for the instruction and entertainment of students and people, there is not in these United States a single general collection of living plants, systematically arranged and adapted to convey any adequate idea of the wonders of the vegetable kingdom. It seems, therefore, not inappropriate to devote this hour to a consideration of the nature and objects of Botany, its relations to agriculture, and the position it should occupy in the education of farmers. The study of this science, with suitable facilities and a proper regard to its practical applications, cannot fail to add immensely to the material wealth, the intellectual and æsthetic culture, and

*A lecture delivered before the Massachusetts Board of Agriculture, December, 1872.

thus to the happiness and general welfare of the community. Nevertheless many, even of our best-informed people, not only have no appreciation of its power to please or benefit, but actually regard it with prejudice, so vague and erroneous are their ideas concerning it.

Some suppose it treats merely of flowers, and consequently while well enough as a pastime for school-girls, is utterly unworthy the attention of a sensible and industrious man or woman. They have an idea that the sunflower, the poppy, the hollyhock, and such like blossoms, are the loftiest, most intricate and most profitable themes with which the botanist has to do,—which is just as correct as to suppose the science of anthropology to consist in the study of hats and bonnets. Flowers are, indeed, conspicuous and important parts of plants, where they occur, and well worthy our admiration and study. But a large portion of the species of the vegetable world are flowerless, yet they must be included in botanical science, and we shall find that the knowledge of some of them is of the utmost importance to agriculture.

Others, again, imagine the chief business of the botanist to be the gathering and pressing of specimens which, in their appearance, are calculated to awaken feelings of disgust rather than of pleasure in the breast of the unscientific observer. Dried plants are of much service for purposes of investigation and reference, but their acquisition is by no means the chief end of the science. Many a person has collected an admirable herbarium who was no botanist in any proper sense of the term.

As chemistry originated in alchemy, which was a search for the elixir of life, destined to cure all diseases, so the early botanists were incited to a critical examination of plants by a desire to procure new medicines, and ascribed remedial virtues to every species, even to the most inert. The first work on botany in the English language was entitled, in the antique style, "The Great Herbal whiche giveth parfyct knowledge and understandyng of all manner of Herbes & their gracyous vertues whiche God hathe ordeyned for our prosperous welfare and helth, for they hele and cure all manner of dyseases & seknesses that fall or misfortune to all manner of creatoures of God created, practysed by many expert & wyse masters, as Avicenna, &c., &c., prented by me Peter Traveris, 1516." The title of one printed in London in 1551 is, "A new Herbal wherein the names of herbs in Greke, Latin, Englysh, Dutch, Frenche, and in the Potecaries and Herbaries Latin, with all the properties, degrees, and natural places of the same, gathered and made by William Turner, Physician unto the Duke of Somersettes Grace." Botanic gardens were formerly called physic gardens, and were designed especially for the instruction of physicians, the growth of drugs, and for testing the medicinal properties of new plants. The Roman emperors maintained such a garden on the island of Crete, and Montezuma had one at Mexico at the time of the Spanish conquest. Medical botany, at the present time, is merely an important branch of the applied science, and one very greatly neglected in this country. Botany, however, is something more than the science of roots and herbs.

Another common objection against this study is founded upon the fact that the botanical names of plants are in Latin, and the descriptive terms are largely derived from the ancient languages and must be learned by careful application. If the botanist had no other aim than to acquire the names of the one hundred thousand species of the vegetable kingdom it would be a forbidding and unremunerative task; though it should be remembered that a Latin word is quite as easily retained in memory as an English word that is new. Latin names are, also, much more easily spelled and pronounced than the popular names applied to plants in their native countries, when they have any, but the greater part have none whatever till Latin ones are given them. There are many obvious advantages in botanists of all nations having as they do this one universal language, and the precision of botanical descriptions resulting from an accurate terminology is moreover a source of very great pleasure to the student, and renders botany one of the most useful means of mental discipline. Comparing botanical studies with the classics and mathematics, Professor Lindley says: "These subjects train the memory and the reasoning faculties, but they do not touch the habit of observation." This is of prime importance, and best acquired by the pursuits of the naturalist. Hence Professor Edward Forbes remarks: "The study of an animal or vegetable species is the perfection of observation as far as that species is concerned. The form, the substance, the qualities, the phenomena of existence, the influence of surrounding objects, are all observed with the greatest precision and defined so as to be capable of expression in words. No point affecting that species is left untouched. The study of a group or genus of animals or vegetables is in like manner the perfection of discrimination. All the members of the group are compared in all their parts with each other, the relations which they have in common are all summed up and their differences recorded in every possible point of view. The causes of those relations and differences are carefully inquired into and a survey is taken of the bearings of the whole group to its proximate allies, and, finally, to all equivalent assemblages in organized nature. Who can rise up from such a study and not feel mentally strengthened? The mind in such an exercise must gain in both its anyalytic and synthetic powers."

Another argument of great moment in favor of botanical pursuits arises from the endless number and variety of ojects for investigation everywhere presented to view whereby the attention is awakened and all the powers of the mind kept in a condition of activity. In mathematical and classical studies the lack of interest often entirely hinders progress and tends to beget dullness and inattention. In the training of young men to become intelligent and progressive farmers and gardeners, the value of this kind of mental culture and discipline can hardly be overestimated. The records of worthless experiments which fill our agricultural libraries attest the truth of this assertion, and show that more education is imperatively demanded in this profession.

It has been said that a person might be an excellent botanist without knowing the name of a single species. While this is not literally true, it expresses with great force the fact that the names of plants do not constitute the science of botany. They bear about the same relation to it that a Webster's spelling-book does to English literature. The word botany means a plant, and every plant has once existed in a single cell. All plants are either single cells or aggregations of them, and differ from each other only in the number, form and mode of combination of these their constituent elements. The foundation of our science, therefore, is seen to lie in a knowledge of the vegetable cell and the changes of which it is susceptible. By the aid of the compound microscope we learn that a uni-cellular plant consists of a globule of protoplasm enveloped in a thin membrane of cellulose. This protoplasm is in an albuminous fluid, somewhat like the white of an egg, and usually containing one or more granules floating in it, which are apparently analogous to the yolk. Under the influence of the mysterious force which we call life, this gelatinous fluid exhibits a tendency, under favoring circumstances, to divide and increase in quantity, producing the phenomenon of growth. In the simplest plants this division occurs within the outer envelope, and each portion develops upon itself a new membrane and gradually increases to the usual size of the parent. By this process, the original cell is burst and destroyed, and the same operation continues during the growing period, producing in the aggregate countless numbers of individuals. Most plants, however, consist of a combination of cells, arranged in threads, or thin expansions, or masses of various but definite forms, each species assuming at length, on maturity, its own charácteristic shape and substance.

Ordinary growth, as in the grasses, occurs by the subdivision of cells into two parts by the formation of a partition in the protoplasm, and then each of these parts enlarges to the normal size and becomes a perfect cell. The lower or inner one generally remains stationary, while the upper or outer one again subdivides, and so the process goes on until the plant attains its complete development. This growth may be well nigh imperceptible, as in some of the lichens, which stand for centuries almost unchanged, or it may be amazingly rapid, as in the giant puff-ball, which has been known to form sixty-six millions of cells per minute. Upon reaching a certain degree of maturity, every species is observed to produce and cast off seeds, bulblets, or spores, usually in large numbers, for the continuation of its kind. This may be followed by immediate death and decay, as in the mushroom and century-plant, or, as in most perennials, growth and fruiting may go on together for many years, and the decline of the vital force be gradual. In the simpler forms of vegetation we find great uniformity of structure, even when the individual attains an enormous size, as in the gigantic kelp of Cape Horn, which reaches a length of several hundred feet, but shows no distinction of vegetative organs. If, however, we plant the seed of an apple, and watch its progress from germination to maturity, we notice at once several sets of organs with distinct forms and functions. The young tree has a root which avoids the light and penetrates the soil in all directions where the conditions are suitable. It has a stem of curious construction which rises from the ground, lifting its head high into the air. It is covered with leaves, which are evidently designed to expose the largest possible surface to the sunlight and the atmosphere. After a few years of growth, a portion of its annual crop of buds develop into blossoms, which in time become fruits with seeds.

Thus the chief end of all vegetable life, so far as the plant itself is concerned, seems to be the perpetuation of the species,—the multiplication of itself. But in the wise economy of nature no living thing exists for itself alone, and vegetation is the indispensable forerunner and companion of animal existence. The air we breathe, our food, our clothing, our timber, our fuel, our artificial light, and the mechanical power of our domestic animals, and our steam-engines, are all the more or less direct results of vegetable growth. Now, living beings grow only by the digestion and assimilation of food, and one of the first objects of inquiry for the botanist is, "Upon what, and how do plants feed?" They are seen to flourish as epiphytes without any connection with water or soil; they thrive most luxuriantly in the briny ocean, and they spring out of the earth as if that were the great storehouse of their existence. The careful investigations of modern science have explained these mysteries and taught us what it concerns every botanist and every farmer to know, and what, thanks to Professor Johnson, they may now readily learn, namely, "How Crops Grow," and "How Crops Feed." We are also promised a a volume, by the same learned author, upon "Tillage and Fertilizers," that we may understand how to apply our knowledge to the production of the most profitable crops, as well as how to improve and perpetuate the fertility of our soil.

We have thus alluded to a few facts of Structural and Physiological Botany, to show what an immense and important field of research is opened to the botanist without any regard to the names of plants. Descriptive and Systematic Botany are, however, by no means to be neglected. The human mind naturally associates together similar objects, and separates those which are unlike. The classification of plants is, therefore, a necessity, and greatly facilitates the study and comprehension of the vegetable kingdom. Various systems of classification have been suggested, most of them of a very artificial character and so quite unsatisfactory. Dioscorides, for example, in the first century of our era, names the six hundred species he describes under the following four divisions, viz: Aromatic, Alimentary, Vinous and Medicinal Plants. Linnæus made twenty-four classes, based upon the organs of fructification. This system was remarkably simple and complete, and rendered it very easy for beginners to learn the names of plants, though often associating together those which were very unlike. In more recent times, the so-called natural system has been adopted, the plan of which is to bring together groups of plants which resemble each other, not merely in one particular, but in their general characteristics. Thus we have the *Rosaceæ*, furnishing the queen of flowers and nearly all the fruits of the temperate regions; the *Palmaceæ*, containing the most beautiful and useful trees of the tropics; and the *Graminaceæ*, producing fodder for cattle and most of the bread for the human race. As there are only about one hundred and fifty orders of flowering plants it is not a difficult matter for the student of botany, with proper means, to acquire a correct apprehension of the vegetation of the entire globe, so that wherever he may be he may feel in a certain sense acquainted with the scenery about him. The importance of botanical knowledge to the traveller, or even to the reader of a book of travels, is so obvious that it hardly needs illustration. Darwin says, "As in music the person who understands every note will, if he also possesses a proper taste, more thoroughly enjoy the whole, so he who examines every part of a fine view may also thoroughly comprehend the full and combined effect. Hence a traveller should be a botanist, for in all views plants form the chief embellishment." Humboldt often expresses his admiration of the plant world. In his Cosmos he remarks that, "Although the character of different portions of the earth depends on the combination of external phenomena, as the outlines of mountains, the physiognomy of plants and animals, the azure of the sky, the forms of the clouds and the transparency of the atmosphere, it must still be admitted that the vegetable mantle with which the earth is decked constitutes the main feature of the picture."

The ability of a person to enjoy and improve the constantly changing scenes of travel will be readily seen to depend upon his previous preparation by contrasting the experience of an Agassiz with that of a common sailor upon the same journey. The one is continually under the influence of interesting thoughts and pleasurable emotions, during every waking hour of health, whether on the land or on the sea. New facts rush in upon his already crowded mind incessantly and are forthwith arranged in their appropriate places to serve his great purposes in the various departments of science. The ignorant, unthinking sailor, on the other hand, goes whistling round the world, acquiring but little information and utterly unable to use that. The mental habits and capacities of educated and uneducated men are just as different in every-day life,—on the farm, or at a meeting of the Board of

Agriculture. Other things being equal, he who has the best-trained intellect and the most knowledge will everywhere learn the most and accomplish the most.

The general character of the vegetation in every country depends chiefly upon the nature of the soil and the climate,—that is, upon the amount of heat and cold, moisture and drought, sunshine and cloudiness, and the force of the winds. The least-observant traveller can hardly fail to notice the peculiarities of plant growth in different portions of the world. Even in our own country, we have regions with singular and remarkable vegetation, such as the giant cactus of Arizona, the sagebrush of Nevada, the red-woods of California, the herbaceous carpet of the prairies, and the long-leaved pines of the Carolinas. Whoever has ascended Mount Washington must have been struck by the gradual dwarfing of the forest firs and birches, until at last they rise only a foot or two above the ground, and, before he reaches the summit, disappear altogether. The distribution of plants with relation to latitude, elevation and climate, constitutes a department of our science called Geographical Botany, which is both exceedingly interesting and of much practical importance in agriculture and horticulture. Multitudes of exotic plants are now cultivated under glass in an artificial climate, and the highest success in this branch of culture can only be expected when the natural conditions of each species in its own habitat are thoroughly known and imitated. This knowledge is also invaluable to those who desire to introduce from abroad hardy trees and shrubs, as is well illustrated in the attempt to grow the Patagonian beech in England. Notwithstanding its evident ability to endure the temperature, it was observed everywhere to perish, except in a single locality on the sea-coast, where the air was very moist, as in its native land. Every intelligent cultivator of fruit understands that he must adapt the varieties he would raise to the soil and climate of his locality. Hence the American Pomological Society has prepared with great care catalogues of all kinds of fruit which are specially adapted to the different sections of our extended country. Even in Massachusetts there is a marked difference in the adaptation of varieties to localities. The bouquet of wines and the flavor and perfection of fruits is effected often by very obscure causes, and there is abundant need of well-educated and shrewd observers everywhere in the domain of horticulture. The best wines and the best fruits are always in demand at the highest prices, and only those who can produce such can hope for distinguished success. Even the age of the vine influences in a noticeable manner the quality of the wine,—so that in Burgundy, where there are productive vineyards two hundred years old, it is said the worth of a vineyard, as determined by the value of its product, cannot be known before the end of thirty years from its planting. In the Azores, young orange-trees bear fruit with a thick skin and many seeds, while trees one hundred years old and more, produce a much more valuable fruit with a very thin skin and no seeds. Around London are twelve thousand acres of land devoted to the raising of vegetables, and six thousand acres to the production of fruit; and even in this limited area the quick-witted market gardeners have learned that each locality has its peculiar adaptations, and the principal crop of each is regulated accordingly, so that the main supply of each variety is grown in one particular section. In like manner, the finest damsons in England are said to ripen in Cheshire; and near Paris, one town in a favored site, Montreuil, sends to market remarkably fine peaches, to the exclusion almost of those from other localities. Doubtless many similar instances of special adaptations in raising fruits or vegetables occur in this country. The importance of attending to this subject will not be questioned.

The necessity for the application of botanical knowledge to agriculture is again clearly shown by the recent investigations concerning those microscopic fungi, which are among the most destructive enemies of cultivated plants, and often suddenly blast the hopes of the farmer and gardener. The Report of the Commissioner of Agriculture, for 1871, contains an interesting article on the fungi found on the fruit of the pear, tomato and grape, and the foliage and bark of the peach, the vine and the lilac, with excellent illustrations and many useful suggestions respecting their nature and treatment. The disease called the yellows, which—though unknown in Europe, where more shelter is given to fruit-trees—has almost entirely deprived Massachusetts and the whole of New England of the most delicious of our fruits, appears to be only the result of the growth of a fungus, which our peculiar climate fosters. That careful observation and experiment will devise some means for its suppression, there can be no reasonable doubt. Can we afford to neglect longer the means which are necessary to accomplish this most desirable result, as well as to aid us in preserving from similar destruction, the foliage and beauty of our phloxes, our loniceras and many other ornamental plants?

The "Monthly Report" for October, 1872, contains an illustrated article by Thomas Taylor, microscopist of the Agricultural Department, upon the onion blight and smut, which have proved exceedingly destructive in Essex County, in this State. The loss in a single season upon a four-acre field, belonging to Benjamin P. Ware, Esq., of Swampscott, from which were obtained specimens for examination, was estimated at $2,000. Mr. Taylor regards it probable that the blight and smut are but different forms of the same species, which is very tenacious of life, and develops so fast as to ruin a promising field in three or four days. Mr. Ware states that the common custom of growing onions on the same land for several successive years cannot be safely continued after the appearance of this pest, as the spores will spring up the following year. The conservators of the agricultural interests of the Commonwealth certainly ought to encourage the study of microscopic botany at the State College, and ask for special investigations in regard to the habits and characteristics of so formidable a foe to one of our most profitable crops.

The mildew on the grape has been the cause of much annoyance in this country, while in Europe it has inflicted an annual loss of many million of dollars in the wine districts, where it has raged for many years. In Madeira, where the vine is almost the only source of revenue, it has caused the greatest distress, reducing the people to actual starvation, so that contributions of food have been sent to keep them alive. Showering the infected foliage with dilute solutions of sulphide of calcium, or sulphurous acid, and dusting it with flowers of sulphur, have proved tolerably effectual remedies; but doubtless improvements are to be sought in this direction, and M. Dumas recently proposed, in the French Academy of Sciences, that the government offer a prize of $100,000 for a means of entirely preventing the ravages of this destructive parasite.

In Europe, wheat is often attacked by a disease called pepperbrand, or bunt, which renders the grain disgusting in odor and unfit for food. It has been found by botanists to be caused by a fungus so minute that four million plants may occcupy a single kernel of the grain. A similar disease, called smut and dustbrand, affects oats and barley, often doing great damage. It has been found very useful in preventing the attacks of these fungi to soak the seed-grain, just before sowing, in a solution of sulphate of soda; then to mix the moist grain with caustic lime, by which the plants or their spores are destroyed, if present.

Ergot is the distorted and diseased seed or grain of rye, and sometimes of other grasses, caused by the attacks of a fungus, and is exceedingly poisonous to both men and animals. It is not so likely to occur on well-drained land as on that which is wet.

Rust is a disease attacking grains and grasses, and occasionally other plants, and is found to be caused by the development of minute fungi in the cellular tissue of the floral bract, or chaff, and the leaves. It weakens the plant, and often renders the grain crop worthless. The growth of different fungi seems to depend largely upon the state of the weather,—whether dry, moist, or variable in temperature,—and is therefore difficult to control. Something in addition to what has been suggested may be done against these enemies by a judicious rotation of crops; by the selection of the most suitable varieties of seed; by improved methods of cultivation; or by removing from fields, ditches and hedgerows all those plants which support these injurious fungi, and so perpetuate them.

Another very destructive form of fungus develops in woody fibre, in close, damp places, producing "dry rot." This is so prevalent in some parts of London that wood-work in houses has to be renewed every ten or twelve years. This form of fungus may be checked in its ravages by saturating the wood with some metallic poison, as corrosive sublimate, or chloride of zinc. Fungi likewise often penetrate the wood of fruit and forest trees, beginning where wounds have been made, and gradually causing the death and decay of the entire mass of timber. In many cases, timber apparently sound, cut from dead trees, will be found on examination to be permeated by the mycelium of some fungus which on exposure to air and moisture will develop and destroy its durability. The growth of fungi on fruit which has been bruised or injured by insects, is one of the most common causes of decay. Experiment has shown that a sound apple, innoculated with fungus from a decaying one, may be destroyed in three days, and its tissue filled with the cells of the destroyer. The obvious remedy is extreme care in sorting, handling and storing the fruit.

Time would fail us to recount the damages inflicted upon the husbandman, and so upon the race, by these almost invisible, but innumerable and relentless foes. It must answer our present purpose to state that every plant is subject to their attacks, and that their presence even is often unsuspected, as in the case of the potato rot, the cause of which was everywhere sought in vain for many years, until at last Mr. Berkeley, the celebrated botanist of the Royal Horticultural Society in London, demonstrated that a microscopic fungus was the undoubted source of the terrible evil. "Where the carcass is, there the eagles are gathered together," and it has been discovered that the potato plant, weakened by the assault of its principal enemy, is subsequently attacked by no less than ten different fungi. More than thirty species are parasitic upon the grasses, which are infested by them, wherever cultivated, the sorghum and cane of the tropics, as well as the oats and barley of the North. The coffee-tree, the orange, the olive, and the mulberry suffer under the attacks of various blights, which, obstructing the cells and stomata of the foliage, induce disease and the failure of the looked-for crop. Even the silkworm has become the victim of a fungus, to eradicate which millions of dollars have been sent to Japan and China for the purchase of healthy eggs, which are annually imported into Southern Europe. Thus the knowledge of the origin of the disease has led to the finding of a remedy, without which one of the great industries of France and Italy must have perished. Still more impressive is the fact that epidemic and contagious diseases among men and animals are usually accompanied by the growth of microscopic fungi on or within the bodies diseased, which are often the cause of great discomfort, and sometimes of death.

The argument in favor of botanical studies might be still further strengthened by allusion to the useful qualities of some of the larger species of fungus. The chemical composition of these remarkable plants is very peculiar, and resembles that of animal fibre. Though the majority of them are exceedingly poisonous, yet more than one hundred species are used for food. The savages of Tierra del Fuego and New Zealand rely upon them as staple articles of diet, and in all parts of Europe they are regarded as delicious luxuries. In London, dried truffles are worth five dollars per pound, and other edible fungi are sold at high prices; and the demand generally exceeds the supply. In Paris, also, immense sums are expended for them, and, in 1867, there was one cultivator of common mushrooms who had twenty-one miles of beds, twenty inches in width, devoted to this crop in the subterranean passages of the catacombs beneath the city. It is evident, therefore, that a large amount of excellent food is annually wasted in our fields and forests from the ignorance of our people, who are unable to distinguish the edible from the poisonous species, and consequently avoid them all. Many of these might be gathered and eaten, or sold in the city markets, and many more might be profitably raised by our gardeners. Even the microscopic fungi are sometimes useful. The mould, which epicures often plant in their cheeses to impart a desired flavor, the yeast-plant, which is inseparably associated with the important process of fermentation, and the vinegar plant, are examples of fungi which are beneficial in consequence of their power of producing chemical changes. Without their aid we should have only soda or unleavened bread, and neither alcohol nor acetic acid, except at great expense.

Turning now from the least among plants to the greatest, and gratifying thus our natural fondness for antithesis, let us for a moment consider the importance of botanical studies in their relations to forestry, or the care, cultivation and the utilization of trees for shade, shelter, ornament or timber. Much discussion upon this subject has occurred of late with special reference to the preservation of forests on our public domain, and the planting of useful species on the treeless prairies and plains of the West. Many millions of valuable forest trees have been planted during the past few years, and enthusiasm on this subject has attained such force in Nebraska that the legislature has set apart a special day to be annually devoted to this business. While from the nature of our government, it seems impossible to accomplish much toward the permanent preservation, or the renewal of our forests by legislation, great good will result from the agitation of these topics by the enlightenment of the people. Very few are fully aware of the beneficial influence of growing woods upon the soil, the streams, the climate, the crops and the salubrity of the atmosphere. The planting, pruning and proper harvesting of a wood crop are not deemed matters of sufficient utility to be considered by our land-owners. Large areas of stony, bleak and barren soil exist in our own Commonwealth, which to-day would be covered with a luxuriant growth of wood, except for the pernicious habit of burning over recently cleared lands for the sake of one poor crop of rye or a few years of scanty pasturage. While the inventions of modern times have provided innumerable substitutes for the wood which two centuries ago seemed so indispensable for fuel, house and ship building, and a thousands uses in the arts, it is still an indisputable fact that every country, to be the comfortable abode of civilized man, must have no inconsiderable portion of its surface covered with living trees. Wherever wealth is amassed and luxuries are sought, the planting of trees for ornament and shade, as well as for fruit, will be largely practised. The millions recently expended upon the Central Park of New York and Prospect Park in Brooklyn, are indications of this tendency in the United States. But in Europe, and especially in England, where the law of entail exists, and untold revenues are hereditary from generation to generation, the royal palaces and the mansions of the nobility are environed by the most magnificent gardens, parks and forests which the art of man can create. Henry Ward Beecher is reported to have said that he never had any suitable appreciation of the power of the Almighty, as exhibited in creation, until he undertook to level a small hill. Those who have attempted grading for ornamental purposes will agree that landscape gardening is one of the most expensive luxuries, and where immediate effect is to be produced by planting large trees, the cost is enormous. This is clearly demonstrated in Paris, where one hundred thousand shade-trees are maintained by the government at an annual expenditure of three hundred thousand dollars. These trees have to be reset on an average every twelve years, and the expense of the larger ones is from twenty dollars to twenty-five dollars each.

In Europe, all the principal agricultural schools teach the whole art of forestry with great thoroughness, and the utmost care is everywhere bestowed upon the planting, keeping and cutting of timber. As a large proportion of the forests belong either to the government or to wealthy nobles, it is comparatively easy to apply there the most perfect system which science and experience have hitherto been able to devise. In Massachusetts, we can only hope, by the thorough education of our college graduates, by frequent discussions, with the powerful aid of the agricultural press, and by the example of a few intelligent leaders, to introduce rational improvements into this department of our agriculture.

Here again botanical knowledge will prove of very great service. That no one is qualified to engage intelligently in tree culture without an acquaintance with Structural and Pysiological Botany is self-evident; but familiarity with Descriptive and Geographical Botany is hardly less essential. This is admirably illustrated by the introduction of the Australian *Eucalyptus globu-*

lus, or blue gum, into cultivation. It was first planted in France in 1856, and so rapid is its growth, that plantations of this species are estimated to produce five times as much valuable wood in the same period as an equal area of native timber. The forests of France are now valued at eight hundred million dollars. To increase the annual product fivefold is therefore a matter of some consequence. Hon. Marshall P. Wilder informs us that he saw specimens of blue gum in California which, at the age of six years from the seed, had attained the height of fifty feet. This tree has a surprising power of absorbing and exhaling moisture, and of destroying malarious exhalations from swampy and unhealthy regions. It also imparts to the air a salubrious, balsamic odor. It has been affirmed by good medical authority that the general planting of this species in the malarial districts of Southern Europe would be followed by the speedy restoration of the people to health, vigor and enterprise.

Nothing but experiment, continued for many years, can teach us what trees are best adapted for planting in New England. The ailanthus, which grows here more rapidly while young than any other hardy deciduous tree, and the European larch, which has been so successfully grown in Scotland by the Duke of Athol and others, are among the most promising of foreign species. It is, however, quite probable that Japan or China, whose vegetation seems peculiarly suited to our climate, may furnish some other more valuable kinds as yet undiscovered or untried. But we have one among our numerous native trees which ought to be planted abundantly wherever it will thrive and does not already exist in quantity. The sugar maple may be raised from seed and transplanted almost as readily as a Swedish turnip, and in a tolerable soil grows with rapidity. Its timber is very highly prized in the arts, and the wood of its branches is most excellent fuel. No tree is more vigorous or symmetrical in form, and none suffers less from the attacks of insects. Its foliage is clean and beautiful in summer, and as the season advances it assumes the most gorgeous tints of yellow, orange and scarlet. The sap, which flows freely from incisions or borings in early spring, yields a large amount of sugar, identical in its chemical composition with that of the cane, the beet and the palm, while its peculiar flavor is far more agreeable. Trees thirty years old will furnish one pound of sugar per annum, and larger ones more, according to their size, —the greatest well-authenticated product from a single tree in one season being about thirty pounds. What more certain or sensible way of benefitting the public and improving an estate can there be than to plant a few hundred or thousand sugar maples?

When we compare the cultivated fields and gardens of Massachusetts with our native flora, we can hardly fail to be impressed with the fact that her natural productions are chiefly rocks, ice and timber. Not a plant grows wild within her limits which is capable, even if cultivated, of furnishing any considerable amount of food, so that only a few wandering savages could subsist within her borders, except for the plants which have been introduced from other regions. Our cereals, vegetables, fruits and flowers, and our principal fodder crops, are almost every one exotics, while the great mass of our staple productions remains the same from year to year; yet every intelligent person knows that new species and varieties of useful and ornamental plants are being constantly brought into notice and cultivation. With the exception of a few varieties, like the Concord grape, originated here, this work has hitherto been done for us mainly by botanists and horticulturists under the patronage of European governments and societies, many of whom maintain constantly both experimental gardeners at home and intelligent collectors searching for desirable rarities in various parts of the world. There are also a few enterprising dealers in plants who now employ travelling botanists, whose discoveries enable them to bring out novelties to attract attention of the public to their establishments and to keep up the interest in floricultural pursuits among their amateur customers. Extraordinary facilities for this work have been enjoyed in England, in consequence of the great number of her colonies in all quarters of the globe, and the general attention given to such matters in a country so abounding in persons of wealth and culture. David Douglas, a botanist in the service of the Royal Horticultural Society, sent to England more than fifty new hardy trees and shrubs, and one hundred and fifty new herbaceous plants, from our Pacific coast. He was finally killed by a wild bull while collecting at the Sandwich Islands, being then only thirty-six years of age. It is worthy of mention that more than half the botanical collectors who have been sent abroad during the present century have fallen in the field through sickness, accident or violence. The amount of valuable labor performed by some of the gentlemen who have gone from Europe to act as superintendents of botanic gardens in India and elsewhere is almost incredible. Dr. Wallich, at Calcutta, forwarded to two thousand one hundred applicants, in different parts of the world, one hundred and ninety thousand living plants in the short period of five years. Baron von Müller, at the present time director of the botanic garden at Melbourne, Australia, has also been indefatigable in discovering and distributing new plants, as well as in introducing foreign species which seemed likely to prove of service to the agricultural and horticultural interests of that peculiar country. Among other things, he has recommended the planting there of the cranberry, the blueberry and the huckleberry in swamps and wilds which now produce no useful fruit or root. He has also begun the culture of the tea shrub, and has lately announced the invention of a machine for curing the leaves by steam, with which two men can do the work now requiring the aid of twenty-five Chinamen. Is it not time for Americans to begin to do their share in the great work of introducing new and valuable plants into cultivation?

[The speaker then goes on to show what has been done at the Massachusetts Agricultural College in this department;* including the erection of a fine plant-house, (the gift of Dr. Durfee) requiring, however, an expenditure of $25,000 to complete the original design; the commencement of a fund, the income of which shall be devoted to the purchase of books, drawings, apparatus and specimens, etc., and after detailing other wants, concludes as follows:]

The only remaining item, then, to be mentioned as indispensable to the successful organization and working of the botanical department of the College, is a fund of fifty thousand dollars, the income of which may serve as the active capital of the establishment. This would be used principally to pay for the labor of students in performing the various operations in the gardens and plant-houses, and so would do double service in the cause of education. The money thus expended would enable indigent students to earn something toward their support, would encourage habits of industry and self-reliance, and render it possible to keep the grounds and buildings in good condition without any draft upon the general treasury. Begun in the manner suggested, and

* It is pertinent to add here that nothing as yet has been attempted in this department at the Maine State College of Agriculture and Mechanic Arts, the struggles thus far having been for existence. The want should be supplied at the earliest possible moment.

carried forward wisely for a few years under an enthusiastic, intelligent and indefatigable director, the entire project would so commend itself to the public that abundant means would be furnished for needed improvements, while the annual income from sales would steadily increase with the increase of stock and reputation.

Many other subjects, which might legitimately be considered in this discussion, did time allow, must be entirely omitted, or receive but a passing notice. For instance, the great pecuniary value of even the slightest real advance in agriculture or horticulture, in consequence of the enormous aggregate value of their products, is worthy of notice. Thus an increase of only one per cent. in the wheat crop of the United States would amount to 2,877,456 bushels. There can be no question that in many ways this might be brought about. The use of the best variety of seed often does much more than this in all crops. Hence the importance of experimental grounds for testing varieties of plants and modes of culture.

Again, the introduction of new fruits or crops often results in untold good to a country. Thus the sugar-beet in France and Germany has wonderfully improved the whole system of farming, and vastly increased the wealth of these nations. In like manner the fig, the orange and the olive are valuable acquisitions to California. In 1839, a missionary transported from the splendid garden of the Duke of Devonshire to the Navigator's Islands a single banana plant, which increased rapidly, and now the people are abundantly supplied with this agreeable and most nutritious fruit. We might profitably consider the desirableness to the farmer of an acquaintance with the origin and characteristics of the weeds he would exterminate and the crops he would produce; the importance of knowing what each cultivated plant takes from the soil and what it requires for its best development; and the necessity of understanding the relative value of the different grasses and other kinds of fodder for his special purposes.

The exceeding value of botanical knowledge to those who attempt the cultivation of ornamental plants, either indoors or out, both in enabling them to select the best species for their peculiar circumstances, and to obtain desired results, might easily be made evident. There is now an immense waste of money, labor and love in consequence of misdirected effort in floriculture. The pleasures and profits to be derived from the intelligent cultivation of good vegetables, fruits and flowers, for the farmer's family especially, and the consequent importance of educating the students at the College as thoroughly as possible in these matters, might be enlarged upon with great propriety.

Finally, a description of some of the famous gardens of Europe, such as those at London, Paris and Berlin, would be very entertaining, and show what may be accomplished in this direction with ample means and talent of the first order, while it would also demonstrate the comparative moderation and economy of the plan now proposed for adoption.

Thus the council having in charge the *Jardin des Plantes* have recently recommended the erection of conservatories, to cost four hundred thousand dollars, to replace those destroyed in the late siege. The magnificent palm-house at Kew is built of iron and glass, and is three hundred and sixty-two feet long, and the main portion is one hundred feet wide and sixty-six feet high, with a gallery thirty feet in height, from which the visitor may look down upon a most superb variety of tropical vegetation. These gardens now contain the largest and best arranged collection of living plants in the world, as well as the most complete herbarium and botanical museum. Nothing could show the utility of such institutions more conclusively than the history of Kew Gardens during the past thirty years. The estimation in which they are held by the public is shown by the fact that they were visited in 1871 by five hundred and seventy-seven thousand persons. While many expensive features of these large gardens near the great capitals of Europe are neither possible nor desirable at Amherst, yet the facilities which have been enumerated for the study of Botany in its various departments and applications are absolutely essential, if the State College for farmers is to maintain a high position as a school of science and to be eminently efficient in the advancement of agriculture and horticulture. The appropriate work to be executed there is grand enough to satisfy the ambition of the most gifted botanist, or the most wealthy and liberal patron of learning. As the field is all ready for occupation, and trees grow while men sleep, it is fervently to be hoped the planting may speedily begin.

The possible and unforeseen advantages to be derived from cultivating together representative forms of vegetation from different countries, and so imparting to beholders some conception of the variety and magnificence of the flowers and foliage with which the Creator has adorned the earth, are beautifully shown by an incident in the life of the renowned author of "Cosmos." He informs us that "the sight of a colossal dragon tree and a fan palm in an old tower of the botanic garden at Berlin, implanted in his mind the seeds of an irresistible desire to undertake distant travels." The volumes containing the results of his journeys in Europe, Asia and America, are justly regarded as among the most learned and philosopical treatises which the world has ever seen. They have been translated into all the principal languages of civilized nations, and must in ages to come be a perennial source of instruction and pleasure to every scientific lover of Nature. Who can say that some American youth might not be inspired by the scenes in a Massachusetts garden to enter, like Alexander von Humboldt, upon a glorious career of usefulness?

In conclusion, permit me to mention a circumstance in my own personal history in further illustration of the most important principle that all faithful and worthy study of pure science, without regard to its immediate application in the arts, will inevitably result sooner or later in some substantial good. More than twenty years ago I went to Eupope to qualify myself to become a practical geologist, and spending a few weeks in London, I visited the Kew Gardens. Here I beheld, with wonder and delight, the first specimen ever cultivated of the Victoria regia, the grandest plant in both leaf and blossom ever seen in the temperate zone. In this imposing presence the resolution was formed to create, if possible, a botanic garden in the United States, and reproduce there this superb water-lily. The consequence was that my plan of operations was changed, so that instead of seeking my fortune in the mining regions of the far West, I became in due time a teacher at Amherst. My connection with the Agricultural College resulted directly from the opportunity there offered to begin the accomplishment of my botanical purposes; and already my heart's desire to look upon the flowers of the Victoria unfolding their beauty and exhaling their fragrance in my own country has been repeatedly gratified in the Durfee plant-house. Whatever has been or may be achieved at the College through my instrumentality, must therefore be credited to the Royal Botanic Gardens at Kew.

The season of 1872 presented a wider contrast to the one immediately preceding it than has been observed in a long series of years. That was marked by drought of great severity, so that all crops suffered, and especially the grasses; the roots of which, in many parts of the State, seemed to be well nigh deprived of vitality. Added to this were myriads of grass-hoppers which, in some sections, completed the work of destruction, not merely for the grass, but also for other vegetation. Had a farmer then been told of the plenty of the succeeding year, he might have been tempted to exclaim, in the words of a sceptic of old, "If the windows of Heaven were opened, might this thing be?" And yet in the ordering of the Divine Providence, and without any miraculous interposition, we have seen grain and grass crops such as no one anticipated, or supposed to be possible, under the circumstances. It is true the latter rains were so frequent and abundant as to prevent harvesting under favorable circumstances; but we have for results, an unusually good yield of spring sown cereals, a potato crop small in amount and inferior in quality, a large and good crop of Indian corn, a fair average of hay, with grazing so much improved that attention is more generally directed, throughout the State, to dairy husbandry than ever before.

That the severe droughts of previous years were of great indirect benefit, no one can reasonably doubt, although how, and exactly by what methods their benefits accrued, it is not easy to define in full and with scientific accuracy. Of the proximate, or remote causes of so great variations in the character of the seasons, we also know but little. Such, however, has been the progress of meteorological science of late, that a reasonable hope is indulged that results of practical utility may be attained, and at no distant day. Few would have believed, ten years ago, that the "probabilities" of approaching weather would be daily forecast with the accuracy which we now find to be the case. Related phenomena are highly suggestive of how much remains to be learned in respect to the climatic conditions upon which the welfare of plants depend; for instance, at some period between the fall of 1871 and the spring of 1872, some of our indigenous trees and plants, usually considered perfectly hardy, like the hemlock and the arbor vitæ or white cedar, suffered beyond anything known in the memory of the oldest inhabitant; nor was this injury confined to Maine, but extended over a wide area southward and westward; nor to evergreens only, but included some deciduous trees and shrubs which usually pass the winter here without harm. On the contrary, we found that some others, which rarely pass an average winter without serious injury, suffered less than usual. Among these may be named the flowering quince, the Forsythia, Weigela and laburnun; and very notable instances were furnished in the fruit-bearing quince and the peach, both of which, in many cases, and in near proximity to the usually hardy evergreens above named which showed destructive action by their reddened foliage, blossomed with rare profusion, and bore unwonted burdens of fruit.

A broad field here opens to our view for critical observations, and for scientific deductions to be drawn from them, whenever accumulated in sufficient numbers, gathered with sufficient care, and covering a sufficient length of time. It is one which we trust may be successfully cultivated, and it is especially commended to our young farmers and the graduates of our Industrial Colleges.

The year past has also been remarkable for the sudden appearance and extensive prevalence of a disease among horses, in many respects resembling ordinary influenza, yet differing from it by reason of some peculiar features. It was first heard of near Toronto in Canada, whence it spread with rapid yet capricious progress eastward to the Atlantic over the Middle and Northern States, and with slower speed Southward and Westward. Fortunately it was not extensively fatal, but generally presented itself in a mild type, and required for its successful treatment careful and judicious nursing and the free use of disinfectants, rather than a high degree of veterinary skill.

Although compartively few animals died, all classes of people, all industries and all branches of business dependent upon the services of this useful beast were seriously embarrassed; and both the direct and indirect losses were far from trivial. Regarding the causes of its origin, of its spread, of its assuming the epizoötic form, of its wonderfully rapid progress in some directions and slow progress in others, and of the unusual *sequelæ* which sometimes followed it, we can state almost nothing with certainty. Regarding two of its lessons there can be no mistake; first, in respect to our dependence upon this useful and valuable animal for many of accustomed comforts of civilized life; and second, that viewed from a merely pecuniary standpoint, from the lowest and least worthy considerations equally as in respect to higher motives, it is good policy to treat the horse kindly and well; that it is quite as profitable to attend to his wants and his comforts as to exact service from him, and that abuse and neglect are equally extravagant and wicked. The same lesson is a pertinent one in respect to all animals which man has taken from the conditions of nature and subjected to those of domestication. If there be one where penalty for disobedience uniformly comes quicker and pecuniarily heavier than in others it is the milch cow.

Three years ago the attention of the legislature was directed to the need of a revision of the statutes granting bounty to agricultural societies. At the time of its first enactment the present statute met the necessary requirements in a more satisfactory manner than in some cases which have arisen since. One of the instances named in my remarks above referred to, in the Report for 1869, was afterward met by a special act for the purpose, but although undoubtedly not so intended, that act, while providing for the emergency, rather increased the chronic inequality of division and distribution before existing, and which was a well grounded source of complaint. The other case then referred to as one not anticipated when the law was made, and where the spirit and evident intent of the law point to a method of division very different in results from the one indicated by its letter, remains to-day as it did then ; and practice by the Executive Council has been part of the time one way and part of the time in the opposite way. Had an attempt at revision been made with the care and scrutiny which its importance demanded, other matters would have appeared, equally or more worthy of consideration. One of these would have been an inquiry whether the changes which have taken place in the methods and results of the operations of agricultural societies since they were first established did not call for corresponding changes in the methods of extending legislative aid.

At the outset all their methods were directed toward purely legitimate results, such as the bringing together for comparison and instruction as well as for competition, the different classes of domestic animals, farm products and household manufactures, and others equally unobjectionable in their character and effects. Exceedingly useful instruction was thus imparted to large numbers which otherwise would have been exceedingly difficult of attainment in consequence of the isolated character of the labors of individual farmers, each working mostly apart from others, and within very limited fields of observation. The exhibitions of these societies were also held successively in different places, and thus each year the attendance included a greater or smaller number of those who had previously been unable to attend. In this way a widening as well as an increasing interest was awakened in agricultural improvements.

By slow degrees, however, a change took place. One and then another, until at length the majority of these societies "located ;" that is to say, they obtained possession of enclosed grounds, sometimes provided with buildings, and usually or uniformly with a trotting course for trials of speed with horses. It was found that by exacting a fee for admission to these trials of speed, more money could be raised and more easily, for the payment of premiums and for the incidental expenses attending the exhibitions, than could be done by assessments, or by fees for membership in the society. Consequently, for some years current opinions ran strongly in favor of locating, and little or no ill effects were anticipated from so doing. But before very long it was plainly apparent that these trotting matches were absorbing more than their proper share of attention, and were detracting in equal measure from the interest previously manifested in objects of unquestioned utility.

Some of the societies have resisted this encroachment by steadily defeating all attempts to obtain trotting courses within enclosed grounds, and these, for the most part, have successfully pursued the even tenor of former aims and methods; and these are, so far as I am able to judge, at the present time accomplishing more toward the proper ends in view than are those which continue to make the trotting match a prominent feature of their exhibitions. The latter suffer, not only from the inevitable diversion from strictly agricultural objects, but in larger measure than do the others, from the withdrawal or loss of interest on the part of substantial, intelligent, influential farmers who dislike the prevailing modes of management. They also suffer as before alluded to, since by confining their exhibitions to one spot, only those within a narrow circle become interested in, or are profited by their efforts.

Earnest and protracted discussions have been frequent among the friends of agriculture as to the proper solution of this troublesome problem. Difficulties appear in every direction. On the one hand it is claimed that the rearing of horses is as legitimate a branch of farm husbandry as the rearing of oxen; and that, inasmuch as speed constitutes an important element of money value in the horse, the man who raises a good horse is as fairly entitled to an opportunity to show his excellence in that respect, as the grower of sheep is to exhibit the superiority of flesh or of fleece which constitutes the principal element of money value in his flock. This nobody can deny. Yet it does not follow that anything and everything proper and right, abstractly considered, may be properly practiced under all circumstances; for there is no good thing which may not be misused as well as put to proper use. It is admitted on all sides that in the hands of the chemist and the physician alcohol may serve useful purposes. Yet its misuse and abuse have been so frequent that in many communities restrictions are placed on its sale, and Maine is as fully committed to this policy as any part of the world.

In respect to the "trials of speed," it may be remarked that the proposition to note with care and precision the exact length of time occupied by each horse in trotting over the course *successively*, one after another, has never met with any favor, and this seems to indicate that excitement rather than simple competition forms a principal attraction of the trotting course.

It is also worthy of note that when exhibitions have been got up expressly and solely for trotting matches, with no aid from the State, and with no pretence of agriculture attaching to them, they have been usually as successful, pecuniarily or otherwise, as have been exhibitions partly equestrian and partly agricultural, got up by incorporated agricultural societies receiving State aid.

The statute provides that, (within stated limitations and upon certain conditions,) Agricultural Societies may receive from the State Treasury as much as is raised and expended for premiums; or where there are more than one in a county, a maximum amount is to be apportioned among them, in proportion to the sums severally raised and expended by each, but no condition attaches in respect to the methods by which the money is raised, nor for what objects or purposes premiums are awarded, except that they be for "the improvement and encouragement of agriculture, horticulture or the mechanic arts," or for such specific purposes as may be prescribed by the Board of Agriculture. To see how the law works in practice we will look at two cases which present a wide variation in the methods adopted "for the improvement and encouragement of agriculture, horticulture and the mechanic arts." According to the returns received at this office, one Society awarded the sum of $119.00 on neat stock, $29.00 on stallions and breeding mares, $45.00 on other horses and colts, $36.00 on sheep, poultry and swine, $68.00 on grains, roots and vegetables, and upwards of $140.00 on other objects including dairy products, fruits, agricultural implements, household manufactures and miscellaneous objects; or a total of $441 with nothing at all for trials of speed. Another Society reports $7 awarded on neat stock, $2 on roots, nothing on grains or other cultivated crops, nothing for dairy products, fruits, implements or manufactures, nothing for sheep or swine or poultry, nothing for stallions or breeding mares, $45.00 for other horses and colts, and $205.00 on trials of speed. Total amount awarded $261.00. The Secretary in his report remarks that, "There seems to be a fatality attending the days set for our exhibitions, as we have been for three years past completely inundated, and last fall especially, it rained in torrents, and we were obliged to give up our fair, which accounts for the absence in my report of grains, roots and other crops, &c., &c." But it seems, also, that the weather did not compel the giving up of trials of speed, nor awards of premiums on horses not used for improvement of breeds. The trials of speed command attention even uuder difficulties.

State Industrial College.

A very hopeful indication of good it is that the "State College of Agriculture and the Mechanic Arts" is rapidly coming to be better understood by our people generally, both as to its intrinsic character and with respect to its true aims and the methods used to attain its ends. This is sufficiently indicated by the fact that the last class entering it was much larger than any previous one, together with the prospect that its means of providing for students will shortly prove inadequate to the demand.

Very unfortunate has it proved that the popular misnomer, "Agricultural College," has become so strongly attached to the class of institutions provided for by the act of Congress of 1862; partly because the act itself says not a word about colleges for teaching agriculture, nor for teaching any other specific art or science; and more because the name popularly given has caused a great deal of misapprehension in regard to its objects, as well as greatly exaggerated and unfounded expectations of immediate and direct results to ensue for the benefit of agriculture by reason of these colleges.

The facts of the case, as I understand them, are simply these: Congress, by the act referred to, endowed a new class of institutions, differing in essential particulars from those before existing. Their special function and mission was *to bestow a liberal and practical education upon the industrial classes.* That is a work never attempted before. And how and by what methods was the work to be done?—Simply thus, *by employing the natural and physical sciences for the purposes of discipline, development and culture,* as well as for instruction.

There were plenty of colleges before, probably more in number than were actually needed, where a liberal education was given, that is to say, they took a comparatively raw, unformed youth, attended to his growth in knowledge, his training and the development of intellectual power, and graduated him a man of culture. But it was a general culture which required supplementing by special preparation for his future profession in life, whatever that might be. Nor was there any great lack of other institutions and opportunities of every grade, where practical and professional instruction could be obtained. The graduate could *afterwards* prepare himself for practicing law, preaching the gospel, healing the sick; for constructing bridges, railroads, ships or cotton mills; for the production of food or the breeding of cattle; for working mines, assaying metals, or for whatever other calling or profession he chose. He could go upon the farm, into workshops, or to professional or scientific schools, at his option. But all this involved large expenditure of both time and money. Only very few, comparatively, could enjoy so costly privileges.

Nor was it formerly thought that any except the preacher, the lawyer, the physician or the learned man of some other or of no particular profession, needed what might fairly be called a liberal education. But we see more clearly now, and understand better what is the true object of education. It is no less than to increase the capacity of happiness and of usefulness. Its object is to enable us to enjoy more and to help others enjoy more; to do more for others and to help others accomplish more for themselves.

All are not able to obtain a liberal education. It has always been, and for a long time it will be the case, that many must enter upon life's hard work with very scanty instruction, and a meagre measure of mental development, but the number of these is every year diminishing; and there are thousands upon thousands who could obtain a liberal and practical education if the time and expense involved were materially reduced from the cost hitherto. These have been so great that very few, comparatively, could enjoy the benefits.

It is the special mission and function of the Industrial Colleges to do this; and they propose to do it by the adoption of shorter, cheaper and more direct methods; to cut across lots, as it were. They propose to attempt less by means of classical, historical and philosophical studies than the old colleges do, and to employ the natural and physical sciences to a large extent and *for the purposes of discipline, development and culture as well as for instruction.* And it is believed that the true end and aim of education can be thus reached as well as by the former method.

It is not claimed that the pupils in this way will learn as much of Latin and French and philosophy or of some other things very good and very useful in their place, as they might if they traveled the old, time-honored road through classic shades and over Parnassian heights, but where scores could afford the time and the means for the one, hundreds or thousands can enjoy the benefits of the other. The new education is therefore a truly democratic, thoroughly young American movement *for levelling up the industrial classes to a plane which was formerly unattainable by them.*

The ten years which have passed since 1862 have demonstrated some points with regard to those institutions beyond all peradventure. In the first place, it is shown that they are capable of accomplishing and are actually doing a good, a great and a much needed work; next, that they trench upon the sphere of no other colleges; and lastly, that the endowment is greatly inadequate to their present and prospective wants. We cannot think this strange, for at that time very few, if any, realized the magnitude of the work undertaken. An error was also committed in the apportionment, for it was based upon representation in Congress at that time, or in other words, upon the then existing population, without reference to area, or probable future growth. The want of larger means has already been severely felt by the institutions in many of the States, and by none more than by our own, and efforts have not been wanting to have them increased.

A bill is now pending in Congress to devote one-half the proceeds of the sales of public lands to the creation of a fund, the principal of which is to be held by the United States, which shall gradually accumulate until its income reaches fifty thousand dollars annually for each State. It would probably require a long time for this amount to be fully reached, but a good degree of relief would speedily follow its passage, and the income would annually increase, with the growth of the institutions, until it became sufficient to accomplish a work, the real, substantial utility and blessing of which to the whole people, it is beyond the power of language adequately to set forth.

S. L. GOODALE,
Secretary Board of Agriculture.

JANUARY, 1873.

APPENDIX.

COMPILED FROM RETURNS OF AGRICULTURAL SOCIETIES,

For the year ending first Wednesday in December, 1872.

SOCIETIES.	Amount received from State.	Am't raised by Society.	Total am't awarded on premiums.	Am't of premiums on farm improvements offered.	Am't expended for Farmers' Clubs, lectures, &c.	Incidental expenses for the year.	Whole am't of disbursements for year.	Am't awarded for manures & experiments with them.	Plowing at exhibitions.	Bulls and bull calves.	Working oxen 4-years old and over.	Steers under 4-yrs old.	Milch cows.	Heifers and heifer calves.	Fat cattle.
Androscoggin	$358 76	$385 45	$497 75	$80 00	$39 56	......	......	......	......	$4 00	$53 00	$38 50	......	$22 50	......
Aroostook	187 14	186 50	224 50	65 00	52 00	$32 54	$374 04	......	......	17 50	9 00	9 50	$10 00	7 50	......
North Aroostook	108 65	100 00	27 50	25 00	30 00	47 25	104 75	......	......	......	......	......	......	......	......
Cumberland	267 67	416 92	380 75	......	50 00	139 00	......	......	$9 00	33 00	19 00	11 00	......	28 00	$9 00
Franklin	133 80	620 62	564 30	35 00	34 00	346 46	871 76	......	......	15 50	84 00	65 25	15 00	16 00	14 50
North Franklin	53 66	174 94	109 42	15 00	14 00	24 60	96 52	......	......	5 00	23 75	13 52	3 50	4 30	2 50
Hancock	336 00	392 00	346 00	91 00	84 00	150 00	496 00	......	......	......	......	......	......	......	......
Kennebec	80 00	411 20	323 25	20 00	20 00	193 75	527 00	......	......	27 00	20 00	13 00	20 00	35 00	7 50
North Kennebec	125 86	367 10	470 50	......	32 00	120 22	622 72	......	......	35 00	38 00	19 00	34 00	31 00	11 00
East Kennebec	187 00	502 00	869 60	35 00	45 00	200 00	1,069 00	......	......	18 00	72 00	16 00	20 00	19 25	10 00
Knox	179 50	282 20	215 75	50 00	50 00	239 61	......	......	......	8 00	5 00	5 00	8 00	4 00	4 00
North Knox	128 46	......	294 50	32 00	32 00	346 27	640 77	......	......	16 00	15 00	12 00	5 00	11 50	8 00
Lincoln	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

Oxford	145 76	741 25	684 92	45 00	38 50	376 45	1,321 73	......	5 00	5 00	77 50	26 00	5 00	4 00	8 00
West Oxford	93 24	546 69	362 20	24 00	16 00	240 00	602 23	......	......	5 00	20 00	26 00	3 00	9 00	10 00
East Oxford	95 83	587 00	193 60	22 00	24 00	75 00	712 00	......	......	9 00	35 00	22 00	5 00	4 00	7 00
Penobscot	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
West Penobscot	121 62	966 16	441 05	50 00	5 00	433 33	......	......	......	26 75	9 00	13 00	32 00	32 00	7 00
North Penobscot	......	72 22	125 50	......	......	......	......	......	......	8 00	9 00	6 00	5 00	13 00	......
Penobscot and Aroostook	100 00	125 50	86 75	25 00	25 00	67 50	166 89	......	......	3 75	3 00	4 75	3 00	4 25	......
Piscataquis Central	106 25	......	276 15	25 00	25 00	208 00	......	......	......	17 50	38 00	9 00	10 00	8 50	......
West Piscataquis	38 50	55 50	69 60	10 00	......	40 40	110 00	......	......	5 50	8 00	8 00	1 00	2 00	1 00
Sagadahoc	253 83	......	535 75	65 50	......	796 52	2,313 13	......	......	16 00	32 00	17 25	10 00	9 00	12 00
Somerset Central	150 54	372 55	424 15	......	......	178 91	555 16	......	......	......	......	......	......	......	......
West Somerset	104 64	145 90	369 20	28 00	26 00	34 56	273 00	......	......	21 00	18 00	18 25	15 00	22 00	6 00
East Somerset	90 00	487 19	268 07	22 00	22 00	146 49	538 31	......	......	10 00	27 50	33 75	10 00	11 25	......
Shapleigh and Acton	20 82	282 10	171 25	18 00	......	42 85	214 30	......	2 50	4 00	30 50	8 50	3 50	3 00	4 00
Waldo	143 74	......	261 00	35 00	35 00	307 15	662 78	......	......	5 00	......	2 00	......	......	......
North Waldo	120 63	164 53	224 40	31 00	31 00	19 20	233 65	......	......	15 50	9 00	31 75	6 00	12 75	2 00
Waldo and Penobscot	130 00	429 26	559 26	36 00	33 00	78 60	416 35	......	......	18 00	17 00	6 00	5 00	9 00	......
Washington	247 72	554 72	598 55	64 00	62 00	125 75	1,363 55	......	......	20 00	9 00	22 00	10 00	16 50	15 00
West Washington	152 28	367 81	341 78	40 00	50 00	84 75	476 53	......	......	43 00	24 00	22 00	15 00	11 00	......
York	379 29	$1,091 39	593 78	90 00	90 00	623 24	1,217 02	......	......	......	15 00	35 00	17 00	5 00	......

Compiled from Returns of Agricultural Societies, 1872.

SOCIETIES.	Trials of speed.	Stallions.	Breeding mares.	Other horses and colts.	Swine.	Sheep.	Poultry.	Total offered for live stock.	Total awarded for live stock.	Indian corn.	Wheat.	Rye.	Barley.	Oats.	Buckwheat.	Hay.
Androscoggin	158 00	$8 00	$4 00	$30 00	$8 00	$8 00	$6 00	$239 00	$172 00	......	$8 00	$3 00	......	$2 00	1 00	....
Aroostook	$	13 00	12 00	43 50	19 00	11 00	2 50	186 00	154 50	$1 50	1 00	......	......	75	$	....
North Aroostook	......	......	......	......	......	......	......	60 00	....	3 75	4 00	3 00	$2 00	4 75	2 00	....
Cumberland	......	23 00	35 00	25 00	......	13 00	6 00	317 00	211 00	10 00	13 00	......	......	......	....	....
Franklin	130 00	16 50	5 00	23 25	4 00	13 00	17 00	495 50	421 75	5 65	5 00	......	......	1 00	....	....
North Franklin	1 75	2 50	1 75	7 40	......	8 00	75	96 65	75 72	75	......	.....	......	......	....	....
Hancock	115 00	4 00	......	3 00	......	5 00	8 00	48 00	30 00	......	......	......	......	......	....	....
Kennebec	20 00	7 00	6 00	18 75	9 00	20 00	6 00	213 25	207 00	9 00	12 00	......	......	......	....	....
North Kennebec	85 00	15 00	8 00	21 00	9 00	31 00	10 00	472 00	405 00	......	......	......	......	......	....	....
East Kennebec	450 00	11 00	5 00	31 00	......	29 00	1 00	261 25	142 00	......	50 00	......	......	......	0 50	....
Knox	......	......	5 00	12 00	9 00	11 00	12 00	215 00	102 00	4 00	6 00	.....	3 00	......	....	....
North Knox	......	7 00	5 00	51 00	3 00	10 00	2 50	169 00	108 00	9 00	4 00	......	3 00	3 00	....	....
Lincoln	......	......	......	......	......	......	......	....	....	......	......	......	......	......	....	....
Oxford	375 00	15 00	......	18 00	......	11 00	2 00	569 00	578 00	1 00	1 00	......	......	0 25	....	....

West Oxford	63 00	4 00	2 00	13 25	7 00	2 00	2 50	260 50	123 00	11 25	11 25	......	......	......	....	....
East Oxford	25 00	3 00	2 00	10 00	......	......	9 00	116 50	106 00	8 00	5 00	2 00	......	2 00	....	....
Penobscot	......	......	......	......	......	......	......	....	....	......	......	......	......	......	....	....
West Penobscot	......	23 00	6 00	45 00	8 00	21 75	6 75	480 00	230 25	19 70	20 20	......	2 75	3 75	1 50	....
North Penobscot	......	8 00	3 00	22 00	2 75	5 00	50	88 00	82 25	......	......	......	......	......	....	....
Penobscot and Aroostook	......	5 00	3 00	7 25	......	7 00	......	51 25	47 75	2 50	3 00	......	......	......	....	....
Piscataquis Central	85 00	7 00	6 00	19 50	13 00	17 00	6 00	133 50	133 50	3 00	50	......	......	......	....	....
West Piscataquis	......	3 00	3 00	6 00	......	2 50	50	58 00	40 50	1 00	3 00	......	......	1 00	....	....
Sagadahoc	196 00	12 00	6 00	13 00	13 00	15 00	9 00	405 50	227 50	7 75	55 75	1 50	1 50	1 75	1 00	....
Somerset Central	......	......	......	31 75	2 00	22 00	5 25	....	....	......	......	......	......	......	....	....
West Somerset	50 00	9 00	9 00	22 50	7 00	27 50	6 00	413 00	330 15	7 00	......	......	......	......	....	....
East Somerset	80 00	9 00	4 50	20 50	1 00	6 50	......	254 25	229 00	......	......	......	......	......	....	....
Shapleigh and Acton	8 00	3 00	2 00	16 50	3 00	2 00	4 00	114 75	94 50	......	1 25	1 50	1 00	......	....	....
Waldo	205 00	......	......	45 00	......	......	......	....	7 00	......	......	......	......	......	....	....
North Waldo	......	11 00	5 00	20 25	......	12 50	4 25	173 75	128 00	6 00	15 00	3 25	......	1 00	....	....
Waldo and Penobscot	138 00	17 00	6 00	34 00	2 00	8 00	1 00	214 00	123 00	3 00	......	......	2 00	3 00	....	....
Washington	216 00	15 00	14 00	42 00	7 00	15 00	4 50	468 50	406 00	8 50	2 25	......	8 25	8 25	7 25	....
West Washington	72 00	10 00	8 00	17 50	2 50	5 50	3 00	169 00	159 00	1 75	......	......	1 00	1 00	25	....
York	204 00	6 00	13 00	33 00	4 50	5 00	10 00	99 00	72 00	1 00	5 00	......	......	......	....	....

Compiled from Returns of Agricultural Societies, 1872.

SOCIETIES.	Potatoes.	Carrots.	Beets.	Turnips.	Total am't offered for grain and root crops.	Total am't awarded for grain and root crops.	Am't awarded for any other cultivated crops.	Fruits and flowers.	Honey, sugar and syrup.	Butter and cheese.	Agricult'l implements.	Household manufactures & needle work.	Manufactures of wood, iron and leather.	Other mechanical products.	For any object not enumerated above.
Androscoggin	$1 50	$0 50	$0 50	$0 50	$103 00	$17 00	$35 50	$28 75	$5 00	$18 00	......	$16 75	$6 00	......	$30·75
Aroostook	1 25	......	0 75	0 75	40 00	....	8 50	6 75	2 00	7 00	......	19 50	20 25	......	......
North Aroostook	3 00	......	2 00	1 00	44 25	27 50	......	......	......	......	......	....	......	......	2 00
Cumberland	......	......	......	......	99 00	29 00	6 00	26 25	......	25 00	$6 00	29 50	6 00	......	44 00
Franklin	3 25	0 20	0 35	0 45	29 00	15 90	3 30	6 60	0 80	3 50	5 75	18 10	8 00	$6 10	42 25
North Franklin	......	......	0 90	0 50	40 05	2 15	2 90	3 35	1 00	3 75	0 90	16 40	1 00	......	2 25
Hancock	......	......	......	......	25 00	25 00	......	27 00	1 00	7 00	......	13 25	......	7 00	91 00
Kennebec	......	......	2 00	......	54 75	23 00	......	10 25	......	28 00	......	29 50	......	......	25 50
North Kennebec	......	......	......	......	65 00	....	......	13 00	1 00	16 00	......	14 00	......	......	21 50
East Kennebec	0 50	......	......	0 50	27 50	5 60	1 75	......	1 50	9 00	5 50	14 50	......	......	5 00
Knox	2 00	......	1 00	2 00	76 00	20 50	......	20 00	2 00	17 00	4 00	9 00	......	......	45 50
North Knox	5 00	......	0 50	1 50	63 50	26 00	......	19 50	3 00	27 00	6 00	....	......	......	......
Lincoln	......	......	......	......	....	....	......	......	......	......	......	....	......	......	......
Oxford	1 00	......	8 00	......	33 00	3 75	8 00	16 75	1 10	19 00	6 00	19 85	29 00	......	18 72

West Oxford	2 00	0 50	0 50	2 00	53 75	29 50	......	19 00	4 20	17 25	11 50	38 25	19 25	......	......
East Oxford	3 00	......	......	......	20 00	20 00	5 00	6 50	......	7 50	6 00	8 85	5 00	......	3 75
Penobscot	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
West Penobscot	20 20	......	......	......	250 00	68 10	16 40	29 25	3 25	17 25	19 25	29 05	8 75	......	4 50
North Penobscot	0 25	......	0 25	......	......	......	......	2 00	......	15 00	......	15 00	......	......	5 00
Penobscot and Aroostook	1 50	......	......	......	13 50	9 50	2 50	3 75	......	4 00	......	9 75	1 00	......	......
Piscataquis Central	......	......	0 25	0 25	27 00	4 00	2 25	3 25	4 00	18 00	......	31 14	3 00	0 25	......
West Piscataquis	1 00	......	......	......	10 75	6 50	2 25	3 00	1 00	3 50	1 75	7 85	2 00	......	1 25
Sagadahoc	4 50	0 75	1 00	3 75	85 50	79 25	7 00	28 25	3 00	23 00	......	35 00	14 00	......	33 00
Somerset Central	......	0 75	4 25	......	......	......	8 25	......	......	12 00	7 00	3 50	......	......	31 50
West Somerset	......	......	0 75	0 75	36 00	8 50	......	......	......	9 00	......	......	......	......	17 55
East Somerset	......	......	......	......	......	......	......	......	14 50	0 50	......	13 50	1 00	......	9 57
Shapleigh and Acton	1 25	......	1 25	1 25	34 50	28 25	......	7 50	......	4 50	......	26 75	......	......	9 75
Waldo	......	......	1 00	1 00	......	......	......	......	......	......	......	......	......	......	......
North Waldo	6 00	......	1 25	1 25	67 50	40 50	......	8 75	2 25	6 00	9 00	19 00	2 50	......	......
Waldo and Penobscot	3 00	1 50	1 50	1 50	34 00	15 50	6 00	6 00	......	3 00	......	11 00	......	......	19 75
Washington	12 25	2 50	......	10 50	113 25	59 75	32 25	18 75	1 00	13 00	......	39 80	22 00	......	6 00
West Washington	2 50	1 00	1 00	1 00	32 00	17 10	......	15 90	......	9 50	......	22 60	9 00	......	41 78
York	3 00	3 00	2 00	......	71 00	24 00	5 00	31 75	......	12 00	......	74 28	......	......	10 25

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