Public Documents of Maine:

BEING THE

ANNUAL REPORTS

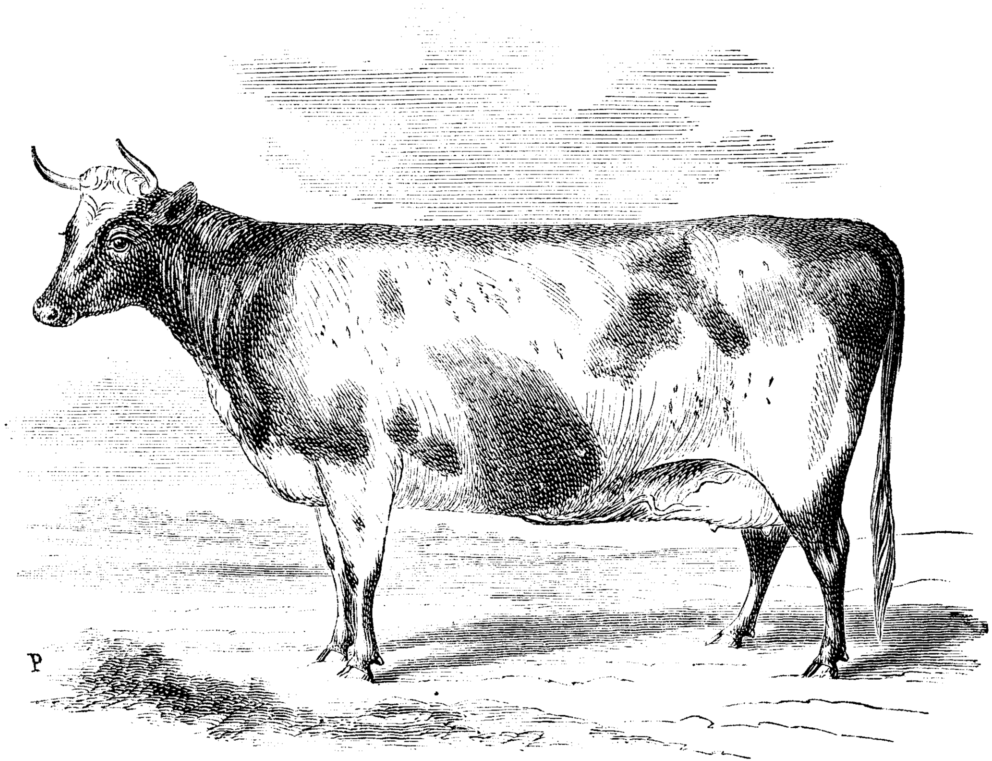
OF THE VARIOUS

PUBLIC OFFICERS AND INSTITUTIONS

FOR THE YEARS

1871-72.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1872.



Ayrshire Cow "DARLING," 337, the property of H. L. Stewart & Son, Middle Haddam, Ct.

SIXTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Maine Board of Agriculture,

FOR THE YEAR

1871.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1872.

BOARD OF AGRICULTURE.

D. H. THING, President.
Z. A. GILBERT, Vice President.
S. L. GOODALE, Secretary.

MEMBERS AT LARGE APPOINTED BY GOVERNOR AND COUNCIL.

Name.	P. O. Address.	Term Expires Dec. 31.
C. E. Hamlin	Waterville	1871
C. F. Brackett	Brunswick	1872
S. F. Peckham	Orono	1872
M. C. Fernald	Orono	1873
George L. Goodale	Brunswick	1873

MEMBER CHOSEN BY THE STATE AGRICULTURAL SOCIETY.

Calvin Chamberlain	Foxcroft	1871

MEMBERS CHOSEN BY COUNTY SOCIETIES.

Name.	County.	P. O. Address.	
Daniel H. Thing	Kennebec	Mt. Vernon	1871
Z. A. Gilbert	Androscoggin	East Turner	1871
G. E. Brackett	Waldo	Belfast	1871
John Bodge	Lincoln	Jefferson	1871
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

REPORT.

To the Senate and House of Representatives:

The winter session of the Board of Agriculture was held in Farmington, January 3d to 6th inclusive. The attendance of farmers was larger than at any previous session, and great interest was manifested in the proceedings. A novel feature of the meeting was a display of fruit, contributed by cultivators in the vicinity, of very superior quality and great beauty, indicating the possession of facilities for its culture inferior to that of no other section of New England.

The first day was devoted to organization, admission of new members, choice of officers, selection of committees and the transaction of other business.

On the second day Hon. Hannibal Belcher of Farmington addressed the Board with words of welcome, as follows:

Mr. President and Gentlemen of the Maine Board of Agriculture—In behalf of Franklin and North Franklin Agricultural Societies, and of the various Farmers' Clubs in this county, I extend to you a hearty, an earnest, and a cordial welcome. We regret that you could not visit our county and look upon our intervales and our hills, our forests and fields at a more favorable season of the year. But we regard ourselves fortunate that you should be able at any time to visit us.

The County of Franklin is almost entirely agricultural. There is but little manufacturing carried on—hardly enough for the supply of our needs. Nor is it a lumbering region. We have placed our dependence almost entirely upon what is raised from the soil. We are here in the latitude of about 44° 40′, longitude about 70° west of Greenwich. The Sandy river, which is a tributary of the Kennebec, extends through nearly the entire length of the county, upon both sides of which are beautiful intervales, equal almost or quite to those in the valley of the Connecticut. This county was settled about eighty years ago, and we have made some progress in agriculture in that time. We do not boast in regard to what we have effected here, neither do we feel much ashamed of it. We know there is yet a great opportunity for improvement.

The situation of the county is such that we never can be to great extent a manufacturing people. We have no great water powers, such as are found upon the Kennebec, the Androscoggin and the Penobscot rivers, and as a matter of necessity we depend mainly upon what can be raised from the soil.

We believe that we are favorably situated for agricultural pursuits. Our soil yields well. The intervales, with proper cultivation, yield every year a very heavy burden of hay, the uplands furnish good grazing, and we have ever found the raising of stock in this county profitable.

Until the extension of the Androscoggin railroad to this town we were dependent upon teams for the transportation of our goods to and from this place. We have derived great benefit from the extension of the road in this county. Everything that the farmer has raised the present year has borne remunerative prices. The situation of our county has been such that up to a recent period we have not exported any great quantities of potatoes, as you have in other counties. We have depended mostly upon our stock, and very little grain has been sent from the county. We have had, as we think, a fair degree of prosperity in the rearing of stock. This region has been quite celebrated for its horses and oxen.

Our people have not devoted themselves much to dairying. I see that in the notice which is given of the meeting here, your distinguished Secretary, who has done so much towards creating an interest in farming operations throughout the State, suggests that this is a suitable region for dairying, and that seems to be the general opinion. When we look upon the map we find that one of the finest dairying sections in New England is about St. Albans, Vermont. That town is very nearly in the same latitude as this. It is well understood that St. Albans does as much as any other town in New England towards establishing the price of dairy products. We see in the market reports of the papers quotations of butter and cheese at St. Albans. I know of no reason why our facilities are not as good, or why we cannot make it as profitable to manufacture butter and cheese as it is made in other places. But our people have as yet paid but little attention to it. There has been no united effort for the production of butter and cheese. There are very few who keep a large number of cows for dairying purposes. I believe that it must eventually prove very remunerative to our people to engage in this business.

One great objection to the business of dairying is, that it involves so much labor and care on the part of the women; but with the introduction of butter and cheese factories this objection would be removed. If our farmers had large numbers of cows, and carried on this business extensively, they might employ men to do the hardest part of the labor, and very much lighten the burdens of their wives and daughters. The prices that dairy products have borne for the last few years indicate with a good degree of certainty that the business will be prosperous in the future, and I believe that it will prove so. What we want in this matter is information; the experience of those who have been engaged largely in the business and have ascertained the most profitable way of raising milch cows, taking care of and feeding them, and the nature of the soil best adapted to dairying, and the methods of manufacturing on a large scale. When we ascertain these things, and it is proved that it may be made remunerative to our people, I think there will be no difficulty in inducing them to engage in it to a considerable extent; and I rejoice to know that some of the most experienced men in the country and who have devoted a great deal of time and attention to this subject are here present, and will give us the benefit of their experience. We want to know how to obtain the best kind of cows. In some instances our native cows have proved to be the best that could be used for this purpose; but there is a serious difficulty—we are not at all certain as to the offspring of those choice native cows. We may be able to raise such as will be as profitable as any that have been reared in any part of the country. I claim that we have in a few instances raised as good cows from our native stock as have ever been known. I believe that the food and climate of this State have contributed to bring out occasionally as good animals as have ever existed. There is one thing that is certain—the Oakes' cow, which was for many years famous in Massachusetts, was reared in Maine. Then there is the Ingalls cow, that was reared about fifteen miles from here, one of the best cows, undoubtedly, of later days; she yielded as much as any cow that has ever been raised in Europe. I say, therefore, that it is possible to rear as good cows here as has ever been raised anywhere.

I claim farther, that our cattle are more free from disease than those in many other dairy regions in the United States. For the last fifty years experience has proved this.

Another thing. It is a well established fact, that the best cattle in the world are raised in as high a latitude as we live in. Perhaps the climate of England may not be as cold as ours, but it is certainly in a higher latitude. The famous Dutch cattle, which have been introduced into this country, are raised in a higher latitude; and the best domestic animals in the world have been reared in climates almost as cold as ours, and certainly in higher latitudes than this.

It is certain that wealth has been acquired in the County of Franklin, and in great measure it has been gained by the rearing of stock. Take for instance the town of Farmington. Most of our farmers own the farms on which they live, unencumbered; and while there are no very rich men here, there are no very poor men. This wealth has been gained in some way. And certainly not by the raising of wheat; not by raising corn; not by raising potatoes and sending them away. It has been by the raising of stock. Now I say, that with the improved breeds that are being constantly introduced into the country, and with the improved implements of husbandry that have been introduced, it is clear that agriculture must be a paying business. I do not believe that there is any section of New England where, taking the whole body of the people together, wealth is so equally distributed as it is in our own little County of Franklin. I have never been in any part of New England where everybody seemed to be so comfortable and thriving, and to take so much interest in the pursuit of agriculture. We are situated very much as the farmers of Vermont are, in that respect, and I am very happy to see a Vermont dairyman here. One great difficulty has been, that we have sent too much capital out of the State. If the money which has been sent into the Western States had been devoted to the improvement of our farms and of our stock, we should be one of the richest counties in New England.

There is another disadvantage. When a farmer attains to the age of fifty or sixty years, he thinks he must sell out and go into some village to live, and invest his money in stocks. Now I hold that every patriot, every friend of the agriculture of the State of Maine, should try to induce our people to invest their means at home; use their money in building our own railroads, instead of sending it away to build railroads in the West. If we do what we can to stimulate enterprise among our people in the direction of providing means of transportation for the products of the farm, in the long run it will be found better for the State, and a great deal better for the individuals who have these means to invest.

Mr. President, the strides that have been made within the past few years in the improvement of agriculture are most remarkable. The improvements that have been made in farming implements, the great interest that has been awakened throughout the State in all agricultural matters, the taste that has been created for rural pursuits, seem to me astonishing. The ablest men we have in the country are turning their attention to questions connected with agriculture. The distinguished Prof. Agassiz does not feel that it is beneath his dignity to engage in this work, and I understand he says that the pleasantest moments of his life are those spent in trying to improve the agriculture of the country. We find, too, that the ablest papers in the nation are now devoting very much of their space to increasing the interest in agricultural matters.

This taste that is growing up in the country in regard to these matters is an augury of good for the future, and I believe the day will come, and it is not far distant, when the agriculture of the State of Maine will be so much improved that the same great results will be realized by the people that are realized in other countries.

Without taking up more of your time, gentlemen, I will say again, that we thank you most cordially and kindly for coming here. We shall listen to the discussions upon the various subjects pertaining to agriculture with great interest; and we believe that the result of your meeting here will be to create a new interest in everything connected with the cultivation of the soil, and to not only increase the wealth but the happiness of the people of our county.

The Chairman. Permit me to say to you, sir, and through you to the citizens of Franklin county, in behalf of this Board, that we cordially and thankfully accept your kind welcome to this beautiful village, and more beautiful valley; and I assure you that it shall be the earnest effort of this Board to make our meeting here as profitable to you as I am satisfied it will be to ourselves. We know, by the generous attendance of the bone and muscle upon our meeting, that something is expected from us. Please remember, gentlemen, that this is a public Farmer's Convention, and it is desired and expected that you will do your part towards making these meetings instructive; for it is by a free mingling and interchange of views among thinking, practical men, and thinking and studying scientific men, that such gatherings yield their highest use.

Col. William Swett read the following on the

MANAGEMENT OF DAIRY COWS.

The subject assigned me is so wide that my remarks must be general, and touch briefly on a few of the most important points. In the first place, we must have good cows to start with; poor ones yield no profit. If any one has poor cows let him get rid of them or give up the expectation and hope of being a successful dairy farmer. Having good cows, we should treat them in the way to secure the best results.

Every animal requires a certain amount of food to repair waste and to sustain it in good condition. It is only what is eaten and digested over and above that amount, which goes to make milk or yield strength for labor or add to the weight and value of the animal. This much is certain: if our cows are not yielding milk nor gaining in value we are certainly losing. No farmer can afford to supply cattle with food and get nothing for it.

As a general rule it is true, at least with such animals as are worth keeping, that the more they can be induced to eat and digest the greater the profit. It is easily demonstrable that ten cows yielding ten quarts each daily for the year will be more profitable than twenty cows each yielding five quarts daily. The amount of milk is the same in both cases, but in the latter the cost is greater by as much as it costs to sustain ten cows. There is a truthful and sensible proverb that "a cow milks only through her mouth." It is one of the commonest and most serious of errors which farmers fall into, to keep more stock than can be fed to the point of greatest profit. And not only should the food be abundant in quantity but it should be suitable in quality. Much has been said and written on the subject of cooking food for milch cows. I have had no experience in this direction, but others have, and I propose to quote somewhat from their testimony.

Mr. Thomas Horsfall of England fed his cows for butter and beef, his cows increasing in flesh as they decreased in milk, and were mainly sold to the butcher when ready. He says, "In Craven, Yorkshire, where meadow hay is principally used, store cattle of fair size, not worked, need twenty-one pounds of hay per day, to keep them in condition. For the supply of casein in a full yield of milk (sixteen quarts) it would require an addition of fully twenty pounds more hay beyond the amount needed for the maintenance of the cow, forty pounds for the supply of oil for the butter, and for phosphoric acid nine pounds. You cannot, therefore, induce a cow to consume the hay requisite for her maintenance and for a full yield of milk. I had, therefore, to seek assistance from other sources, selecting such substances as were rich in albumen, oil, and phosphoric acid, paying regard also to their comparative cost. My food for milch cows, after having undergone various modifications, has for two seasons consisted of rape cake five pounds, and bran two pounds for each cow, mixed with a sufficient quantity of bean straw, oat straw and shells of oats, in equal proportions, to supply them three times a day with as much as they will eat. The whole of the materials are moistened and blended together, and *after being well steamed* are given to the animals in a warm state."

His cows in full milk did not fall below twelve quarts per day for six or eight months, at which time they had gained in weight; and he adds, "My experience of the benefits of steaming is such that if I were deprived of it I could not continue to feed with satisfaction."

Mr. H. S. Collins of Collinsville, Conn., says, "I commenced steaming feed for cows in 1856, with a Mott's furnace. A wood cover was fitted and wired down, and a lead pipe communicated with a large cask close by, which was hung on pivots so as to discharge into a wheelbarrow when the food was steamed. I filled this cask with cut cornstalks and sugar beets. The food being ready, I wheeled my barrow to the barn and entered the alley-way between the cows. It was not long after feeding time and most of them were lying down. Before I had got ten feet they commenced getting up, and in two minutes every animal was on her feet, and every nose stretched out to catch the savory odor. I gave to each one about a peck, as far as it would go. It was as warm as I could bear my hand in, and apparently an utter astonishment to them. They smelled, then tasted, then looked around, but in a few minutes every head was down and busy. It was all eaten up, the mangers licked clean, and the request came for more on every side." That was his first trial, and its success was such that he continued the practice with constantly increasing satisfaction. He says he never found an animal which didn't thrive by it; that they all increased and sustained their flow of milk remarkably.

In regard to the amount of saving, those having the largest experience, such as Mr. Stewart of New York and Mr. Birnie of Massachusetts, claim a saving of fully a third. Mr. Stewart says that he found as the result of many careful trials, that two quarts of middlings, or a pint and a half of corn meal added to a bushel of cut straw and well steamed, made the whole fully equal to the same weight of hay. For my own part, I am strongly inclined to adopt the practice, and I trust all the farmers of Maine will give it their careful and serious consideration.

When I began life, we had none of the scientific helps which we now have, no State Board of Agriculture, no farmers' clubs, no books and papers, but my wife was an expert in butter and cheese making, and we had in those days better pastures than now a days. I did then as well as I knew how, and much the same as many farmers do now. My cows were fed with corn fodder, the best hay being given to the oxen; they were wintered in a cold barn, had no grain nor roots, were driven a long distance to an ice-bound brook to drink; and the result was, that I did not get half the returns from them which I might have had, and they came out so poor in spring that it took a good part of the season to bring them up to where they were when they went to the barn in the fall, and it would have taken the whole if the pastures had been as poor as they are at the present time. I often wonder how we got along as well as we did. But those days of ignorance are gone by. We have more light and knowledge than formerly, though I must confess that some of the light is rather foggy, and some of the recommendations which are made to us I cannot endorse; for instance, Dr. Loring says cotton seed meal is injurious, and corn fodder is worthless for cows; but with due respect for the Doctor, I cannot agree to any such statements, for they do not correspond with the facts of my experience. I have fed fodder corn for the last twenty years, and I don't know what I should do without it. It has carried my cows through a hard drought with scarcely any falling off from a full flow, when I had enough and gave them all they would eat morning and night. Fresh grass is the most natural and healthful food for dairy cows; red and white clover taking the lead, with red-top, timothy and other cultivated grasses following on; but I think it pays to give a few quarts of shorts and a quart of cotton-seed or corn meal daily through the summer.

August, September and October are hard months to the dairy farmer, especially in dry years. Grass at that season is hard and woody and fodder corn is succulent and sweet. Nothing I ever fed to cows seemed to relish better, and considering the small expense required to produce one or two acres of fodder corn and the large crop realized, I consider it very profitable for the farmer to cultivate for dairy cows.

In relation to feeding mowing lands after haying, there are various opinions. Some feed closely spring and fall, others in fall only; others still are opposed to both, but mow the second crop. My opinion is that in the middle course there is more safety than in either extreme. Cutting the second crop for fodder I do not think much of. At the season for cutting aftermath in the State of Maine the days are short, rains more frequent than in July, the sun has lost his drying power in a great degree. From what practice I have had in cutting aftermath I fully agree with T. S. Gold, Esq., of Connecticut, that if the aftermath is such that there is danger of its smothering in winter, or giving the mice a chance to work upon the grass roots, that the most profitable way of disposing of it is to feed it off in September, and not too close.

No branch of the dairy exceeds in importance the feeding and management of the dairy cow in winter. The breed may be the best in the world, yet success with dairy cows will depend very largely upon feeding well and regularly and good general treatment. In the first place dairy cows should have a warm, well ventilated, light, clean stable; and in the second place a plenty of good palatable food. I am now producing milk for market. I find it requires more judgment and skill to feed a cow in winter in such a way that she will give a full flow of rich milk and hold her flesh than it does in summer. A good milker is not apt to gain in flesh while giving a full flow of milk. To do this she must have good food and plenty of it; a good supply of good hay, eight quarts of shorts with boiling water, and two quarts of cotton seed or corn meal per day, or other feed equivalent. Some think that such feeding will not pay. My experience in feeding cows for twenty-five years is that the more I give them to eat of the right sort and variety the more profit I get. If a farmer expects to get a full flow of rich milk from a cow without furnishing the material to manufacture it from, he will fare no better than Pharaoh did in compelling the children of Israel to make brick without straw.

I have had some experience in feeding roots. Raw potatoes I found too expensive; rutabagas affected the milk; carrots worthless. Much depends upon keeping cows warm in winter. If cows have only a cold open barn to be tied up in, and are turned out in stormy weather and driven fifty or a hundred rods across a bleak field to drink, it requires one-fourth more feed to keep up their animal heat than would be required with proper treatment. In travelling through the country I have sometimes seen cattle out in a cold snow or rain storm without any shelter except the lea of an open barn, with forward and hind feet so near together that they could stand in a bushel basket, and when I see that I am sure that the owner is not a member of a well conducted farmer's club, and that he is a poor farmer and has missed his calling. I am happy to say that such pictures are rare. The farmers of Maine generally are waking up on the subject of erecting good, substantial, warm, well ventilated barns, with good cellars and plenty of running soft water, which is indispensible to the best results with milk cows, since free access to pure water in summer or winter will increase the flow of milk.

Regularity in feeding, watering and milking is highly important. Cows are correct time keepers; if you go to the barn at the stated time of feeding, your cows will plainly show that they are glad to see you; go at other times and they will be lying down, chewing their cuds, and take little notice of you. It is as important to be punctual to the time of milking as in feeding; and it is poor policy to change milkers; cows when they become accustomed to a good, kind milker, are loth to part with them. Gentle and kind treatment is very important, and few are aware how important. Milch cows should be treated with kindness and consideration, not only from motives of humanity but of economy. No dairyman can afford to have his cows abused in any way; the penalty is sure to follow in loss of profit. There are farmers who keep cows, but neither house or feed or treat them well. To such it makes little difference whether the breed be Ayrshire, Jersey, grade or native; they will be poor and unprofitable, let them come of what stock they may. A poor farmer will convert a good cow into a poor one; while a good farmer will convert a poor one into a tolerably fair one, or else fatten and kill her.

God in his good providence has given the cow one of his best gifts to the human family. In her milk are found rich cream, excellent cheese, delicious butter; food and luxury for the poor and the rich. And then so mild, gentle and uncomplaining under abuse! The man who can half feed, swear at, kick or set a dog on such a forbearing, generous, christian animal must be only a human beast himself.

MR. ROBINSON of Dover. Did I understand Col. Swett to say that carrots were worthless?

COL. SWETT. That is my opinion.

SEC. GOODALE. Does Col. Swett mean to be understood that carrots are worthless for food, or that it costs more to raise them than they are worth?

COL. SWETT. So far as my experience goes they are worthless for food. One year I raised 175 bushels and fed them out without receiving any advantage. I had a cow, thrifty and in good order, which I thought to fatten for beef. She ate thirty bushels of carrots and as much good hay as she wanted, without gaining five pounds. Then I gave her potatoes, and before she had eaten twenty bushels she was fat. Two of the best farmers in our town raised, one 300 bushels, and the other 500 bushels. One told me that soon after feeding them to his horses and colts they came out with boils, lost flesh and spirits, so that a plain difference was seen in driving. He then fed them to his cows. In two weeks they were plainly losing flesh, still he kept on awhile, and his cows never came in so poorly as that spring following. He tipped 200 bushels into his manure heap. The other one had a similar experience, and he threw a hundred bushels away.

This fall, at our depot, some gentlemen were talking about the cultivation of roots for cattle and the feeding of carrots. A stranger stepped up, after having heard us through, and said, "Well, gentlemen, your opinion is in accordance with mine. If you want your horses to come out sore all over, or if you want them ruined you will feed them with carrots. I live in the vicinity of Boston, and I keep a livery stable with thirty horses. A dozen or fifteen years ago we thought carrots were valuable, but now I would not feed them to my horses if they were given to me."

MR. THING. My father raised carrots for many years and found no cause of complaint, but he found he could raise sugar beets more easily and finally gave them the preference. When I took the farm I thought I could do better with rutabagas; but I should sow carrots if I could raise them as cheaply as rutabagas. If I could get them for nothing I certainly should not raise rutabagas.

WARREN PERCIVAL of Vassalboro'. I understand the discussion this morning is more particularly in regard to the feeding of dairy cows. My brother from Oxford has diverged somewhat, but in a direction very proper in connection with this discussion. But I cannot endorse the view that carrots are worth nothing, or less than nothing as food for cattle or horses. Some farmers tell me that carrots are worth a dollar a bushel, others that they are worth nothing. Now, who shall decide. All will agree that we must depend mainly upon the grasses as food for animals. Beyond these we should be governed by circumstances. We must understand, in the first place, what we want to accomplish in feeding an animal; in the next place we must get the right kind of a machine to convert our fodder into what we want it. It is necessary, in the first place, that we should have the right kind of cow to feed in order to produce milk. We have some cows that you might feed till doomsday, and you would not get much of milk from them. The machine is not adapted to convert that food into milk; perhaps it will convert it into flesh or fat. We should understand what we want to produce, and what is the composition of the articles we feed. If you feed bog hay, its chemical composition is very different from that of English hay. The properties of the carrot are somewhat different from those of the rutabaga. These roots should be used something like condiments in our food. Some require their food very highly seasoned, others prefer it seasoned but little. It is so with animals. We must understand the constitution of the animal, and what we want to produce from it, and feed accordingly. I believe if those gentlemen had fed carrots to the right kind of a machine, and fed them with proper judgment, they would have been successful.

When we understand the machine with which we have to deal, and the chemical properties of the materials we put into that machine, we shall reach successful practical results. It is a very broad field to go over. I do not feed nor cultivate carrots, from the fact that I depend upon hired help, and carrots require too much finger work. I cultivate rutabagas, because I can grow them cheaply. Yet I have been told by one man that he would not give a cent a bushel for rutabagas; that he would not carry them into his barn if he could get them for nothing. I do not agree with him. If we feed roots with dry food, thus making it more succulent, they will be found valuable.

Dairy cows should be fed with reference to producing milk, as that is the object and nothing else. If you want to breed a valuable Shorthorn or Hereford for market, and milk is of secondary importance, feed accordingly. Hence I am for educating farmers, that we may understand first principles, and carry on our operations understandingly. Then we will come out right; but if we go to work hap-hazard we shall make more mistakes than successes.

MR. THING. I would inquire of the Secretary if a chemical analysis of roots will determine their actual or comparative value for food? In my practice I do not feed straw without rutabagas, or some other roots, because it would be worthless, but with those I find it to be worth feeding. I can feed stock in that way as well as I can with fair merchantable hay without roots or grain.

SEC. GOODALE. A chemical analysis will show the amount of solid matter contained in roots, and of what that solid matter consists. But it is not competent to determine their nutritive value. It ought not to be expected of chemistry to tell anything about nutritive value, for that is something not to be ascertained by chemical methods. Chemistry can tell us how much starch there is in a potato, how much sugar in a beet, and can give a thousand other items of knowledge of that sort, but it tells nothing at all about the nutritive value of starch or carrots or sugar or turnips or corn-meal. Nutritive value is to be determined by a very different method, namely, by putting the substance into the stomach of a living animal and noting the results. Chemical analysis deals with dead matter in dead crucibles and beakers and retorts, and reports to us what are the proximate or the elementary constituents of which it is composed. If you want to know the value of an article of food for nourishment put it into the living animal, where it undergoes digestion and assimilation by the action of forces in connection with life. As a matter of fact, we have already some knowledge of the nutritive value of sugar, starch, oil, gluten, albumen and other constituents of grains and roots which has been obtained in the way I spoke of, so that when we find a root or a grain to contain a large or a small proportion of these, we can make a tolerable guess at its nutritive value, but reliable knowledge is only obtained by *addressing the question to nature in the proper mode*; that is, by observing the results when used as food. A great many experiments have been made as to the nutritive value of roots, as well as of grains, and the results vary; they are found more useful in some cases and less in others, depending on the requirements of the different animals and on numerous causes.

Ample experience has shown that a small amount of roots given daily to cattle with dry food generally does more good proportionately than a large amount. Probably four quarts or a peck per day are attended with beneficial effects beyond the mere nutritive value they contain, perhaps by acting as a condiment, as suggested by Mr. Percival. So that if a peck of roots given with dry fodder does a given amount of good, you cannot expect four times as much from a bushel, because when the roots have done what they can in aiding the digestion and assimilation of the dry food, you have got all the good they can furnish in that way, and any further amount will aid only by the nutritive matter which they contain. In Great Britain, roots, especially Swedish turnips, are very extensively fed to cattle. A bullock put up to fatten receives three or four bushels daily, with chopped straw and some concentrated food added, like oil cake or meal.

Rev. Mr. Gurney of Foxcroft. I think one objection made here to the carrot might be made with equal force against apples. In autumn my children are allowed to eat as many apples as they want; and I notice that at that time those humors which have been accumulating, for a year perhaps, in the system, all come to the surface, and frequently they break out in sores and blotches, just as described in the case of cattle, but after these sores heal, they are all right and continue so perhaps until the next fall comes round; and it would lie as well against all succulent food. I have often thought that the best-abused article of this kind was the cucumber, but I now begin to think it is the carrot. Cucumbers have become proverbial as the most indigestible and unwholesome article of food; but we have learned to use them all the season, morning, noon and night. Our children eat them with their bread and milk just as if they were apples, and we find them an excellent article of diet if they are only used properly. The trouble is all from misuse.

Mr. Simpson of Bangor. I would inquire of Col. Swett the amount of carrots fed during the time mentioned.

Col. Swett. I commenced with half a bushel daily, and increased it until I fed a bushel daily, the same as I did of potatoes.

Mr. Robinson of Dover. Is not a bushel a day too much?

Col. Swett. I thought not. I thought if they were good I could feed them about as I would potatoes. I did not know any other way to use them, except to give them to cattle, and if they proved not to gain any flesh on them, I did not know what to do with them, except to throw them away.

Mr. Robinson. How long was the experiment tried?

Col. Swett. I fed thirty bushels to one cow.

Mr. Robinson. In how long a time?

Col. Swett. Perhaps thirty-five or forty days.

Sec. Goodale. The fact that what agrees with one does not agree with another, may give us a clew to many discrepancies of which we hear. Col. Swett's experiment was confined to one cow. We know that some animals are very well suited with what does not agree with another. I see an illustration of this in my own family. I am very fond of cheese, and so is my wife; but of our five children, while two like it as well as we do, two dislike it, and one would rather go without his dinner than eat the smallest particle of cheese with it. You will find all through the human race and the brute races similar peculiarities. The only way to learn the nutritive value of any substance as food is to multiply direct questions addressed to nature, and while we can thus get general rules, we will find there are many exceptions to those rules. You can find many who would not agree with the gentleman from Foxcroft with regard to cucumbers as an article of diet. Putting food into living organisms is one thing, and putting it into the crucibles and retorts of the chemist quite another thing. All we can do is to question nature in the proper way, observe carefully the results, and be guided by the best light we can get from them.

Col. Swett. We thought, in Paris, that we gave carrots a pretty fair trial. They were fed to something like twenty-five cows, and there was not a single case where they appeared to do any good. They all ran down. Both Mr. Merrill and Mr. Thayer say that their cows lost flesh while they fed carrots. None of our cows came out with sores, but the horses did, and they also ran down in flesh.

O. S. Bliss of Vermont. Were the horses that were fed with carrots deprived of grain?

Col. Swett. They were not, and some were colts that never had any grain.

Mr. Bliss. The experience of my neighbors in feeding roots has been uniformly favorable. I never have known of a case where they have fed without roots. We find it necessary to husband our meal, and roots are fed to a large extent in all my section. In regard to the adaptation of foods for different animals, I think it would be found one of the most profitable fields of experiment open to us as experimental agriculturists. I had an illustration this year. I had a litter of fine Cheshire pigs, and I undertook to winter them on roots entirely, as I am in the habit of doing. In the litter was one sow, the finest pig I had, that disliked turnips. I found it necessary to take her out of the lot, and feed her otherwise. As soon as she was put upon house slops—less nutritious food as a whole than the turnips, and less satisfactory to pigs ordinarily,—she began to improve, and came right up again. It became convenient shortly after to put her into the pen with the others, and she would eat turnips enough to live, but not enough to do well, and I had to take her out a second time. The other pigs, when I put them upon Swedes, did not do as well as they had on turnips, but this sow, when I returned her a second time to the pen, did very well on the Swedes, until I sold her.

Something was said by Col. Swett in regard to cooking roots. Mr. Birnie came to the conclusion, from his experiments, that steaming was of no use. Mr. Cochrane of Canada cuts his roots, mixes them with his other feed, and lets the mass heat. He does not cook them.

On motion of Mr. Chamberlain of Foxcroft the subject was then laid on the table.

The Chairman announced that the question next in order was that of

STOCK RAISING AND BEEF MAKING IN MAINE.

Mr. L. L. Lucas of Somerset was called upon to open the discussion, and read the following paper:

Stock Raising and Beef Making in Maine.

I hardly know what I can say upon this subject that is not already before the public. Almost every journal and newspaper has an article of some kind upon agriculture. I can say but little from my own experience. I have not made farming and stock raising a specialty. I have dealt too much in stock to raise it to much extent. I have read our State Agricultural Reports but little, but I find considerable upon this subject published in them, and I will here say that I have not read one of the reports since 1863, hence I am entirely ignorant of what they contain; but these reports from 1860 to 1863 show that this subject has not been overlooked, and doubtless much more has appeared than I had supposed until quite recently.

That the system and practice of stock raising and beef making in Maine is very imperfect many will admit, and very few deny. Is there any remedy? Can any improvement be suggested to render them more perfect, hence more remunerative? It would seem that something might be done in that direction, and although I may fail to throw any light upon the subject, I can raise the question for others who may not be so obtuse as I am. That there has been a gradual improvement of stock in Maine for the last quarter of a century is evident enough; but that a still greater advance may be made in that direction is equally evident. Experiments have to be tried and proved by the few. Skepticism, jealousy, and credulity enter largely into the minds of the masses of the people, and they all operate against any rapid improvement. Imposing upon credulity strengthens skepticism and jealousy, so that no improvement can become general any faster than it proves itself so by careful observation. The first step to take, the first thing to be done, is to get a better breed of cattle than the natives or grades. Get full bloods to breed from. Herefords I regard as the best for our climate, being hardier, not quite as large as Durhams, hence mature younger at less expense of feed. They can be obtained now, so that almost every locality in the State can have the benefit of them; their numbers are increasing, and they are becoming more popular every day. And here allow me to say, that Mr. Webber of my town (St. Albans) bought last year of Charles Shaw of Dexter a full blood Durham bull, one year old; the first full blood ever in St. Albans, a town that has a population of nearly 1800, and mostly farmers, and has been settled more than sixty years. The size of the bull created mistrust at once, he was a *Shanghai*. They were not to be imposed upon by him. They have all been obliged to acknowledge their mistake; he is now two years old past, measures six feet ten inches, and is as perfect an animal as can easily be found. The promise is good for improvement in the stock, as also in the people, who have been entirely ignorant of the real value of pure bred animals. That the use of him will prove a success is evident, as an examination of Mr. Shaw's stock fully demonstrates. Mr. Burleigh of Fairfield exhibited a very nice Hereford bull at the State Fair, also some very nice cows and calves. An examination of them ought to shame most of those in the State who call themselves farmers and keep such stock as they do. In order to have good stock you must have good blood; then give good care, and the raising and growing of the same will not only be an improvement but a success; it will remedy the existing evils to a very great extent. I would recommend, however, in the absence of full blood, that the farmers use the best stock they have for breeding, and keep and raise only a few of the best of their calves. Stock can be improved to some extent by always breeding from the best, even if they be natives; but there is no certainty about it, as there is with pure bloods, but it is safe when it is the best that can be done.

The second step to be taken is to reduce the number of cattle, say from one-third to one-half. One-fourth of the fodder fed to cattle in Maine is worth more for bedding than for feed; also worth more for manure before it goes through cattle than after, and if two-thirds of the cattle wintered in Maine could have all the feed consumed by the whole number, and what is not eaten used for bedding, the cattle not only would be worth more than the whole number, but the manure would be worth more, a gain in two ways. The stock in Maine as a whole loses in flesh and weight in winter, which must be a loss, except in case of milch cows and working oxen, which are not ordinarily expected to gain much either in winter or summer. The milk of cows, and labor of oxen, if kept at work, ought to be a fair return for their keeping; but any and all other stock ought to be kept growing, otherwise it must be that it is kept at a loss. Suppose it should be kept so right through the year, would anybody pretend there was any gain, and is it anything uncommon to have a pair of oxen remain in the hands of a farmer during a year with no work outside of the farm, nothing to do in winter except to haul a few cords of fire wood, and be poorer and lighter at the end of the year? The stock of farmers is generally too numerous for the hay-mows and pastures. Stock that goes from the barn in good condition usually gets fat in the early part of the season, while there is plenty of feed in the pastures, while that which goes from the barn poor only gets fairly started to gaining when the feed fails in the pastures, and remain so until housing time again. Can there possibly be any profit in keeping stock in the manner last named? If there is I fail to see it, and farmers the present year I think must have learned a lesson that will not or ought not to be forgotten very soon. They ought to know that prices of cattle have not depreciated so much on account of the numbers thrown upon the market as upon the quality. The cry from the market has been, poor, *poor*, POOR. While good cattle of every grade have been in demand, at the highest market prices, poor ones have sold slow, hard. They have not been in demand at what would seem fair prices; they have been bought only because better could not be had. Good ones were not in the market in numbers sufficient to supply the demand. The effect has been to keep good cattle up, so that the farmer has made money who had them to sell, while the poor ones have sold at a loss to the farmers, and frequently at a loss to the drovers. It is out of the question to think of raising much of a breeze out of poor goods, it is a very up-hill business.

I shall not attempt to show that stock raising for beef purposes is the most profitable to the farmers of Maine, but what I shall attempt to show is, that what stock they do raise ought to be good. Suppose I raise four calves, every way equal when dropped, give two of them half of the milk from their dams until eight weeks old, turn them away to pasture and let them remain until October; the other two I give all the milk until four months old, with as much provender as will keep them fat and sleek. The last two perhaps have cost twice what they will sell for at four months old, but they are large, in good order, used to eating all kinds of provender, and in good condition to winter. The first two have cost but little, comparatively; they come to the barn quite as large framed as when they left it, "as poor as wood," with two lice to each hair. I then begin to feed them, and with extra care and food get them through the winter and get them out to grass again. In the fall they will girt probably four feet and eight or nine inches, while the other pair will girt five feet and eight inches. It costs quite as much to winter the small ones as the large ones, and while the small ones will not sell for more than twenty dollars, the large ones will sell for seventy-five. Which pair pays me for raising, if either? There may be some little excuse for raising an inferior heifer calf from a superior milch cow, to perpetuate the breed, but I cannot conceive of any excuse for raising poor calves for any other purpose; yet the country is full of them, and but very few good ones.

Let us look at the prices of two years old cattle as they have sold in the market the past season. They range from $15 to $45. The average has not been above $26, or six and one-half cents per pound, since the first of September, while in July good ones were worth ten cents per pound, and other fat cattle in proportion. One-half as many cattle as we now send to market ought to represent as much beef and as many dollars as the whole number does now. The cattle would give better satisfaction in the market and would cost but little more than half as much to market them. Half the number of drovers could do the work. The buyers would have but half as many to look at and find fault with, the butchers would have but half as many to kill, the consumers would get as much beef with little more than half as much bone or waste, and the farmers or feeders get double the profit they do now. The farmer that now keeps twelve cattle can keep six, and the farmer that keeps thirty can keep fifteen. Any farmer can reduce his number of cattle, and if he could be made to understand that it is for his interest he would do so at once. As a class they are as sharp and as jealous of their rights as men of any other profession.

The prices obtained for cattle is in no way commensurate with the cost of raising in Maine. Two years and a half old—thirty months,—at twenty-five dollars, or eighty-three and one-third cents per month for keeping and paying taxes on the same! Must be fed from the barn at least six months in the year. Would farmers do so if they would reckon and calculate the cost, and realize how much of their substance they are throwing away? Just call upon a farmer with a drove of cattle and see if he does not fix a higher estimate upon the cost of keeping than he is getting for keeping his own stock. Hire him to winter a cow or pair of steers and see if he will not charge for it about what it really costs. There is one thing in which almost every farmer is mistaken, that is in the quantity of hay he raises or feeds out. What farmers call twenty tons will generally weigh out about fifteen, so they can credit themselves with five tons fed out that they did not have.

I question the propriety of keeping cattle on the farms in Maine not in a condition for beef, milch cows excepted. In the older and most populous parts of Maine there is but little work for oxen to do, divided as it is, part done in the fall and part in the spring. There are but few farmers (or ought not to be) who cultivate much more land than they manure in some way before seeding down to grass. The quantity I judge would range from six to twenty acres per year, and where twenty acres are cultivated there are usually a pair of oxen, one or two pairs of steers, and not unlikely a pair of horses, so that all the labor does not fall upon the oxen. They help to break the greensward, haul the manure and the rocks (if any to haul). The horses plow the old ground and do the harrowing, which facilitates the business and relieves the oxen from their hardest labor. And here let me say that horses are generally a dead weight upon farmers except they are kept at work. The large majority are of little value except for what work they do.

There are a few among the many farmers in Maine that overwork their oxen, sometimes do two days' work in one, or three days' work in two. There is another class that do one day's work in two, or two days' work in three; and the latter class uniformly have the best cattle. There is rarely any real excuse for overworking cattle; the little amount of work to be done and the remuneration for the same does not pay to work flesh off from cattle. Their size and flesh ought to be kept good, and when there is any change they ought to show larger and better. Cattle can work and still hold their flesh, if properly fed and treated. Look at the city teams of Portland, Bangor, and other large places in the State; also at the teams of Messrs. Bailey of Winthrop, manufacturers; and you will find cattle uniformly well matched, and almost every ox good market beef, although worked every day; their beef is made and kept on them at the expense of good feed and good care, which is quite as cheap in the end as to work off the flesh. Once start off the flesh, get cattle on the down grade, and continue it any length of time and you have no team, you must stop work; increase your feed, or get their hides. You have got to stop somewhere, you cannot keep them continually on the down grade and never come to a stopping place.

In the spring of 1857 I had occasion to go West; before starting, in April, I bought a pair of oxen five years old, girt six feet eleven inches, paid one hundred and thirty dollars; I also hired a man, and among other things I instructed him to take good care of the oxen. I returned home the 24th of May, we finished the last of our work the 5th of June, let a neighbor work them the 6th, and sold them the 7th for one hundred and sixty-five dollars. Their girt when sold was seven feet and one inch. They worked almost every day, ate about half of a bushel of meal and what good hay they wanted. They looked well, thrifty, and suited the purchaser, a man who would not have any other kind of cattle than good ones, and I take no credit of buying low or selling high.

The two inches in girth worked on, and the flesh they gained, made them appear as cheap at $165 as they were at $130 when purchased. I put in this for the purpose of showing that cattle can work, grow and fatten all at the same time, if worked, fed and treated properly.

One word in relation to feeding cattle for beef. One man tells me that a plenty of green English upland grass will cause cattle to gain as fast as anything they can be fed upon; that an allowance of meal with the same would be substantially thrown away, even if they would eat it. The same man contends, also, that hay cut green and cured green will do the same thing for cattle as green grass from the pasture, and he claims to speak from experience. I have also seen reports the past season of cattle brought from Vermont to the Cambridge market, examined by the butchers, pronounced to be good enough, and it was said that these cattle had never eaten any meal nor provender. The report referred to was made by Stillman Fletcher, Esq., in the Weekly Thursday Spectator, printed in Boston, the date of which I do not recollect; neither do I remember the name of the farmer who fed the cattle. The practice of most of our farmers who attempt to fatten cattle in fall or winter, is to feed them until they will barely answer for beef, just do to skin, and they sell them of course for what they will fetch; and they sell them just at the time when they are the most profitable to feed. The practice of the feeders in Massachusetts, especially on Connecticut river, is to select the best shaped, largest and fattest cattle that can be found in the market, (they are even more particular than the butchers,) which proves that they think cattle can stand more feed, and improve by the same, than they often get in Maine. A man who claims to be an experienced feeder upon hay and meal, tells me that an ox, an ordinary feeder, will gain ninety pounds in a month upon a peck of corn meal per day, with what hay he will eat; that he will gain 450 pounds in five months upon that feed; and that cattle will vary in gain from 75 to 150 pounds per month. One that has a good appetite, is quiet and contented, and does not stir about much, will gain 150 pounds while one that is uneasy, restive, dainty, &c., will not gain more than 75 pounds. Now as to the question whether it pays to feed cattle and make them good, or throw them upon the market when they will just pass for beef, I have put the following questions to an experienced butcher in Portland, Mr. Henry Fowler—Take an ox of 900 pounds, worth ten cents per pound, to start on.

What is he worth per pound when he weighs 1000 pounds? What is he worth when he weighs 1100 pounds? And what is the average weight of bone in a ten hundred ox? also, which class of cattle are most profitable and desirable to the butchers according to the prices paid for each class? His answers are as follows: the ox of 900 pounds, worth 10 cents, fed until his weight is 1000, is worth 12 cents, and if fed to 1100 is worth at least 13½, and might reach 14. The average weight of bone 30 per cent., extremes from 25 to 34 per cent.

From the above let us examine, cypher a little, and see if it will pay to feed ten cent cattle. It is comparatively safe to say that twenty bushels of corn meal and one ton of good hay will feed a pair of 1800 pound cattle forty days. We will call the feed $40. The cattle have gained in weight 200 pounds; that 200 has cost $40, or 20 cents per pound, and it is not worth but 12 cents per pound or $24, a loss of $16, calling the manure and trouble of feeding equal. But is the above reckoning correct? does it show the true result in the above transaction? The first 1800 pounds is reckoned at 10 cents and the 200 pounds at 12 cents, making $204 as the value of the oxen when weighing 2000 pounds, and an expense of $40 in feeding, leaving a loss of $16. Now let us call the oxen 1800 at 10 cents, $180; add $40 dollars for keeping forty days, and we have $220 as the cost, and 2000 pounds at 12 cents gives us $240, a gain of $20. Now suppose we feed forty days more at the same expense, $40, and get 2200 pounds at 13½ cents; then we have $297, against a cost of $260, leaving a balance in our favor of $37; and if we get 14 cents, or $308, it leaves a balance of $48 upon the transaction, the feeding of one pair of cattle from 1800 pounds at 10 cents, to 2200 pounds at 14 cents per pound.

Now, if my premises are right, that cattle will gain upon the cost of feed what I claim they will, and the price of beef is increased in the ratio I have stated, feeding will not only take care of itself, but will actually pay a large profit. The cost of labor and care in feeding is but a trifle more than when fed upon hay alone, and the excrement is worth as much more as the extra trouble. There is also a decided preference for good beef in all the markets where the bulk of it is sold and consumed.

Now if farmers will count the cost of keeping cattle in the ordinary way, *poor*, and note the paying results, also the cost of keeping in the manner I have indicated, so that their cattle will improve by the same, and note the result, which is a very easy and simple thing to do, they can determine for themselves which is the most for their interest.

Now let us look for a moment at the quotations of the prices of cows in the market, December 22, 1870. Milch cows, slim to fair, $30 to $65; good to extra, $70 to $100; heifers and farrow cows $25 to $50; extremes four to one. While a fair cow will sell for only $30, an extra one will sell for $100, and a good one for $70. These same cows must have been fed from the barns something like two months, and if farmers have made anything by keeping these poor old refuse creatures there is no fear for their welfare, they don't need any counsel from me. They can take care of themselves. I consider it generally very poor policy to throw poor stuff upon the market; it pays the producer nothing, it pays the drover nothing; the commission man gets all the profit if the stuff is worth enough to pay his commission. I have seen a four-horse team loaded with carcasses of sheep, at from 2 to 3½ cents per pound, from the commission stores in Boston, and it was said that there were no customers in Boston poor enough to buy such stuff; it had to be sent to the country markets. The expense of marketing those sheep must have eaten up their entire carcasses. Suppose they had been slaughtered at home, where pelts are worth more than in Boston, and the carcasses fed to the hogs; no money would have been lost to the owner, and all the meat was worth for the hogs, with some of the best for soups and mince pies, would have been saved. As it was, he simply got pay for the pelts and gave the meat to have them taken off.

I noticed a short time since an old bill of lambs, sold by a commission man in Boston; one weighing 41 pounds, 82 cents; another of 15 pounds, $1.05. Which of the two would you infer was the fat lamb?

I cannot see what is to be gained by pursuing this subject farther. I have presented it as well as I am capable of doing; I have aimed at facts directly, without any preamble or apology, and whether I have succeeded or failed is for you to judge.

SEC. GOODALE. While Mr. Lucas was reading his rich and suggestive paper the inquiry arose in my mind, How came he by views so different from those which generally prevail among cattle growers in Maine? and the answer probably is, by going where the facts in the case are to be learned. If he had always remained at home or near home, probably his views and practice would have corresponded with those of his neighbors. One of the greatest disadvantages under which farmers labor is, that they are isolated; that they do not know what is going on; that they do not know so well as they should the difference between a fat and a lean animal. Some of the points in this paper were exceedingly suggestive, and worth carrying out a great deal further. He referred, for instance, to the manure from fattening animals, which he said was better than the manure from poor ones. I hardly think as much force was given to that point as it will bear. If you keep poor animals your manure is poor. They get out of the food all they can. If you give rich food, and keep them fat, you have rich manure. It is one of the secrets of the wonderful agricultural success in Great Britain, that they feed to fatness, and so make rich manures. It is one of the reasons of the poverty of farming here, that our animals are poorly fed. We sell many cattle for less than they cost, and this because they are poor, when by feeding fewer and better we should reap remunerative returns, and at the same time have richer manure. To grow a poor or store beast costs nearly as much, probably more, for equal weights as to grow a fat one. It certainly exhausts the land more to grow a hundred pounds of bone and offal than to grow a hundred pounds of fat, for the latter comes originally from the air and moisture, because the former require largely of both phosphate and ammonia, while there is not a particle of either in fat. The importance of higher feeding is one which can hardly be impressed too strongly upon the minds of the farmers of Maine, and I most heartily concur in all he said on this point. Bone and offal are quite too costly to produce, for us to sell any more of either than we cannot avoid.

Something was said to the effect that much of the fodder which went into animals was better fitted for bedding. Here we may get a lesson regarding the importance of cooking food. I believe in giving animals good bedding and comfortable surroundings; but at the same time there is a good deal of what goes under the name of meadow hay, which furnishes a part of what cattle need just as really as any other food, but it lacks some elements which you must add if you would have it supply all their wants; and the great gain of cooking comes in where you have such poor hay and coarse fodder, corn-butts, &c., that cannot be digested without being cut up and cooked. By adding to them what will make them equivalent to English hay, in the shape of anything that furnishes nitrogenous food, like grain or oil cake, you have the equivalent of good English hay. While I believe that the cooking of food is as useful as it is represented to be, in some cases, if we represent it as adding a third part to good English hay, we exaggerate. If you have *good* hay there is small gain, if any, in cooking it. There is also little gain in cooking roots, potatoes excepted; cutting or pulping them answers as well. But there is great gain in cooking those poor articles of food that require additions, if you make the necessary additions and feed them warm.

I was rejoiced to hear the gentleman go over the ground he did, for it is a matter I have thought of very much, and one which it seems to me ought to be investigated and dwelt upon by every farmer in the State. It is only by increasing the value of your stock, and bringing them up to a high grade, that you can get the prices which they ought to bring. I consider the paper a very valuable contribution to that end.

Mr. Leland of Foxcroft. Will the same money's worth of corn meal and cotton-seed meal produce manure of equal value?

Sec. Goodale. At ordinary prices the cotton-seed meal will give double the value of manure that Indian corn meal will, but there is this difference: the greater amount of nitrogen which is thrown off from feeding the cotton seed passes chiefly in the urine, and if that be not saved the gain in manure from feeding it is small. In feeding corn meal the solid excrement is rich, and that is more generally utilized.

Mr. Lucas. What I meant by the statement that one quarter of the fodder fed to cattle was worth more for bedding than for food, was this. There is a portion of meadow hay that cattle will not ordinarily eat. There is a small portion of English hay that they will not ordinarily eat. They are fed, in many sections of this State largely with straw, and a great portion of that they never ought to eat in its crude state. In some localities cattle are fed with buckwheat straw; that is rather hard eating. Now, with the explanation of the Secretary, if meal is added to that in sufficient quantities to make it equal to that portion of the food which is really suitable for and adapted to cattle, and that they will grow and fatten upon, then this difficulty is removed, and they can eat it all. It reminds me of the story of the man who fatted his hog on sawdust and Indian meal. He said the more meal he put in with the sawdust the better his hog grew! This refuse stuff, by being mingled with cotton-seed meal, very large quantities of the meal being mixed with very small quantities of the refuse, may be consumed with advantage.

SEC. GOODALE. The cases are not parallel. The gentleman's illustration will not bear examination. Look at a pig and then at an ox, and tell me if they are built after the same model, either externally or internally; and if they were intended to serve similar purposes and to be fed upon similar food? The truth is, that the Creator designed the pig to feed chiefly upon concentrated food, food rich in nutritive matter. This is plainly indicated by the fact that he has but one stomach, and that a comparatively small one; while the ox has no less than five stomachs, and one of them of immense size, the paunch as it is commonly called, together with a great length of intestinal canal. One of the purposes for which the ox was designed is to extract nourishment and build up its body from *bulky food,* less rich in nutritive matter than grains are. Their digestive apparatus is adapted to this end. The food is chewed again and again; it passes from one stomach to another, each extracting from it all it can, and then it goes through a great length of intestines by which the rest is extracted.

I have no idea that Mr. Lucas or any other farmer makes such a blunder in practice as to feed his swine and his cattle upon the same kind of food. I would venture to predict that if he should feed both a pig and an ox upon meal and skim milk only, in a few weeks, or sooner, the ox would be in worse condition than the pig; and if he should then change and feed both on hay and water only, would both fare alike well?

The point I desired to make was this, that bulky and coarse fodder, poor if fed alone, contained what was really useful, and to a certain extent indispensible for cattle, and that if supplemented by a moderate, not a large amount of such food as contained the necessary constituents which the other lacked, might be employed to great advantage; and farther, that such combination could be best accomplished by cooking, first cutting and mixing, the whole being thus made more palatable and more easily digestible.

PROF. PECKHAM. I want to say a few words in reference to chemical analysis. It is a subject which is not generally well understood. We may undertake analysis after two very different methods. They are called "proximate analysis" and "ultimate analysis." The object of the ultimate analysis is to determine the ultimate elements of which the substance consists; the object of the other is to determine the *proximate* constituents which make up the substance. Now, if we analyze a number of different succulent roots, after we have driven off the water, we find the solid residuŭm to be almost identical in constitution so far as its ultimate elements are concerned. They will be found to be carbon, hydrogen and oxygen, and a certain amount of nitrogen. This identity tells nothing with regard to the differences that all know exist in those roots when used as food for men or cattle. But if we determine the proximate constituents which make up these roots, we shall find them differing very widely. Some of these are substances with which we are familiar. Starch, for instance, enters largely into the constitution of roots. Then we have sugar, varying in its proportion in different roots. We have also gelatine and gluten, two substances which exist in smaller proportions. Then, again, there are certain essential constituents which exist in extremely minute quantities, which give the roots their particular flavor. Take carrots as an illustration: we find in them a coloring matter in considerable quantity, and similar peculiar constituents often give to the root its medicinal properties, if it has them. Now, when we separate these different proximate constituents,—the starch, the sugar, the gluten, the gelatine, etc.,—we perform an analysis which gives us some idea of the differences which exist between roots; but the ultimate analysis gives us no clew to them whatever. When we say that ultimate analysis is of no value at all in determining nutritive quality, we speak correctly; but if we get the relative amount of the proximate constituents, that is, of sugar and starch and gluten, &c., we can form some opinion as to the value of those constituents, because we know from experience that starch and sugar have a certain relative value; when we estimate the nitrogenous principles, the relative amount of gluten and albumen, we are able to assign to a large proportion of these substances their proper place as nutritive substances.

Mr. Robinson. I wish to put a question to anybody who will answer it; a practical question, and hope for a practical answer—not a chemical analysis answer, but one that I can communicate to plain farmers, who are not chemists, in such a way that they will understand it. The question is germane to the paper just read: How to kill lice on cattle?

Mr. Percival. I understand the question before us to be the rearing of beef. I do not know that there can be a single word said upon the paper last read, except to apply first principles, which I go back to in all cases, because unless these are right we are wrong every time. While the gentleman was speaking of certain animals, I was reminded of the remark of a drover, made to me yesterday. He said, "I have been up yonder and bought some splendid beef." "Why," said I, "that is the locality of Elijah Wadsworth, and the Underwoods, of Fayette." The question arose, "Why does he get those splendid oxen there?" And the answer plainly is, because those gentlemen have introduced thorough-bred animals. Do you ever see drovers going to buy splendid oxen where no blood animals have been introduced? Certainly not. No sensible man, if he wanted to raise such oxen as Charles Shaw has in his barnyard, weighing 5,800 pounds, would get an inferior race of cattle to breed them from. Then as to feeding, would anybody expect to produce those 5,800 pound oxen on hay? Of course not, because its analysis does not indicate the presence of the right constituents to produce such oxen. The only case in which a man is justified in feeding straw and rough fodder, with roots, is when he wants growth; he ought not to give such fodder to fatten animals. In feeding my Shorthorns, from a year to two years old, I give them rough fodder and meadow hay, and roots of various kinds, believing that there is something in them which keeps the animals in fair growing condition; but that feed will never make the beef which Charles Shaw and some other men have got.

Mr. Robinson. I do not think the gentleman has answered my question satisfactorily. I remarked in the outset, that it was germane to the question before us, and I did so because the opening address presented an appalling picture. It is perfectly apparent, that if we have an animal which is beset with vermin, it is impossible to bring it up to a condition of thrift for any purpose or use whatever. I repeat the question, Does anybody know of an easy, safe and effective method of exterminating lice upon cattle, which are very common, and a very great nuisance? I do not.

Mr. Gilbert of Androscoggin. The question is really one of practical importance. It is asked every year, "How shall I kill the vermin on my stock?" I would not make light of it, small as the matter seems. I will say that I have tried many remedies, and the simplest and the most effectual is, to wash the animal in a decoction of tobacco. It never injures the animal in the least; it has no effect upon the hair or skin, and it effectually exterminates the vermin. It does not need to be steeped strong; and if any one does not wish to purchase tobacco for the purpose, he can raise it himself. Tobacco plants can be raised as easily as cabbages, and the home grown is equally efficacious with that purchased at a large price, grown abroad.

Mr. Robinson. How is the decoction made?

Mr. Gilbert. I cannot state the exact proportions. I judge by the eye. It is necessary to have the water well colored, and only that. It need not be very strong.

Mr. Percival. I applied it to a very nice calf once, and it came near killing it.

Mr. Gilbert. I once washed a calf of eight weeks old all over, killing every louse, and with no more injury to the animal than if washed in water.

Mr. Swett. Some years ago I was told that sulphur, given internally, was effectual, and I found it so upon trial.

Sec. Goodale. My impression is that no remedy will compare favorably with carbolic acid, if properly used, either for vermin on cattle or on plants, or for many other kindred uses about the farm and garden. When pure it is corrosive and dangerous; but one ounce dissolved in a gallon of water will be abundantly strong and perfectly safe. It is coming into use in the form of soap, and is sold at many stores where seeds and agricultural implements are kept. I make my own, and any farmer can do the same. Dissolve a pound or two of bar soap in as little hot water as possible and stir in an ounce of the carbolic acid. When cold it can be cut into cakes and kept any length of time. The easiest way to apply it is to wash the animal with this soap and water. Its uses are so numerous and varied that I would no sooner keep house without it than without an almanac. In the report for 1869 are several pages devoted to the agricultural and sanitary uses of this article. It is coming rapidly into favor as fast as its qualities become known. Tobacco is dangerous.

Mr. Lucas. Within seventy-five rods of where I live, a man had three cows which became lousy. He tried a decoction of tobacco. I do not know how strong it was, but the effect I know. Within an hour they all died.

Mr. Bliss. I wish to add a word of caution in regard to the use of tobacco for washing animals. I have some friends in Vermont who, a year and a half ago, lost a valuable bull by washing him in tobacco juice. They dislike to have it said that that was the cause of the bull's death. They profess to believe that the bull was poisoned, but nobody who knows the circumstances believes that he was poisoned by anything else than tobacco. Mr. Williams, the herdsman of Mr. Griswold of Morristown, Vt., who is one of the best qualified herdsmen in this country, told me that he had known of several such instances, and although he uses tobacco, he is careful to keep them tied up so tight that they cannot possibly lick themselves for an hour or two after washing them with the tobacco, and then gives them a thorough washing in soap suds.

PROF. PECKHAM. The poisonous principle of tobacco is absorbed by the skin, and passes into the circulation through the pores. The color of tobacco is no indication of its strength, neither is the color of a decoction of tobacco any indication of the amount of nicotine, the poisonous principle of tobacco, which it contains. A sample of light-colored tobacco may contain twice as much of the poisonous principle which effects the nervous system and produces sudden death, as a dark-colored sample. The amount of nicotine which tobacco contains varies very greatly in different samples. I have found as much as fourteen per cent. in one sample and in others less than six per cent. Its use is attended with serious danger.

Adjourned.

Upon reassembling, Rev. Mr. Gurney of Foxcroft delivered an address upon "The advantages of associated action in Dairying." Being substantially similar to the one delivered at Dover last autumn, and published in the report of 1870, it is omitted here. He was followed by Mr. D. H. Thing of Kennebec, who delivered the following on the

ADVANTAGES TO ACCRUE TO FARMERS' WIVES AND DAUGHTERS BY ASSOCIATED DAIRYING.

There is one consideration connected with the subject of associated dairying upon which I desire to say a few words. It is the intellectual and social improvement that would result to the wives and daughters of farmers through relief from the care and toil of the dairy. I do not know that in all my life I ever so earnestly desired the gift of eloquence as now, that I might clothe in appropriate and intelligent language the thoughts which seek for utterance.

I make no apology for appearing in behalf of the ladies, for if we can do anything to relieve the minds and hands of our wives from the cares and labors of the dairy, we shall do more to promote their ease and comfort, to elevate their social and intellectual standing, to make them happy and contented with their lot, than will be done by male costumes, strong minded lecturers, and the right of ballot combined, with a henpecked husband thrown in for each; for while the advocates of what is popularly known as "women's rights" are striving to make women discontented and dissatisfied with their circumstances, with nothing better to offer them instead, we open a plain and easy road to a pleasanter and happier life.

Most farmers in Maine, who are too far from market to sell hay and buy manure, wish to keep from five to eight or more cows, and taking into account the intimate connection that exists between a productive and profitable farm and a well filled hog-pen, and between a profitable hog-pen and plenty of skimmed milk and whey, they are well nigh compelled to do so.

Suppose you call upon one of these housewives on some of the long, sultry days of July or August, and ask her what difference it would make in her work to be relieved from the care of the milk, to have it sent out of the house each morning, and, save in the cash returns, to be known no more to her forever. Fancy the quick and incredulous look of inquiry, as much as to say, "Is such a thing possible?" Repeat your question, and she will tell you it would make all the difference in the world; the difference between a treadmill life of constant toil and drudgery and one of comparative ease and comfort. Now she rises at early dawn, and by the time her hasty toilet is completed and breakfast got under way, the milk is brought in (if, indeed, she is so fortunate as to be relieved from the milking itself, which I am happy to know is usually the case now.) The milk is to be strained and set by, then some ten or fifteen pans are to be skimmed, breakfast got ready and eaten; and then think of the array of pans, pails, bowls and skimmers to be put through a course of using, washing, scalding and sunning, which, together with the chamber work, sweeping, dusting, putting things "to rights" generally, and in the meantime having dinner under way, a luncheon for the men in the hay field, a dinner put up with all a mother's love and pride for the "wee bairns" to carry to school, with butter to work every day, the churning to superintend, churn and cream pots to wash, scald and scour three times a week, together with the thousand and one other items which go to fill up the time of the farmer's wife, keeping her completely occupied from early morn till dewy eve, leaving no time for intellectual culture or improvement, no time to make or receive calls, no time to read the papers and current literature of the day, no time for the house plants or flower garden, and, indeed, hardly time to sleep.

This is no fancy sketch, as too many of us know, but an every day reality. Is it any wonder then that the farmer's wife looks prematurely old? Is it any wonder our girls do not wish to stay at home? Is it any wonder the farmer's boy does not want to marry the girl he loves better than life itself and by settling upon a farm devote her to a life like this? Is it any wonder our rural towns show fewer inhabitants with each returning decade?

Suppose the farmer's wife was relieved entirely from her labors connected with the dairy, and the time and care now devoted to it given to intellectual and social culture and enjoyment of herself and children, should we not see a striking and happy change in the farmers' home? Should we not less often hear the sad complaint, "no time?" How the little ornaments and tasteful surroundings which a woman's fancy, or pride, if you will, for none of us would wish for a wife without it, I say how these little adornments would multiply! How quickly there would be an improvement in her children and in the comfort of herself and husband; for if it helped *him* in no other way it would ease his conscience wonderfully. How quickly the tired, careworn face of the wife and mother would light up with the smiles of quiet content. How ready she would be to take her place in social life, in the sanctuary and Sabbath school, from which she is now well nigh shut out, for the sole reason that she has no time for preparation.

Why, brother farmers, in looking over this subject I have almost come to the conclusion that if there was a well conducted cheese or butter factory within reasonable distance of my farm, I would be content to stick to farming in Maine, to wear out my life in tilling the fields which my father reclaimed from the forests, and dying, lay my bones beside his in my own quiet churchyard. And you will permit me to say in passing, that I verily believe that a two thousand dollar farm, well calculated for dairying, if in the vicinity of such a factory, would be worth at least three thousand; that the rise of real estate in the immediate neighborhood would pay the whole outlay of the operation, for every dairy farmer who knows the difference between living and staying would want the benefit of the association; and every farmer's wife with aspirations above the duties of a housemaid, would want her husband to sell out and go into the new El Dorado, where the ceaseless din and clatter of tin pans and pails, cream pots, churns, butter firkins, cheese presses, tubs and rennet jars is not heard, where in place of the cheese press and churn would be seen and heard the piano or cabinet organ, where the girls would be content to stay at home, and which would of course keep the boys there to, where the bright spring flowers bloom under the window, and the grapes hang in rich clusters beside the door, where the Ladies' Book and Mother's Journal are read, and where the children cluster around the old roof-tree as the dearest spot on all the earth, for there they would find society and privileges congenial to their tastes, and realize their ideal of what a home should be.

I have pictured no fancy sketch, for I well know from the observations of boyhood and of manhood something of the life of a farmer's wife, something of the reality of the picture drawn, and I hope to live long enough to see what is to be. If I had my life to live over again, rather than take the woman of my choice and settle down upon a farm in Kennebec, with a half dozen cows as one of the leading interests in my business, I would go into a cotton mill and toil till others had extracted all of value there was in me, and then lie down and yield up the life that was worth nothing to myself. But there is a brighter prospect for the next generation if in every suitable locality dairying shall be associated, and where this is not practicable, sheep husbandry will take the place of dairying. I have not asked whether there is more or less money in associated or in private dairying, for I do not think that consideration ought to weigh against the advantages I have named. Can there be any satisfaction derived from selling coupons when the very life blood of the wife of your bosom and the mother of your children is stamped into the bond? After your wife has scoured tin pans and pails till she has *scoured* her strength away, *turned* cheese till the raven locks of which you were once so proud are *turned* to silver, or *worked* butter till she has *worked* her life away, will the invested proceeds be to you a source of comfort and satisfaction, or will you feel, when you think of the halcyon days of youth, when you took her fair hand in yours and vowed to love, cherish and defend till death, as though you would fain throw down the thirty pieces, more or less, the price of youth, strength and vigor, and commence life anew under more favorable circumstances? But, say you, this cannot be: no this cannot be, for

"All yesterday is gone, its hours forever fled."

Our work is summed up each day and our only hope is to do better to-morrow, for

"We nightly pitch our moving tent
A day's march nearer home"

If we cannot retrieve the past, let us do what we can to atone for it, by opening a way for those who are to come after us to escape the failures and disappointments which have fallen to our lot.

It is all very well, and indeed may be eminently wise and patriotic and loyal to stand up for Maine, and to claim for her the combined advantages of all the other states; to predict for her a future that shall eclipse the imaginary Utopia of the sanguine dreamer, and to exhort our young men and woman to make her their home. Yet it is a fact nevertheless that by far the greater portion of our young people are leaving the home of their fathers, and that many who remain do so from the force of circumstances rather than from choice, and we all know that when a constant drain is made upon any state or country of the best of its bone, muscle and brain, its decay is only a question of time. Then to save the heritage of our fathers we must do something to keep our young men and women at home.

Think of the absurdity of sending our own boys and girls to people the Rocky mountain slopes and the far off shores of the Pacific, and then importing Scandinavians to take their places.

It may be all very well for them, but for me, if I can only be saved by such salt, I prefer to follow my boys across the Mississippi. Associated dairying, as has already been said, is no longer an experimemt, but wherever tried has proved a complete success. Shall it be put in operation in Maine?

Let the farmers of this most beautiful valley in all New England answer. If it can be successfully operated in Maine, and become general, it will do more to keep our young people at home than all the patriotic speeches that buncombe orators have made since the Fourth of July was thought of, or Bunker Hill put in the calendar. For the purpose of protecting and perpetuating that society and enterprize, which has been alike our pride and the whole country's blessing, I would sooner take a thousand of the hardy sons of Maine descended from the old stock which landed at Plymouth rock, than all the workmen between the Baltic sea and the Arctic ocean.

God save the State of Maine!

Adjourned till evening.

In the evening Prof. M. C. Fernald delivered the following lecture on

PLANT GROWTH.

In the hour allotted me, it is not my design to discuss the methods of growing potatoes, corn, rye or wheat, or any other special product, but to consider briefly some of the principles which pertain to the growth of plants in general.

It will be my endeavor not to enter upon the domain of science so far as to obscure the intimate relation between science and practice, yet far enough perhaps, to render obvious the fact, that the one may be in a high degree servicable to the other.

The microscope, revealing wonders in the minute forms of vegetable and animal life, has shown that all organized matter originates in the form of little vesicles or cells.

These are the elements or units of which every part of the vegetable structure consists. A plant is made up of individual cells somewhat as a house is made up of bricks, or a honey-comb of cells, only the plant has the power of constructing itself, of moulding its own materials into appropriate forms.

In the pulp of a ripe orange the cells are one fourth of an inch or more in diameter, but in most plants of the higher orders, they are not more than 1-1200 to 1-200 of an inch in diameter; so there may be from 8,000,000 to 1,728,000,000 of cells in the compass of a cubic inch. Their natural figure is spherical, but when pressed upon by other cells, they acquire a variety of forms; in a heap of spheres, those in the centre are pressed upon by twelve adjacent spheres, so in dense tissues, each cell is touched by twelve adjacent cells, and yielding to their pressure, appears twelve-sided when seen entire or six-sided (like cells of honey-comb) when viewed in cross section. Another form of cell is seen in the root hairs of plants, which are single, elongated, cylindrical cells, as also are the fibres of hemp and cotton.

The microscope has also revealed the structure of the cell itself, its wall, consisting of a delicate membrane, encloses a transparent fluid. Within the cell is a round gelatinous body called the nucleus.

Connected with this and lining the cell wall is a yellowish mucilaginious semi-fluid substance, known as the *protoplasm* or *formative layer*, from the fact that it is the portion of the cell first formed, and that from which the remaining portions are developed. This protoplasm is known to contain a vast number of minute granules, which in the living cell, move about maintaining a slow circulation. The fluid which distends all living and active cells, consists of water, which holds in solution chiefly gum, dextrin, the sugars, organic acids and various salts, and constitutes the sap of the plant. Vegetable tissue is formed by the aggregation of cells. The life of the plant is the sum of life in the individual cells. The growth of the plant consists in the enlargement and multiplication of the cells which compose it.

This process may go on slowly to all appearance as in the century growing tree, or rapidly as in the giant puff-ball, which attains a diameter of ten inches in a single night, and in which cells are produced at the rate of three or four hundred millions per hour, or it may be entirely suspended at times, as in the vegetation of our northern latitudes during the inactive period of winter.

Chemical changes go on constantly during the active existence of the plant, by which the contents of the cells are transformed into cellulose, lignin, starch, gum, gluten, vegetable casein, and other products of growth. The cellulose and lignin are deposited on the interior of the cell walls, thickening them and giving them fixed position and strength. The starch, gluten, &c., are stored in different parts of plants for future use. In most cases, the cells attain their full size in a brief period of time. The principal growth of plants, therefore depends upon the rapid and constant formation of new cells. The process of cell multiplication may take place, by division, by budding, which is a method of division, and by what is termed free cell-formation. In the first named process, the nucleus within the young and living cell divides into two parts, the line of division extending through the protoplasm, which infolds at the border until the opposite edges meet. Thus a single cell has become two active cells, with a nucleus in each; these two, by division become four, these in turn, eight, and thus the process may go on indefinitely. The growth of the cells continues by a further deposition of cellulose. In the process of budding, new cells spring from the side of the parent cell; and before attaining their full size, break away from it, in the case of one-celled plants, like yeast, or remain attached to it, forming a tissue, in the case of higher forms of plant life.

These processes of cell multiplication are peculiarly analogous to the methods of reproduction in some of the lower forms of the animal kingdom.

In the process termed free cell-formation, nuclei developed in the protoplasm of the parent cell, surround themselves with cell membrane of their own, and finally become independent by the resorption or death of the parent cell.

Notwithstanding the fact that the membranes of the cell reveal no apertures, even when examined by the highest magnifying powers, they are readily permeable to liquids. The farmer should not forget that all the processes of elaboration going on in the plant, take place within the net-work of cells, and that no substance can be taken into the plant and appropriated to its growth, which cannot pass through the cell membranes, or which, in other words, is not in the liquid or gaseous state. In the use of liquid manures, there is sound philosophy, which has been almost universally disregarded, for it is well understood that solid fertilizers, applied to the soil serve as plant food only as they are converted into the liquid condition and are thus absorbed. It may not be practicable, it may not be desirable, in a majority of cases, to make use of liquid fertilizers, and yet the question, whether or not they can be employed with profit, is one which may well engage the attention of the practical farmer; is a problem for the solution of which experiments may well be instituted.

You will remember that Mr. Mechi, on his farm at Tiptree Hall, has for many years adopted the method of converting all the manure of the stables into liquid, and by means of underground pipes and hose distributed it over his farm, and he pronounces the system profitable.

In tracing the life of the plant, we begin necessarily with the germination from the seed.

We may not fathom that wisdom which has implanted in the seed the power of germinating in moist earth, and of developing into a plant, which shall put forth leaves and flowers, shall produce seed, and when its appointed mission has been fulfilled, go down to decay!

We may not at all comprehend the phenomena of life in the vegetable world, and yet we may learn the conditions upon which vegetable life depends, the conditions most favorable for plant growth, and by the study of nature's processes, receive hints which may serve us in practical agriculture.

The conditions of germination we proceed to notice.

1st, *Temperature.* A certain amount of warmth is necessary that germination may take place.

Prof. Johnson gives as the lowest temperature for the germination of agricultural seeds, as determinnd by Sachs, 41° and as the highest temperature 116°. He adds, however, that "it is probable that some seeds will germinate nearly at 32°, or the freezing point of water, while the cocoa-nut is said to yield seedlings with greatest certainty when the heat of the soil is 120°."*

The most rapid germination occurs between 79° and 93° as appears from the following table (From Prof. Johnson's How Plants Grow, p. 313) giving the special temperature for six common plants:

	Lowest Temperature.	Highest Temperature.	Temperature of most rapid germination.
Wheat	41.° F.	104.° F.	84.° F.
Barley	41.	104.	84.
Pea	44.5	102.	84.
Maize	48.	115.	93.
Scarlet bean	49.	111.	79.
Squash	54.	115.	93.

A range of temperature of from 55° to 90° is given as adapted for the healthy and speedy germination of the agricultural plants of New England.

Thorough drainage of land, by removing superfluous water and allowing the ingress of air and warmth, can but exercise the most favorable influence upon the germination of seeds. The season may thus be rendered earlier by several days and perhaps weeks, and the advantage thus gained may determine between success and failure in the crop.

2d, *Moisture.* A certain amount of moisture is necessary for germination as well as for growth. A half-sprouted seed allowed to dry will cease to grow. The seeds of aquatic plants germinate most readily when immersed in water, but the seeds of land plants require simply to be moist in order that a healthy germination be secured.

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*For facts and figures we desire to acknowledge indebtedness to Prof. Johnson's, How Crops Grow, Stockhardt's Agricultural Chemistry, Liebig's Laws of Husbandry, Waring's Handy Book of Husbandry and Waring's Elements of Agriculture.

3d, *Light.* An impression generally prevails that light is injurious to germination—that seeds must be kept in the dark, or be covered, in order to germinate readily. In nature we observe no provision for covering seeds, but on the other hand they are permitted to fall upon the surface of the ground, and readily germinate while half covered or wholly exposed to the light. Experiments have shown that the seeds of our common agricultural plants are influenced by light in no very appreciable degree during germination.

4th, *Air.* The presence of air or of oxygen seems to be necessary for the process of germination. It has been demonstrated by Saussure that it is impossible for germination to proceed in an atmosphere of other gases. Indeed, there is good reason for believing that the oxygen of the air is the actual agent in setting in operation those chemical forces which result in the development of the germ within the seed.

In connection with the conditions of germination, the proper depth of sowing should be considered. The covering of seeds in the ground, serves to prevent their drying, and protects them from birds; the soil serving as the medium to supply warmth and moisture, and permitting ingress of air, but beyond this, it exercises no essential influence on germination. Experience in temperate regions has determined the appropriate depth of the larger number of agricultural seeds to be from one to three inches. The proper depth, however, must depend upon a variety of circumstances. In light and porous soils, seeds may be sown at a greater depth than in heavy and close soils. The condition of land as to drainage and exposure to the sun, would very properly modify the depth at which seeds should be deposited.

An experiment detailed by Prof. Johnson (How Crops Grow, p. 317), will be of interest in this connection. "R. Hoffman, experimenting in a light loamy soil, upon twenty-four kinds of agricultural and market garden seeds, found that all perished, when buried twelve inches. When planted ten inches deep, peas, vetches, beans and maize, alone came up; at eight inches there appeared besides the above, wheat, millet, oats, barley and colza; at six inches those already mentioned, together with winter colza, buckwheat and sugar-beets; at four inches of depth the above and mustard, red and white clover, flax, horse-radish, hemp and turnips; finally, at three inches, lucern also appeared. Hoffman states that the deep planted seeds, generally sprouted most quickly, and all early differences in development disappeared before the plants blossomed."

The immediate object of depositing seeds in the ground as regards germination, should be kept in mind, viz: to secure requisite conditions as to warmth and moisture.

The time required for germination depends upon the kind and size of seed, and the condition of the soil as to porosity, warmth and moisture, and the depth of sowing; seeds that have thin coverings and abound in starch, germinate most readily. Those that have thick and tough envelopes, as well as oily seeds, germinate slowly. Large seeds require more time in which to complete the process of germination than do small seeds, inasmuch as they have larger stores of nutriment upon which the germ may draw, and hence are not so soon exhausted.

There *are* seeds which begin to germinate within twelve hours after falling to the ground. The willow furnishes an example. Most grains, however, as wheat, barley, oats and clover, germinate in three to five days. "The fruits of the pine and the walnut, sprout in four to six weeks, while those of the beech and maple, are thought not to germinate until one and a half or two years have expired."

Different kinds of seeds retain their vitality for very unequal periods of time. The seeds of the willow are said to lose their power of germination in two weeks after maturity, and never to germinate after having been dried. Peas have been raised from seed estimated to be three thousand years old. These are extremes, and by them one cannot be guided. Seeds of plants having agricultural value are generally regarded better when new than when old, although melon seeds kept several years are thought to yield larger returns in fruit than fresh seeds, which give rise to plants that run to vines.

The following table is instructive upon the subject of duration of vitality in seeds. (How Crops Grow, p. 306). Per cent of seeds that germinated in 1861 from the years:

	1850.	1851.	1854.	1855.	1857.	1858.	1859.	1860.
Wheat,	0	0	8	4	73	60	84	96
Rye,	0	0	0	0	0	0	48	100
Barley,	0	0	24	0	48	33	92	89
Oats,	60	0	56	48	72	32	80	96
Maize,	0	not tried.	76	56	not tried.	77	100	97

Seeds can be kept, undoubtedly, for an indefinite period of time, and retain their vitality, if protected from insects and the action of air and moisture. If thoroughly dried and enclosed in sealed vessels their power of germination may continue for ages.

A word upon the subject of selection of seeds will be in place. Baron Liebig (Natural Laws of Husbandry, pages 23 and 24) asserts that "The development of a plant depends upon its first radication, and the choice of proper seeds is therefore of the highest importance for the future plant." Further on he states that "A mixture of seeds unequal in their development or differing in the quantities of amylum (starch), gluten and inorganic matters which they severally contain, will produce a crop of plants as unequal in their development as the original seeds from which they sprung. The strength and number of the roots and leaves formed in the process of germination are (as regards the non-nitrogenous constituents) in direct proportion to the amount of amylum (starch) in the original seed."

Although the correctness of the latter statement may not have been fully sustained by later experiments, yet the farmer well understands there is an advantage which he cannot afford to disregard on the side of *plump, dense* seeds. From such seeds the germ is abundantly supplied with the materials for development, and the young plantlet thus started sends down vigorous roots into the soil, and unfolds healthy leaves to the air, and thus the sooner is in condition "to shift for itself." When once independent of the parent seed, it draws all its nourishment from the earth and from the atmosphere. The entire plantlet now consists of root, stem and leaves, and through and by these organs the processes of growth must henceforth be carried on.

Liebig says a proper knowledge of the radication of plants, is the ground work of agriculture; all the operations which the farmer applies to his land, must be adapted to the nature and conditions of the roots of the plants, which he wishes to cultivate. On the root he should bestow his whole care; upon that which grows from it, he can no longer exert any influence.

Therefore to secure a favorable result to his labors, he should prepare the ground in a proper manner for the development and action of roots. The root is not merely the organ through which the growing plant takes up the incombustible elements of food, required for its increase, but it may in another not less important function, be compared to the fly-wheel in an engine, which gives regularity and uniformity to the working. It is in the root that the material is stored up to supply the growing plant with the needful elements for conducting the processes of life, according to the requirements made upon it by the action of light and heat.

The fibrils of the root extend in the direction of the least resistance, and hence roots formed of fine fibres can be developed but imperfectly in stiff, heavy soils; such soils need sand and complete pulverization. The deeper and the more thorough the pulverization of the soil, the more easily will the spongioles of the roots penetrate it, and the more perfectly will the nutritious liquids it contains be absorbed and appropriated to the growth of the plant.

The farmer also should not fail to recognize the fact that he owns his land to an indefinite depth, and should not hesitate to put in the plow deeper and deeper, year after year, applying organic and other fertilizers at the same time, until he has secured to his growing crops, the advantage of easily obtaining all the lime, all the potash and all the phosphates, that can be made available from the subsoil.

The wide or deep range that roots will take in a fertile soil, if unresisted, is surprising. The roots of clover have been known to extend six feet, of winter wheat in a light subsoil seven feet, and the roots of lucern, even thirty-feet. The manner of extension, depends upon the character of the soil as to fertilizing properties. Roots which grow in poor sandy soils, are long and slender, and send out but few rootlets, while fertile spots in the soil, as those where bones are decomposing, are frequently found completely covered and penetrated with large and vigorous roots.

Prof. Johnson (How Plants Grow. p. 240,) mentions experiments bearing upon this point, an account of which will be of interest. He says, "Noblue has described some experiments which completly establish the point under notice. He allowed maize to grow in a poor clay soil, contained in glass-cylinders, each vessel having in it a quantity of a fertilizing mixture, disposed in some peculiar manner, for the purpose of observing its influence on the roots.

When the plant had been nearly four months in growth, the vessels were placed in water, until the earth was softened, so that by gentle agitation it could be completely removed from the roots. The latter, on being suspended in a glass vessel of water, assumed nearly the position they had occupied in the soil, and it was observed that where the fertilizer had been thoroughly mixed with the soil, the roots uniformly occupied its entire mass. Where the fertilizer had been placed in a horizontal layer at the depth of about one-inch, the roots at that depth formed a mat of the finest fibres. Where the fertilizer was situated in a horizontal layer at half the depth of the vessel, just there the root system was spheroidally expanded. In the cylinders where the fertilizer formed a verticle layer on the interior walls, the external roots were developed in numberless ramifications, while the interior roots were comparatively unbranched. In pots, where the fertilizer was disposed as a central vertical core, the inner roots were far more greatly developed than the outer ones. Finally, in a vessel where the fertilizer was placed in a horizontal layer at the bottom, the roots extended through the soil as attenuated and slightly branched fibres, until they came in contact with the lower stratum, where they greatly increased and ramified. In all, the principal development of the roots, occured in the immediate vicinity of the material which could furnish them with nutriment."

There is no special searching for food, as if by instinct, on the part of the roots in such cases. The plant simply sends out roots in all directions, and those that come in contact with food, appropriate it, and thrive upon it, and thus ramify and enlarge, while those roots that do not find nourishment, remain undeveloped or die. Those portions of the root which possess absorbing power, are formed of very soft and delicate cells. The prevailing notion that absorption takes place through the ends of the root, is incorrect. The most vitally active portion, is a little within the extremity, not exceeding the one-sixth of an inch.

The extent of absorbent surface in the case of most roots, is vastly increased by the root hairs, which establish a very intimate connection with the particles of the soil. The absorbent force of the root is largely influenced by temperature, increasing as the sun of the morning warms the soil, and diminishing as the sun declines. The idea which has long prevailed, that roots possess the power of rejecting or excreting the matters absorbed, which cannot be appropriated to plant growth, is regarded as questionable. Recent investigations seem to show that the roots of healthy plants, not at all possess such power. The plant, however, undoubtedly exercises in a degree, selective power, in absorbing salts dissolved in water, independently of the absorption of the water itself. Besides the offices of the root already indicated, viz: the fixing and maintaining of the plant in the soil, and the absorption of nutriment from the soil, for the growth of the plant, the root in the case of many plants, especially biennial plants subserves another important purpose, viz: as a storehouse of food to supply the wants of flowers and seed which are developed another year. Fleshy roots, like the carrot, beet and turnip, take up nourishment from the soil by means of delicate rootlets which issue from all parts of the main or tap-root, and which are exceedingly active as absorbing agents. Instead of allowing such plants to attain the end of all plant life, viz: the production of flowers and seed, man generally appropriates the pectose, sugar, and other materials stored in the fleshy roots, for his own purposes, and this he does not unfrequently year after year, making no returns to the soil, and then wonders why his land should beome exhausted.

For our present purpose the structure and office of the stem demands no special consideration. We will not forget, however, that the stem has one most important function in admitting the passage to the leaves of water and mineral matter received through the roots of the plant, and allowing at the same time the downward transfer to the roots of materials of growth gathered by the leaves from the atmosphere.

An organ not less important than the root in the economy of plant life is the leaf. The covering or epidermis of the leaf is provided with a vast number of breathing pores or stomata through which a communication is established between the intercellular spaces in the interior of the plant and the outer atmosphere. The stomata are not found on portions of leaves which come in contact with water, and hence are not found on the submerged leaves of aquatic plants. Their number is comparatively small upon the upper surfaces of leaves in the case of land plants, but on the lower surfaces of green leaves they exist in great abundance. On an apple leaf of average size 100,000 may be counted. "They are said to vary in number from less than 1,000 to 170,000 to the square inch of surface." (Gray's Lessons in Botany, p. 157.)

Through the stomata of the leaves a large amount of water, drawn into the plant from the soil by means of the roots, is exhaled in the form of invisible vapor. At the same time air is freely admitted into the interior of the plant together with certain gases which furnish the principal materials for the organization of vegetable matter.

We thus perceive that the plant is provided with two sets of feeding apparatus, the leaves (and with these for feeding purposes the green bark should be reckoned) and the roots. The former absorb carbonic acid from the air, which is decomposed, the carbon appropriated in building up the plant structure, and the oxygen returned to the atmosphere, while the latter absorb from the soil necessary mineral matters, carbonic acid and ammonia.

Burn a plant, and the larger portion of it escapes into the atmosphere, for from the atmosphere the elements which made up its structure were largely drawn. The atmospheric elements, as they are termed, are carbon, oxygen, hydrogen and nitrogen, although not all of these are taken by the plant directly from the air. Indeed, but one, viz: carbon, is directly appropriated from the atmosphere for plant growth. Oxygen and hydrogen enter by the roots in the form of water. Nitrogen is also taken up by the roots, principally in the form of ammonia. Although from its volatile character ammonia is constantly escaping into the air, yet it is brought again to the earth by every rain, and is held more or less securely by entering into combination with carbonic or some other acid. Wonderful it is, that while plants are surrounded by an ocean of oxygen and nitrogen (the principal components of the atmosphere) they obtain neither of these elements directly from the air, but from compounds absorbed through their roots. Two other elements, sulphur and phosphorus, may be regarded as belonging to the destructible or volatile part of plants.

The ashes of plants, making but a small percentage of the dry weight, contain the inorganic or earthy constituents. Adopting the classification of Waring (Elements of Agriculture,) the earthy portion of plants may be divided into three classes of substances, alkalies, acids and neutrals. The alkalies embrace potash, soda, lime and magnesia; the acids, sulphuric, phosphoric and silicic acids; the neutrals, oxide of iron, oxide of manganese, and the element chlorine. Of these inorganic constituents, iron, manganese, chlorine, sulphuric acid, silicic acid, magnesia, lime and soda, need ordinarily give little care to the farmer. They exist primarily in the soil, and are generally supplied in ordinary farmyard manures in sufficient quantity to subserve the purposes of growth in plants. If a large amount of chlorine or soda is wanted for special crops requiring these constituents, both may be supplied by applying to the soil common salt; if silica is wanting, as is frequently the case with clayey soils, especially if grains are to be grown upon them, the deficiency can be made good by supplying sand. The special inorganic constituents, therefore, which must engage the thought of the farmer, and which he must carefully plan to supply, are potash and phosphoric acid. Of the so called atmospheric elements, carbon is derived from the carbonic acid of the air, oxygen and hydrogen from water, while nitrogen alone remains as an element indispensible in the economy of plant life, and yet most difficult to secure.

Without a proper management of these three substances, viz., nitrogen, potash and phosphoric acid, no farmer can be in a high degree successful. He grows no plant upon his farm which does not contain them; he sells no product from his farm, vegetable or animal, which does not carry them away, and he has no soil rich enough to endure for any considerable period of time the draft made upon it for these substances, by plant growth, without losing its fertility. They must be resupplied or exhaustion follows.

Mr. Waring, before quoted, cleverly says, "Whatever course of cultivation he (the farmer) pursues, he should never lose sight of these elements, and he should pay no greater heed to the dollars and cents that he receives and pays out than to the *nitrogen, phosphoric acid* and *potash* which constitute his real available capital, and whose increase and decrease mark the rise and fall of his true wealth."

The amount of nitrogen contained in 1000 pounds of each of the following articles is given in the table, based upon the experiments of Boussingault. (From Waring's Handy Book of Husbandry.)

Wheat	23 lbs.	Peas	42 lbs.
Wheat straw	4 "	Pea straw	23 "
Rye	27 "	Potatoes	15 "
Rye straw	3 "	Beets	17 "
Oats	22 "	Turnips	17 "
Oat straw	4 "	Red clover hay	21 "

From the table it would seem that the principal demand of nitrogen in case of the grains, is for the development of the kernel, the amount in straw being comparatively small.

The general sources of supply of this important element to vegetation are ammonia and nitric acid, or the nitrates. In the decomposition of vegetable and animal matters their nitrogen is evolved sometimes in combination with oxygen, in the form of nitric acid, but more generally in combination with hydrogen in the form of ammonia. In the former case the nitrogen is retained for plant purposes, since the nitrates formed are readily dissolved and absorbed. It is the latter constituent, however, the ammonia, which gives great value to all animal manures. While ammonia and nitric acid are supplied to plants by nature's processes, yet the large growth desired by the farmer is, in general, secured only by such cultivation as shall increase the absorption of ammonia from the atmosphere, or by applying it in the form of manures. This end can be attained only by thorough drainage, complete pulverization of the soil, and that wise and judicious economy which saves *everything* that can serve as a manurial agent, and appropriates it to the demands of the growing crop.

The amount of potash contained in 1000 pounds of the ashes of various agricultural products appears in the table below. (From Waring's Handy Book of Husbandry.)

Grain of wheat (average of six analyses)	237 lbs.	Grain of beans	462 lbs.
Grain of Indian corn	250 "	Hay	300 "
" " rye	220 "	Clover	161 "
" " oats (with shell)	123 "	Potatoes	515 "
" " buckwheat	87 "	Beets	390 "
		Tobacco leaves	264 "

One ton of red clover removes from the soil thirty-one pounds of potash, an amount which would be restored by the application of twelve and a half bushels of unleached oak-wood ashes. One ton of potatoes removes from the soil twenty-eight pounds of potash. Five tons would be a moderate yield for an acre, therefore one hundred and forty pounds of potash at least would be abstracted for every acre of potatoes, an amount which would be restored by applying fifty six bushels of unleached oak wood ashes to the acre.

It is true that few crops exhaust land of potash to the extent that do potatoes. (The fact that one crop demands largely one constituent of the soil, and another another, is the basis of the idea of rotation of crops.) Although potash is restored to land by the application of all kinds of manures, and especially by the use of swamp muck or seaweed, yet the most available source is unleached wood ashes.

A farmer designing to maintain his land in fertility cannot afford to sell ashes, but on the other hand can afford to pay at least twenty-five cents a bushel for all the unleached hard-wood ashes he can secure.

The following table gives the amount of phosphoric acid contained in 1000 pounds of the ashes of each of the following substances. (From Waring's Handy Book of Husbandry.)

Grain of wheat (average of six analyses)	498 lbs.	Hay	120 lbs.
Grain of Indian corn	501 "	Clover	63 "
" " rye (average of two analyses)	490 "	Potatoes	113 "
Grain of oats (with shell)	149 "	Beets	60 "
" " buckwheat	500 "	Milk	217 "
" " beans	357 "	Lean meat	300 "
		Bones	390 "

The amount of available phosphoric acid in the soil is small, for the larger part of what the soil contains is in compact clods or locked up in the interior of pebbles, where no root can penetrate. Grain and meat producing crops exhaust land very rapidly of available phosphoric acid. It is probable that in nine cases out of ten when the soil has been exhausted by improper husbandry it is phosphoric acid or phosphates that are most needed.

In Waring's Handy Book of Husbandry we read, "From Maine to Minnesota the gradual advance of "*enterprise*," that sort of enterprise which as it passes from east to west reduces the yield of wheat from thirty to twelve bushels per acre, has been marked by the taking up of new lands, by the production of good crops for a few years and of a precarious subsistence for a few more, and by the destruction of the profitable fertility of the soil within the lifetime of the second generation,—all through ignorance or disregard of the value of phosphoric acid, and of the limited ability of the most fertile soils to supply it to consecutive crops."

Phosphoric acid, as appears from the table given, forms about one-half of the ashes of wheat, corn, rye and buckwheat, and it forms nearly the same proportion of the ashes of peas, beans and barley, nearly twenty-two per cent. of the ash of milk, thirty per cent. of that of lean meat, and a very large proportion of the bones of animals, and yet exists in the soil in only small quantities that are available.

It has been estimated that every hundred bushels of wheat removes from the soil sixty pounds of phosphoric acid, and that for every cow kept on a pasture during the summer there is carried off in veal, butter and cheese, not less than fifty pounds of phosphate of lime on an average. It is no wonder that old dairy pastures become exhausted of this substance, and refuse to yield nutritious grasses, unless by judicious top-dressing it be restored to them. Aside from the liquid and solid excrements of animals, guano and phosphoric deposits, the most available source of phosphoric acid is from the bones of animals. They contain about fifty per cent. phosphate of lime.

The manner in which phosphates are used as manures determines in a very great degree their efficiency. The finer the particles the more active and valuable the fertilizer. Bones can be reduced in no better way than to manufacture them into what is called superphosphate of lime, a compound richer in phosphoric acid, but containing less lime, than does the simple phosphate. A simple process of composting bones with ashes, by which their decomposition is secured, is given in Waring's Elements of Agriculture:

"They should be placed in a water tight vessel; first three or four inches of bones, then the same quantity of strong unleached ashes, continuing these alternate layers until the cask is full, and keeping them *always wet*. If they become too dry they will throw off an offensive odor, accompanied by the escape of ammonia, and consequent loss of value. In about one year the whole mass of bones (except perhaps those at the top) will be softened so that they may be easily crushed, and they are in a good condition for application to the land. A little diluted sulphuric acid occasionally sprinkled on the upper part of the matter in the cask will prevent the escape of the ammonia."

Dr. Nichols, of the Boston Journal of Chemistry, gives the following method of preparing bones for application to the soil:

"Take one hundred pounds of bones, beaten into as small fragments as possible; pack them in a tight cask or box with one hundred pounds of good wood ashes. Mix with the ashes before packing twenty-five pounds of slaked lime, and twelve pounds of sal soda, powdered fine. It will require about twenty gallons of water to saturate the mass, and more may be added from time to time to maintain moisture. In two or three weeks the bones will be broken down completely, and the whole may be turned out upon a floor and mixed with two bushels of dry peat or good soil, and after drying it is fit for use."

True farm economy restores to the soil in sufficient quantity all the inorganic elements removed from it by plant growth. The ordinary methods of husbandry, however, are still wasteful of the phosphates, and must ultimately lead to impoverishment. By judiciously saving and applying all the manures produced from his crops the farmer may return to the soil in due amount all the needed earthy constituents of plants, save those which have been carried away in the bones of his animals. These can be restored only as the bones or their equivalent are brought back.

Let the farmer develop the resources there are in his sink spout, let him appropriate night-soil, let him build his barn cellar never so tight, so that all the solid and liquid excrements of his stock be retained, and yet without the bones of his animals he does not make returns of plant food to his soil equivalent to the amount taken away, and his farm economy is still that of ultimate exhaustion. Let the wealthiest man of your community send to-day to the bank his check for a thousand dollars and it will be honored, let him send another to-morrow and it will be honored, let him send the next day and it will still be honored; but the time *will* come if he continues to draw upon the bank and makes no returns when his checks will be honored no longer. Just so the farmer who draws upon the fertility of his land year after year, without making complete and ample returns, finds at last that his demands upon it are no longer honored. He has become agriculturally if not financially bankrupt. How many bankrupt farms may be seen in our own State, not to say in New England, their former owners or occupants in the West, impoverishing farms there as they have so successfully done here, all by that ruinous system of husbandry that demands from the soil large crops without making to it adequate returns.

Our people seek new lands that they may draw upon *their stored resources* for crops, but with the most fertile lands of the country occupied as they now are the time is coming and is not very distant when farmers will be forced to adopt modes of cultivation based upon an intelligent interpretation of the laws of demand and supply, modes of culture which shall be competent to renovate old worn out farms, and to maintain them when renovated in conditions of perpetual fertility.

England produces seldom less than twenty-six and on the average twenty-eight bushels of wheat to the acre. The average in our country is less than one-half of the lowest of these figures. The farmers of densely populated England have been learning by experience the law of equivalents in agriculture, and although they allow vast volumes of manure to be poured into the sea, they are engaged in quarrying phosphatic rocks, and even in ransacking the battle fields of Europe for human bones with which to maintain the fertility of their soils.

China and Japan have supported their teeming millions in comfort and plenty for thousands of years without importation from any foreign source whatever. Their bread is now raised from fields which have been under cultivation for uncounted ages. To these they dedicate every scrap of fertilizing material they are able to save by the most scrupulous care. Well would it be for the farmers of Maine, for the farmers of New England, for the farmers of this broad land we call our own, to vie with the inhabitants of the distant East in a system of farm economy so just to the soil and so remunerative to its possessor!

In efforts to extend a system of husbandry which shall be entirely consistent and self-sustaining, which shall fully recognize nature's immutable laws, a large and inviting field of labor is open to every institution and body of men willing to do service in the interest of the present and coming generations.

To this work the members of the Maine Board of Agriculture have earnestly devoted themselves in the past, are devoting themselves now, and will continue, let us trust, to devote themselves in the future. What temporal labor more important can enlist their energies, and what time more fitting to renew their devotion to it, than at the commencement of this blessed year of eighteen hundred and seventy-one!

Prof. Peckham. A matter was suggested by remarks made by Prof. Fernald which I have seldom seen adverted to, and which is important. I allude to the action of carbon in the soil in absorbing ammonia from the atmosphere. I will illustrate what I wish to say by describing an experiment frequently performed in a course of lectures upon chemistry. When we prepare gaseous ammonia, and introduce into the vessel containing it a fragment of charcoal which has been recently burned, we find that the charcoal rapidly absorbs the ammonia. It will absorb many times its bulk. Now, when a log of wood, or wood in any form, undergoes decomposition, upon or near the surface of the soil, in a certain stage of its decomposition it passes through a condition of partial disintegration, during which it possesses the power of absorbing ammonia to a large extent. No matter what the condition of the soil may otherwise be, the effect of depriving it entirely of vegetable matter is to deprive it of one very important means by which it is capable of absorbing from the atmosphere a portion of the food necessary for plants. It is found that by placing charcoal about the roots of fruit trees they are assisted in their growth, while it can be easily demonstrated that the charcoal is not decomposed. The explanation is, that the charcoal absorbs ammonia from the atmosphere, and the rains which fall carry it down; and if the soil contains sawdust or any decaying woody fibre it would take up ammonia, which would be washed out in precisely the same way. I make these remarks to show the importance of introducing into the soil a considerable amount of woody fibre, either in the form of barnyard manure or in some other form, to assist in furnishing materials for the growth of plants.

QUESTION. Would the sawdust which has been floated down the Penobscot, and now lies in the river, be useful as an absorbent?

PROF. PECKHAM. If enough was introduced into the soil to produce acidity, by fermentation, it would probably injure the soil; but a proper amount applied to soil which is destitute of sufficient organic matter, would improve it.

COL. SWETT. When I commenced farming, I went on to a farm where charcoal had been burned, and I well recollect that the crops were twice as large there as in other places. I never put any manure on those spots. I could get heavier crops from them without manure than I could from the rest of the soil with manure.

PROF. FERNALD. I will allude to one point which was not touched upon in my lecture. From what I said, it would appear that the principal if not the only source of the carbon in the plant structure is the atmosphere. The leaves take in carbonic acid from the atmosphere and it is decomposed, the carbon appropriated in the structure of the plant, and the oxygen returned to the atmosphere. Now, besides this source of carbon, there is undoubtedly another by which carbon is introduced through the roots, namely, from carbonates in the soil.

MR. ROBINSON. I understood the lecturer to say that swamp muck was effective in restoring to the soil some of the elements which are exhausted by the growth of vegetation. I would like a further explanation.

PROF. FERNALD. When swamp muck is decomposed in the soil you get from it essentially what you would get from the ashes of plants. If by applying ashes you would obtain potash, you would also obtain it in applying muck, although you would be obliged to apply a larger quantity of muck than of ashes, because everything has been driven off from the ashes except the inorganic constituents; in muck you have the organic constituents with the others.

Mr. Robinson. That is, a given quantity of swamp muck contains a given quantity of potash, and other elements of plant food?

Prof. Fernald. Yes, sir.

Mr. Robinson. Can science determine how much potash is contained in a given quantity of muck?

Prof. Fernald. It can be determined by analysis. The amount would depend very much upon the character of the vegetable fibre from which the muck has been formed.

Mr. Robinson. We are told that a plant absorbs carbonic acid, uses the carbon and rejects the oxygen. May it not absorb ammonia from the atmosphere?

Prof. Fernald. That is a somewhat doubtful point, but the weight of evidence is decidedly that plants do *not* absorb ammonia from the atmosphere.

Sec. Goodale. The inquiry has been made if the application of muck to the soil would supply potash. Undoubtedly it would, but only to a small extent, because muck is mostly formed from plants which contain very little potash. Muck varies materially in its composition. There is some which originated from the leaves of deciduous trees, which is very rich. We have also that which is formed from the mosses, which is very poor, and which is of little value except when dry, and used as an absorbent for liquid manures. We know, too, that peat ashes,—the ashes of dried muck which is used for fuel,—are of some value, but they are feeble compared with wood ashes. And this leads me to offer a remark in connection with this locality. My impression is that a large amount of ashes, especially leached ashes, is sent away from here. I had occasion to use some leached ashes last summer, and on inquiry, I was told that a trader in town had several car loads from the town of Farmington, for sale at twenty-five cents a bushel. I could buy leached ashes made in town for fifteen or twenty cents a bushel, but I took two hundred bushels of the ashes that came from here, for the reason that the ashes from this region were made from hard wood, while those at home were from soft wood, spruce, hemlock, &c.

Now, while it is true that potash is a very important constituent of plants, one that is annually taken from the soil, and must be restored in order to keep up full fertility, and while it is also true that leached ashes have been deprived of nearly all the potash which is soluble, there is still some remaining in the ashes, in an insoluble state, which although not immediately available by plants, is gradually released by weathering; so that when you apply leached ashes, you apply that which gradually and slowly yields potash. Another thing which you sell in leached ashes, and which has been referred to as a very important constituent of plants, is phosphate of lime, just the same article which is found in bones. In fact, the chief value of leached ashes consists in the phosphate of lime and the carbonate of lime, which is in them. I do not object to your sending away leached ashes to fertilize other parts of the State if you choose to do so, but if they can afford to buy, and pay the cost of transportation in addition to the price which you get, you can certainly afford to keep them at home. If your lands are richer now than ours, the time will come when, if you continue to send out that which furnishes the constituents of fertility, you will repent. It would be more economical to keep up your lands by the application of cheap ashes, than to buy superphosphates or import any of the phosphates which a kind Providence has deposited in various localities. As long as you have these ashes, you ought to make the best use of them. This is eminently a practical point for the people of this vicinity, as well as a scientific one.

Mr. Robinson. Will the Secretary inform us what is the relative value of leached and unleached ashes?

Sec. Goodale. That is a question to which no specific answer can be given. Ashes, both leached and unleached, vary in value exceedingly. The ashes of some plants and trees are rich in potash and phosphates; others are poor. As a general rule, the ashes of hard wood are better than those of soft wood; and the ashes of pine are richer than those of spruce. Again, the value depends upon the use to be subserved by them. If soluble potash is required, unleached ashes are much the best, are worth double and more; on the other hand, if phosphates are what is most wanted the leached are nearly or quite as good. For correcting acidity in the soil or for composting with muck, unleached are much better than leached. Much sawdust and refuse wood is used now for fuel for driving steam engines, especially on the Penobscot and Kennebec, since the law requires that all this stuff which formerly went into the stream shall be burned. In such cases very high chimneys are used, having a powerful draft, which takes up the finer particles and carries them to great distances. What is left is largely silicate of potash, which is not a great deal better than sand, even when not leached. Some experiments were tried at Orono with ashes of this sort and they were found worthless.

PROF. PECKHAM. A sample was brought me last spring from one of those furnaces, and I was asked to test it for potash. I examined it only for soluble potash. I could not even obtain enough potash for a test by the spectroscope, from that sample. There was absolutely no soluble potash at all. I don't know how much insoluble potash there was.

PROF. FERNALD. Some of those ashes were applied upon a piece of pasture land, and by the side of that patch was another upon which common wood ashes were applied, and adjacent to it another to which no ashes were applied. The result was, where the common wood ashes were applied the growth was abundant; where the ashes from the furnaces were applied there was no perceptible increase of growth over that where no ashes were applied. They had no effect at all.

SEC. GOODALE. Those ashes would not be reduced in value by leaching. Ashes vary very much in the amount of potash and phosphate of lime which they contain, and when you apply good unleached ashes on soils where soluble potash is wanted, they are worth all that the soluble potash in them is worth in addition to what the same would be worth if leached. There ought to be three or four pounds of potash in a bushel of hard wood ashes, and that ought to be worth a quarter of a dollar. In such case, unleached ashes are worth much more than leached. But there are cases where you want chiefly the phosphate and carbonate of lime which they contain, and in such cases you will find the man who uses leached ashes say, "I would pay as much for leached ashes as for unleached." Perhaps *he* can afford to do so, but it is not because they would be equally good for all uses. They do not contain the potash that another man needs; and another man may say with equal truth that one bushel of unleached ashes for his purpose is worth half a dozen bushels of leached. The value depends upon the want to be supplied. One will supply one want, and the other will supply two wants. If only one want is to be met, supply it at the least cost. There are many things to be taken into consideration in estimating the value of ashes.

Again, as Prof. Fernald intimated, an indirect effect of applying soluble potash to the soil is the liberation of phosphoric acid existing in the soil in an insoluble state. All soils are made originally from rocks, which have been ground down by the glacier, the weather, and other natural processes. Nearly all soils contain more or less of phosphoric acid in some insoluble form, and the application of potash will assist in liberating it. The converse is also true. If you have a soil which contains potash in an insoluble form, say from feldspar, which forms a part of granite, and you put on an acid phosphate of lime (commonly called superphosphate,) which contains the equivalent of free phosphoric acid, that will act upon it, and liberate the potash. Undoubtedly much of the effect which we get from manures is indirect. The way in which manures operate is an intricate subject, and in many aspects a very obscure one. Notwithstanding all the light that science has thrown upon it, what we know is very little compared with what we do not know.

Mr. Tarbox. I am a farmer in North Franklin, and I was glad to have the Secretary call attention to the value of ashes. It is a fact that ashes are hauled twenty miles to this town, leached, and sent to the western extremity of the State. This ought not to be. But we have improved in regard to ashes. Up to about thirty years ago, potash factories were constructed close to the Sandy river, and the ashes were thrown out and washed away. But Major Dill, who has done so much for agriculture in this county, when he bought the potash factory at Phillips, some thirty years ago, saved the leached ashes, and put them upon his land, and it was surprising what great crops of wheat, oats and grass his land produced. The farmers learned much from that trial.

Many wonder that I get so good crops of wheat as I do, usually twenty bushels to the acre. When I have land which is not quite rich enough to produce a good crop of wheat, I apply unleached ashes, and I find they pay me better than any other fertilizer I can get. I put on about twenty-five bushels to the acre, and it adds at least one-third to the crop. We ought not to let ashes go out of the county. It is very poor economy.

I want to inquire how we can best bring muck into use so as soonest to get the benefit of it. If muck is worth as much as some say it is, many farms can be brought up by that agent cheaper than by anything else. We know that if muck is put upon land in a raw state, it is some time before we see much benefit; the first year, hardly any; the next year, but little; when it is mixed with other manures we get immediate benefit from it. Will the Secretary tell us how muck, fresh from the swamp, can be made into food for plants in the speediest and cheapest manner?

SEC. GOODALE. As I remarked before, when we speak of muck we talk of something which is exceedingly variable in its character. In some places you will find swamp muck which is injurious. I have known some kind in my own town, and if you look into Dr. Jackson's third report on the "Geology of Maine," you will find he speaks of muck which he found in Saco which, when applied to the soil, seemed to do good at first, but in a few weeks proved injurious. As the owner, Mr. Jordan, said, "it first makes the corn grow and then eats off its roots and kills it." The trouble proved to be that it contained a corrosive salt of iron, and the evil was corrected by the addition of quicklime in composting it. There are cases where lime alone is insufficient. But usually, taking swamp muck as it runs, I suppose the best way is to get it out in the summer, and let it drain and weather. The frosts of winter go far to ameliorate it and convert it into plant food. With this treatment only it may be usefully employed as an absorbent, to take up liquid manure. The urine, when the muck begins to ferment, developes ammonia, which acts as an alkali, and liberates the plant food which it contains. If you cannot use enough thus, nor compost it with manure, nor with ashes, the next best thing is to use lime and salt, and I will try to explain how these operate. I said, if you use it as an absorbent and it takes up urine, ammonia is generated, and you have the effect of an alkali. Now, lime does not operate sufficiently as an alkali, and to produce the desired result you want another agent. Salt is *chloride of sodium*. If properly used, the lime combines with the chlorine of the salt and liberates soda. That soda acts as an alkali upon the muck, very much as ammonia would, or any other alkali, and helps to *cook* it. If you have unleached ashes, here is the best place to use them. You cannot use unleached ashes to better advantage than to compost them with swamp muck. But if you cannot get unleached ashes, take quicklime, then dissolve salt in water, and with the saturated solution slake the lime and mix with the muck. Do not put the salt in the bottom of the barrel and the water on it, for that would necessitate constant stirring to saturate the water; but put the salt in a basket and support the basket by the handles, putting a stick through them, near the top of the cask; then pour water upon the salt until the barrel is full, and let it dissolve; it will thus quickly dissolve without any stirring, for as the water becomes saturated it falls down and less saturated water comes next the salt. With the saturated solution slack the quick-lime. The lime decomposes the salt, and you have then a free alkali—soda—which operates very much as potash would from unleached ashes. If you leached ashes and put the lye on muck it would have very much the same effect.

There are various other and complicated changes which take place in this compost, which it would take too long to explain. It may suffice now to say that you will find lime thus slaked very different from lime slaked with water, and you will find the compost different from a mere mixture of lime and salt and muck. Take a cask of lime and put on as much water as will "dry-slake" it, that is to say, make it hydrate of lime, and you have a light, fine powder, that will fill two barrels or more; but slake it with brine, and you have an insignifiant looking mess of pasty stuff, which appears as if it had little goodness in it; but it is better than it looks. In the first place, put down a layer of muck, then the lime on it and slake it as I said; when slaked spread over the whole and put on more muck, then more lime and slake and spread that, and so on. Let the heap stand several weeks, and by-and-bye shovel it over. When properly made in this way, being thoroughly composted together, it is, according to Dr. Dana's analysis, very like cow manure, and in many cases it has produced the same effect, weight for weight or bulk for bulk. I would use all I could as an absorbent; and what remains I would compost either with animal manure, or with unleached ashes, or with salt and lime. Dr. Dana, one of our best authorities in such matters, says that the power of producing alkaline reaction upon the insoluble plant-food contained in muck is all that is needed to convert it into the equivalent of cow dung; and that it matters not whether this be done by means of ammonia from animal manure, or by potash, or by soda.

Mr. Lucas. What bulk of muck to a cask of lime?

Sec. Goodale. A bushel of salt answers for a cask of quick lime, and about a cord of muck.

Mr. Robinson, Is there any man in Maine who is prepared, if I send him a specimen of swamp muck, to analyze it and tell me what are its constituents? And if so, what would be the expense of analysis? Is the College prepared to do that now?

SEC. GOODALE. I have no doubt that Prof. Peckham of the College at Orono is abundantly capable, and so is any other Professor of Chemistry connected with either of the colleges in this State; but I doubt if the game would be worth the powder. I think it would be cheaper and just as well to test some of the muck by experiments at home. I believe in chemistry as firmly as anybody, but it would be cheaper for a man to examine his own muck by a few experiments than to engage a chemist to devote his time and his chemicals to the work. Analyses are costly, and many have already been made. So it is also with analyses of soil. While it is possible at large cost to analyze soil with considerable accuracy, yet it is a great deal cheaper and just as well for practical purposes to put a given manure on one soil and then another, and see which best responds; then you have the answer of nature; you have the fact before you, and at trifling expense. If, for instance, you want to know whether a soil needs gypsum in order to produce clover; you can apply gypsum, and you may or may not get clover, and govern your future applications accordingly. While there are some soils which will respond readily to gypsum, I have some that I would not thank any one to put gypsum upon, for it would do no good. Analysis is very useful in its place, but I would not recommend the sending a sample of soil, or of muck to a chemist to be analyzed, with the expectation of getting immediate benefit from it equal to the expense incurred.

Look at it from another point of view. Consider the amount of phosphoric acid required in an acre of land to get a large crop—only a few pounds—and calculate what proportion that bears to the weight of an acre of soil a foot deep, and you will see that any quantity that can be managed by a chemist would yield but an infinitesimal portion, so small as to require the most delicate balance to recognize at all.

MR. ROBINSON. So that, after all, you come back to practical experience?

SEC. GOODALE. Yes, sir; and to get my experience I would employ plows and carts in the field, and hay-scales when they serve the better purpose, and when they do not, I would use the beakers and crucibles and delicate balances of the chemical laboratory. In any given case I would use the means which seem to be best adapted to bring true answers at least cost. I would not pay a chemist twenty or fifty dollars to answer a problem which I could determine for myself for a tenth part of the sum. There is enough for chemists to do in aid of agriculture which farmers cannot possibly do.

Dr. Randall. I take great interest in this muck question. In travelling over different sections of this county, I find beds which are rich and deep. They are near the hard wood growth, and from what slight analysis I have made, as well as from trial in the field, I am satisfied that muck is a success, *when properly used.* I have taken muck from a swamp near this village, and put it upon land directly after it was taken out, and the result was not good. It was decidedly injurious to the land. I have taken out muck, piled it up to drain, and afterwards hauled it into the field near my manure heap. I then took hydrate of lime, to which the Secretary referred, and ashes, and barnyard manure, and mixed together as intimately as I could, and have secured excellent results. The compost thus made was fully equal, in every respect to barnyard manure. I could see no difference in the crops, or, if any, it was in favor of the muck compost..

The Secretary stated that some muck was good and some poor. Very true; but the muck in this vicinity is generally good. In the south part of the town, there is a large muck bed back of Squire Morrison's house. I was there last fall, and saw some in his barnyard, and on inquiry, was pointed to the spot from which he had hauled it. I walked there, and called his attention to some ashes under the muck. He said, "Yes; sixty years ago a fire ran through these woods, and those ashes are the result." I found there was nearly four inches in depth over the ashes, showing that it had taken sixty years to form four inches of muck. Below the ashes the muck was several feet deep. He told me that he had used this muck for years with highly satisfactory results, and from all I have seen, I am satisfied that if farmers would use muck in larger quantities than they do, in connection with the leached ashes which we sell to go out of town, together with lime and manures, they would find it very profitable. One year I kept an account of the expense. My manure heap that year cost two dollars and seventy cents a cord. It was equal in every respect to the best barnyard manure, for which I should have had to pay from four to five dollars per cord.

Question. I would like to ask the Secretary if there is not danger of exhausting the soil by a free use of gypsum? In Aroostook county hundreds of tons of gypsum are used every year; but many of our farmers do not use it, because they are fearful of exhausting their farms.

Sec. Goodale. It is a mistaken notion, and an injurious one in its effects upon practice, to suppose that any manure put upon any soil tends to exhaust it. If lands become exhausted, it is because of the crops taken off, for which no returns or insufficient returns of manure are made, and never because of any manure put on.

Sometimes a soil is deficient of only one element of fertility while rich in all others. In such case a very small application of the right sort enables the land to yield bountiful crops, for a while; perhaps long enough for a large proportion of its stored up wealth to be carried off in the crops grown. We must not expect that a second dose like the first will produce similar results. That operated somewhat as a key, by means of which a safe is opened, and its riches laid open to our grasp. Buying another key will not fill the strong box with gold like that taken out by the help of the key used when it was full. We must deal honestly with land, and *make returns in manure proportionate to the crops taken off.*

With regard to plaster I have had no experience beyond learning its worthlessness whenever I have used it. But if I farmed land in Aroostook, where the application of gypsum alone was apparently successful and sufficient to insure good crops, I would continue to use it until the land *began to show* signs of failing, and then I would put on barn manure freely in addition.

Dr. Randall. On a hill within rifle shot of where I stand, is a sand bank upon which the owner some years ago put plaster and perceived no effect from it. The following year he applied another coat of plaster, which was followed by the springing up of clover, which held possession of the land for a number of years.

Adjourned.

SECOND DAY.

THURSDAY, January 5th.

The Board met agreeably to adjournment, and the day was chiefly devoted to the subject of

ASSOCIATED DAIRYING.

ADDRESS by X. A. WILLARD, A. M., of Herkimer, N. Y., Dairy Editor Rural New Yorker, &c., &c.

Gentlemen:—I am here at the call of your Secretary to discuss topics deemed of vital interest to the farmers of Maine.

I have no oratorical devices for claiming your attention—no splendid therories for dazzling your imagination with visions of speedy wealth. I cannot point out the shortest road to Utopia. What I have to say must be plain, practical talk, concerning a great specialty, which rising from insignificant beginnings, is now a power in the land, and is destined to occupy a still more prominent place in the agriculture of the Middle and North Atlantic States.

We of the New World scarcely appreciate the privileges we are enjoying, and it is only by observation and by contrasting our own condition with that of people on the Continent of Europe, that we begin to realize how much we owe for all that makes life desirable to the freedom of the institutions under which we live. There was no place I looked upon abroad with more interest than the little island in the Thames, opposite Runnymede, and just below the Royal castle of Windsor. It was here the barons in the olden time forced upon King John the Magna Charta, that grand old compact which has given birth to English and American liberties. The stone is still preserved there upon which the king signed the document, more than six hundred years ago; and as I looked upon it I thought how different might have been the destiny of the Anglo Saxon race had the great charter not been given, and how potent its influence in moulding and educating the people in the rights of manhood, and in establishing our civil and religious liberties.

There is nothing more remarkable in the history of the world than this—that when the first key-note of progress happens by chance to be touched, it is taken up and continually sounded until other notes fall in place one by one and a complete and harmonious refrain is produced.

Trace any of the great motive powers of civilization—the art of printing, the application of steam, of electricity—and see how little did the first discoverers of the principle, or law of their forces, anticipate what wonderful revolutions they were to accomplish.

When Jesse Williams, the unpretending farmer of Rome, in 1850 conceived the idea of Associated Dairies, it was forced upon him as a necessary means for accommodating members of his own family. He had not the remotest idea that he had hit upon a great principle that was of wide application, and which was destined in all coming time to be the means of lifting heavy burdens from the arms of toil.

It is estimated there are now more than a thousand factories in the State of New York alone, and they are extending rapidly in other States. They have been carried to the Canadas and across the Atlantic, and wherever cheese making shall be known in after times it will be inseparably connected with the name of Jesse Williams.

But aside from the burdens of toil and the drudgery from which this system operates to relieve our farmers, it has developed another great economic principle—the means of producing food cheaply,—a principle which the Creator in His infinite wisdom, it seems to me, is now impressing upon the minds of people by the establishment and wide-spread dissemination of this system. The question of food, in all densely populated countries, is one that underlies all others. No nation can rise to the highest civilization and power without her people are supplied with an abundance of cheap and nutritious food. When food is scarce, or is wanting in nutrition, there you will find poverty, squalid wretchedness, demoralization and crime, elements of weakness opposed to progress and civilization.

Food nourishes not only the body but the brain, and the cheapness and abundance of good food has had much to do in the rapid progress and active development of mind among the American people. But our population is increasing with wonderful rapidity, and already the supply of meats is becoming comparatively scarce. They are to-day at a price that poor people have difficulty in obtaining them. As our population increases, there will be a still further scarcity of meats for the supply of our people.

Some other form of animal food must be substituted for beef; and the question is becoming every year more and and more urgent how it can be produced cheaply. And in my opinion we must look to the dairy as the chief means of solving this difficulty. I can illustrate this more satisfactorily perhaps by showing a comparison between the relative cost of producing beef and cheese. A steer which will weigh 1,500 pounds at four years must be a good animal, and will yield say 1,000 pounds of meat. Three steers at four years, in the above assumption, would produce 3,000 pounds of beef. Now a good cow will yield from 500 to 600 pounds of cheese per year, and if we take her product for twelve years at 450 pounds per year, deducting the first two years in which as a heifer she yields nothing, we have 4,500 pounds of good animal food. In other words, three steers at four years old, representing twelve years' growth for beef, amounts to 3,000 pounds, while one cow twelve years for cheese, 4,500 pounds. But a pound of cheese is equal in nutrition to two pounds of beef, which would make the difference still greater, giving for the dairy 9,000 pounds of food on the one hand against 3,000 pounds of meat on the other. Then there is the cost of cooking and the time to be charged against the beef, which as you will see adds further to the expense of that kind of food.

Who shall say that in the mysterious workings of Providence the establishment and spread of the factory system has not been for some wise purpose more beneficent than that which has been commonly assigned to it, and that in coming time millions of people are to draw their supplies of animal food from this source.

In regard to milk as an article of food, Dr. O. C. Wiggins, inspector of milk in Providence, says: "The nutritive value of milk as compared with other kinds of animal food is not generally appreciated. There is less difference between the economical value of milk and beefsteak, or eggs, or fish than is commonly supposed. The quantity of water in a good quality of milk is 86 per cent., in a round steak 75 per cent., in fatter beef 60 per cent., in eggs about 68 per cent." From several analyses made last winter he goes on to say: "I estimate surloin steak (reckoning loss from bone) at 35 cents a pound as dear as milk at 24 cents a quart; round steak at 20 cents a pound as dear as milk at 14 cents a quart; eggs at 30 cents a dozen as dear as milk at 20 cents a quart. Many laborers who pay 17 cents for corned beef, would consider themselves hardly able to pay 10 cents for milk, when in fact they could as well afford to pay 15 cents. Milk is a most wholesome and economical food for either the rich or poor. It ought to be more largely used. If the money expended for veal and pork were expended for milk, I doubt not it would be an advantage both to the stomach and pocket, especially during the warm season. Relatively speaking, then, milk at ten cents or even twelve cents a quart is the cheapest animal food that can be used. Whether farmers can afford to produce it cheaper is a matter for them to decide. It is very probable that were they to ask twelve cents, a very large number of poor people would refrain from its use from mistaken notions of economy, notwithstanding they are excessive meat eaters.

But the factory system has inaugurated a series of schools for the education of farmers by means of the numerous dairy associations springing up in the different States, which have been of infinite value in disseminating information and creating a desire for improvement. It has been remarked, that at no previous time in the history of this nation have so many farmers been brought together for earnest discussion as at these dairy conventions. Men come here for no idle purpose, they are seeking knowledge, and their intellects have been so sharpened that our public speakers acknowledge there is no class of men so critical, so exacting, or who can weigh a speaker's words with more precision than those who gather at these conventions. Mere eloquence is of no avail with these men, they demand the stubborn facts of knowledge in such a way that they can be at once applied to their business, and turned into money.

The conventions of the American Dairymen's Association annually fill the largest hall in Utica. At the conventions of the north western dairymen there are more than a thousand people present. The Canadians fill the largest hall that can be had at Ingersoll. And at their meetings you will see men of the largest information and of the highest order of talent. And I think it may be justly said, that in no branch of farming has there been such rapid progress. In no branch will you find so many intelligent men as in the dairy in those states where these associations have been for some time in progress.

If New England hopes to retain her rural population, it must be done through the efforts of agriculturists and agricultural societies, where the best men shall be drawn together for discussion, and where the experience of the best farmers shall be interchanged,—men who can warm into honest enthusiasm concerning the capabilities of New England farms, instead of belittling and bemoaning home and glorifying other lands. Here your statesmen, your editors, your eminent professional men should meet, and indicate by their presence and counsel that they have an interest in the welfare of New England, that they have faith in her resources; that her magnificent scenery, her pure water, her healthful climate, her established institutions of learning, and her sweet and nutritious pastures, still hold out inducements for the rising population to make a home and competence for themselves in her charming valleys and upon her verdant hills.

Our country is vast, and of great diversity in soil and climate. New England and the Middle States have long since ceased to be regarded as the most favorable sections in which men of moderate means may engage in grain farming. There is a tide of emigration sweeping westward, there is another tide ebbing to the cities, and so the rural population in these states is constantly decreasing.

We live in an age of intense competitive industry. Our people are impatient for gain, and with a natural fondness for adventure and an eagerness for any change that holds out prospect of betterment, it is not strange that old landmarks are dying out among the farming population of the North Atlantic States. I shall not stop now to discuss all the causes which have led to this condition of things. It will suffice for the present to name one, the misdirection of the land to the kind of farming to which nature and the elements have most adapted it.

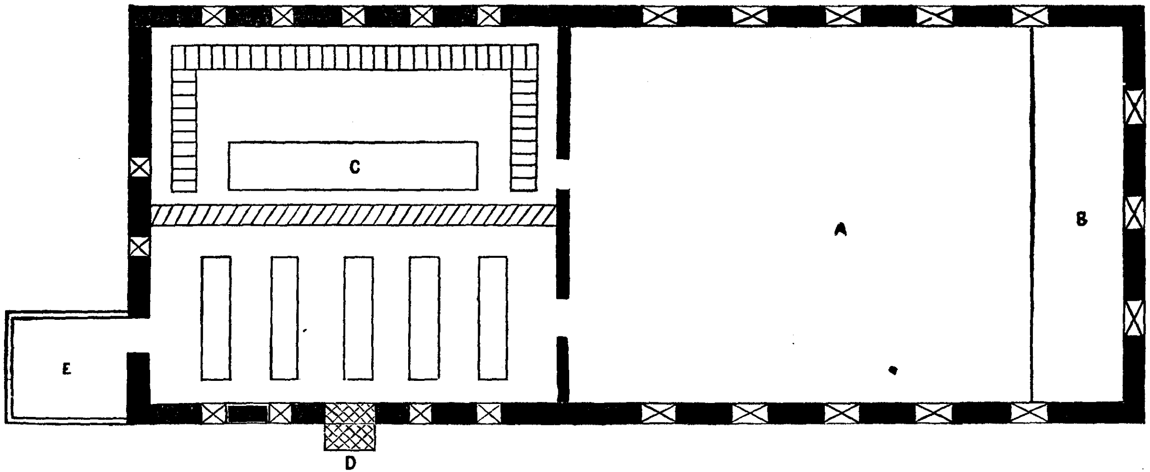
With a favorable climate, with an expenditure of money, by the aid of science, you may force an unpropitious soil to yield ample returns in crops to which originally it was not well adapted. But temperature, moisture and climatic influence are in a measure beyond our control. Hence with many disadvantages facing you at every step, you cannot compete successfully in growing grain with those sections which have none of these to contend with, but have everything in their favor. If you propose to grow corn and make it a specialty, the rugged lands of New England and New York will not present equal advantages with the fertile bottom and prairie soils of the West. From the natural fertility of these soils, and from the ease with which they can be cultivated, the Western farmer can put his surplus grain in your market at a price which compels you to sell at meagre profits. If you grow grain, therefore, it must be as an adjunct to some specialty which gives you decided advantage over other sections.

The dairy is one of those branches from which the larger area of lands in the United States by natural causes is excluded. To the farmer, then, whose lands are adapted to dairying, it presents one of the most remunerative branches of agriculture in which he can engage; and it may well be a question whether New England with her established institutions and her nearness to the best markets in the world, may not now present inducements to the agriculturist second to no other section in the Union.

During the past summer I crossed the Continent to the Pacific coast, and I took some pains at different points along the route to get the price of land in eligible situations near towns along the railroad, and I found such farms often selling higher than lands in New England. I can come into New England to-day and purchase farms convenient to towns and railroads, having all the advantages of schools, of churches, surrounded by the refinement and culture of the East—farms right at the door of the great markets of the world, which are offered less than the cost of the buildings upon them. Why is this so? Does it not come often from a misapplication of the land to the kind of farming to which it is best adapted? One of the first steps in successful farming is to find out to what crops your soil is best adapted. A few years ago in the western part of New York, about the shores of Crooked Lake, lands could be purchased at from $25 to $30 per acre. Now it is worth from $500 to $1,000, because it has been found that the soil and location is wonderfully adapted to the culture of grapes.

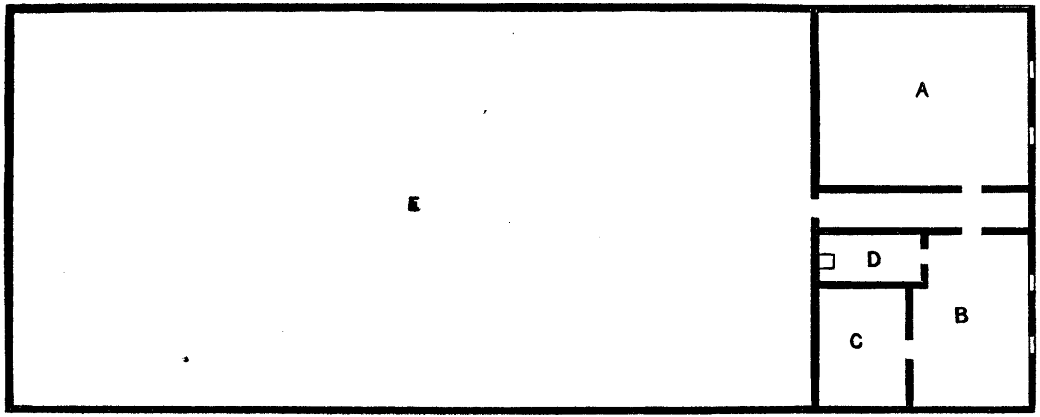
The dairymen of Herkimer county, N. Y., have so increased the value of their lands that good farms, eligibly located, command from $150 to $200 per acre, and often more. A short time ago I made an estimate of the average receipts of all the cultivated lands in the county, and found the income, according to official returns, to be at the rate of $24 per acre. Now, if one-half be deducted for working the land and expenses, the balance, you will see, pays a fair interest on the cost per acre. But should we be compelled to go back to grain raising, I have no doubt land would fall to $50 per acre.

But it has been urged that there is likely to be an over production of dairy products, and therefore it must be unsafe to enter upon dairying. It is now twenty years since this prediction was made, and yet we come no nearer its fulfilment to-day, it would seem, than when it was first assumed. We are producing 700,000,000 pounds of butter and 250,000,000 pounds of cheese per year. The butter is all consumed among our own people, or at



A HERKIMER Co. "FANCY CHEESE" FACTORY AT NEWVILLE.

Size, 114 by 44 feet. Three stories high. Basement five feet below ground, five feet above ground. A, Curing Room, 60 by 44 feet; B, Family Cellar; C, Sink; D, Delivery Window; E, Boiler Room; F, Room containing five Vats.



NEWVILLE CHEESE FACTORY, 2d STORY.

A, Sitting Room; B, Kitchen; C, Bed Room; D, Pantry; E, Curing Room, 44 by 94 feet.

least there is none for us to export. We send abroad annually about 60,000,000 pounds of cheese, but the time is coming, in my opinion, when all our cheese will be needed for home consumption. Our annual consumption of late years has increased at the rate of 13,000,000 pounds per year, and that there is still a margin may be seen from the following estimate:

Our population is now about 40,000,000. Say that each individual should take only one ounce of cheese per day, or a third of an ounce at each meal, simply as a corrective of other food; and this same quantity distributed among our 40,000,000 of inhabitants would make an annual consumption in the United States of 910,000,000 of pounds, which is 660,000,000 of pounds more than we are producing. But suppose we deduct 10,000,000 of inhabitants as non consumers, and allow only half an ounce per day for the 30,000,000 of people, and we have an annual consumption of cheese amounting to 342,000,000 of pounds, which is still about 100,000,000 of pounds more than the whole country produces. The fact that cheese is a wholesome, nutritious and economical article of food, one of the cheapest luxuries of the table, must, it would seem, bring it largely into use.

The American system of associated dairies, as I have remarked, was inaugurated in the early part of 1851. Though twenty years have elapsed since the plan was conceived, the leading features of the system remain unchanged. Great improvements, it is true, have been made in buildings, in dairy apparatus, and in methods of manipulating milk for dairy manufacture. Still, in organizing factories, in the manner of delivering milk, in the relation between manufacturer and patron, in the disposal of the product, indeed in all the general outlines of the system, it is the same to-day as when Jesse Williams mapped it out in 1850, for the first cheese factory, which he erected early the following year.

After nineteen years experience in associated dairying, during which time the system has been put to the severest tests, the dairymen of New York find it more convenient as regards labor, buildings, dairy machinery and appliances, while the factory made product will, on an average, sell for enough more than that made in the farm dairy to pay the entire cost of manufacture.

Another important result of the system has been a constant improvement in dairy management, and a better knowledge of all that pertains to milk and its products, than would naturally obtain under the old system. It has established a special profession, or calling, upon which men enter with a view of making it a sole business. They therefore seek to perfect themselves in it, and as skill and success is sure to be properly rewarded in this department of labor, great emulation exists among manufacturers for excelling in their art.

During the first ten years of the factory system it received much opposition, especially from those who had only a superficial knowledge of its operations. So strong was this opposition among the old dairymen that it was pretty grenerally believed that the system could not long endure, and it was confidently predicted that the factories would be abandoned and those engaged in them must return to the old plan of individual or farm dairying. But the factories meanwhile were steadily gaining ground, and those entering upon the new system found in it so much relief, as well as profit, that they could not be induced to abandon it, and so to-day associated dairying has come to be regarded as a fixed institution.

In the original plan of Mr. Williams it was not contemplated to apply the system to butter manufacture; but the success of the cheese factories suggested to the butter dairymen of Orange county, N. Y., such a modification of the system as would adapt it to their branch of the business. Orange county lies about fifty miles north of New York city, and has long been devoted to producing milk for city consumption. It is a rolling, mountainous region, abounding in sweet and nutritious pasturage, with springs and streams of never-failing water. The whole farming population of this section has for seventy years or more devoted its principal attention to butter making and the production of fresh milk for the New York market. By devoting so long attention to a specialty, the butter of Orange county, as was to be expected, was of fine quality, and acquired a high reputation and commanded better prices than any other brand made in the State. By adopting, however, the associated system, together with a new plan for setting the milk and obtaining the cream, the product has risen to the highest point of excellence, and extraordinary prices in consequence are paid for it. But the farmers under this system have not only reaped better prices for their butter, they have also obtained an additional gain from the skimmed milk, which, under the old system was fed to swine, but which now is turned into a palatable cheese. This cheese goes into the Southern States; it is shipped to China and the East Indies, and not unfrequently commands a price but little below that made from whole milk.

System of Organizing Factories.

The plan of organizing factories is somewhat similar whether it be for butter or cheese. The first effort of organization in a neighborhood generally falls upon one or two persons who may be especially desirous of having a factory where they can deliver milk from their cows and have it manufactured. They perhaps have examined the working of some factory, and having become convinced that greater profits are to be realized from the system than from the farm dairy, besides relieving the wife and daughter of the drudgery attending upon butter and cheese making at home, they set to work to bring their neighbors to the same opinion, and induce them to join in the erection of the proper buildings. They go about and talk with their neighbors, and finally call a meeting at some central point in the neighborhood where all are invited to come and discuss the advantages of the system.

The cost of erecting a good factory and supplying it with machinery and dairy apparatus is not far from $4,000, and the farmers of the neighborhood are expected to join together and pay for the erection of the buildings in proportion to the size of farms, or number of cows from which milk is delivered. The shares are often put as low as ten dollars, so as to be within the reach of persons having but few cows. As a preliminary, a simple agreement something like the following is drawn up and circulated for signatures:

"We, the undersigned, residents of the town of ——— hereby agree to enter into association for the purpose of erecting and operating a cheese and butter factory at ———, in said town. And we severally and individually bind ourselves by these presents, on or before the first day of ——, 1871, to pay to our regularly appointed building committee the several sums set opposite our names, for the purpose of building and furnishing said factory. And it is understood and agreed that when said factory shall have been completed and opened for work, each member of the association is to patronize it by delivering milk for one year in proportion to the number of cows set opposite our names. The manufactured product of said milk to be sold by the regularly appointed agent of the association, and each member to receive his share of the sales in proportion to the quantity of milk delivered, less than the cost of manufacturing, etc. The above not to be binding unless the sum of $4,000 and the milk of 400 cows are subscribed."

This is intended to be only a preliminary agreement. After the stock shall have been subscribed a meeting is called, officers chosen, and powers delegated for the erection of the buildings, and for putting it in operation. The structure having been completed and furnished, a superintendent is chosen and help hired for running the factory, and the expenses are shared by the stockholders in proportion to the amount of milk delivered. The cost of repairs, additions, etc., from year to year, are added to the expense account.

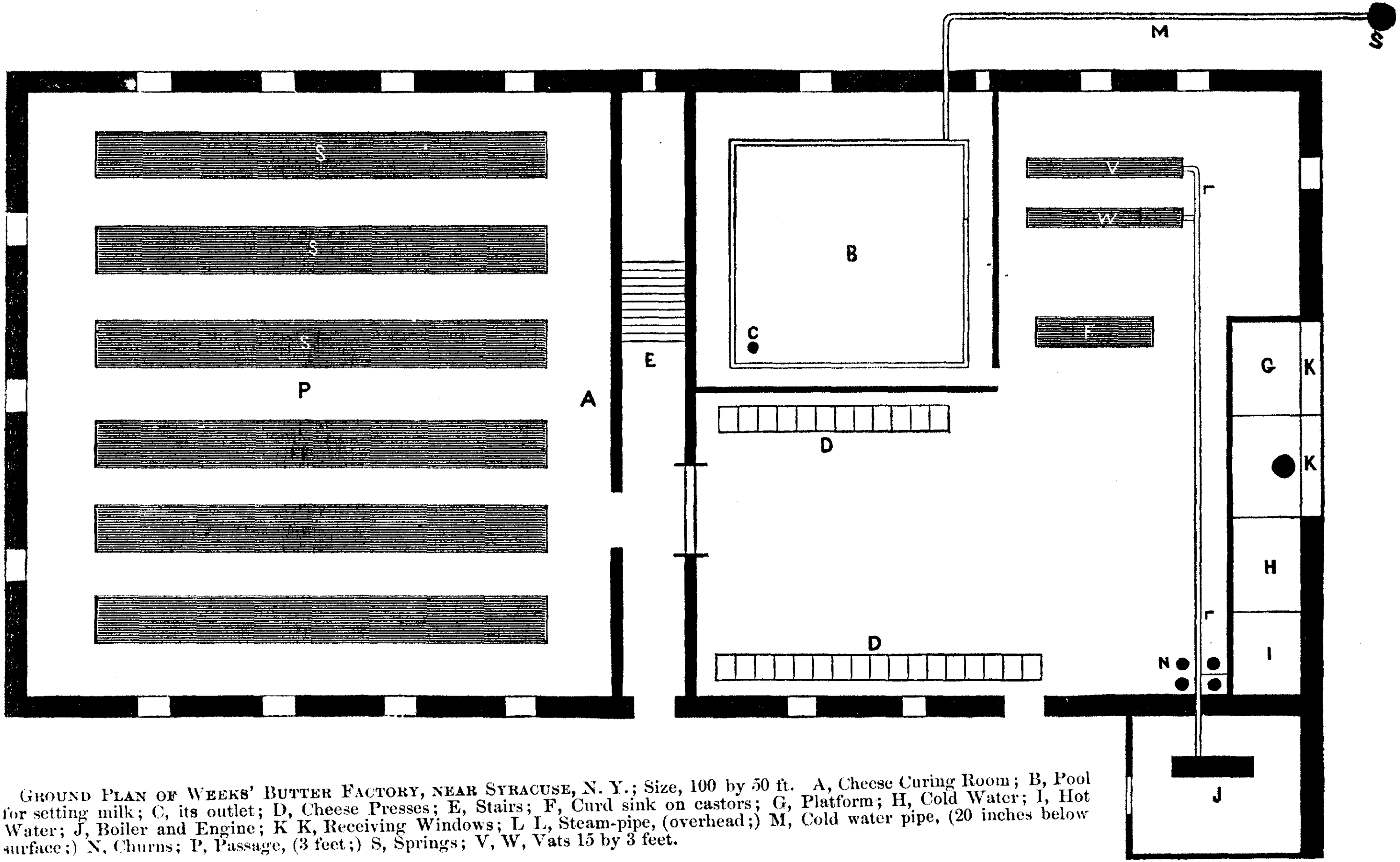
There are other plans for establishing factories, where one or more persons build, furnish and run the factories on their own account, either purchasing the milk or receiving it from farmers and charging for its manufacture. But the plan first named is found to give the best satisfaction, as it makes all parties interested, and all profits accruing go into the hands of the dairymen.

Requisites.

An essential requisite in the success of a factory is an abundance of pure cold water. In the early factories it was supposed to be absolutely necessary to have good running water conducted directly from the spring into the buildings, and in such abundance as to have a considerable surplus to flow under the manufacturing room to wash away accumulating filth. Of course, this is always desirable, and good permanent springs should be taken advantage of if their location is such as to make them convenient. But it often occurs that no such spring can be obtained in a neighborhood without placing the factory in an out of the way, inconvenient location. When such is the case, good wells of large capacity can be made to take the place of springs, and the factory placed in a central position so as to accommodate a large neighborhood. Wind-mills are now so perfected that they will manage their own sails, and a good mill will keep a factory supplied with water by raising it into a large tank, where it may be drawn or kept flowing to any part of the building as desired. Milk, it is true, is often hauled three or four miles to a factory; but factories should be located so that the most distant patron will not have to travel beyond one and a half or two miles to his factory.

The old style of building was to have two or more structures; the curing rooms, manufacturing and living rooms all separate; but the modern and improved manner of building is, to have the whole establishment under one roof.

I have here the plan of one of the modern fancy factories of



Ground Plan of Weeks' Butter Factory, near Syracuse, N. Y.; Size, 100 by 50 ft. A, Cheese Curing Room; B, Pool for setting milk; C, its outlet; D, Cheese Presses; E, Stairs; F, Curd sink on castors; G, Platform; H, Cold Water; I, Hot Water; J, Boiler and Engine; K K, Receiving Windows; L L, Steam-pipe, (overhead;) M, Cold water pipe, (20 inches below surface;) N, Churns; P, Passage, (3 feet;) S, Springs; V, W, Vats 15 by 3 feet.

Herkimer, which is found to be very convenient. It is large; sufficient to take the milk of 1,000 cows, but the general features can be carried into any size, as desired.

Cost of Machinery.

Boiler, with fixtures, $500; vats, $100 each; screws, $6; hoops, $4. From $1,200 to $1,500 will fit up a factory for 600 cows.

About a thousand square feet of curing room will be required for curing and storing the cheese made from the milk of each one hundred cows, unless the cheese is sold young. I do not approve of the cheese being in racks, the one above the other, at least not until they are properly cured, as the evaporation from the lower tier constantly pouring upward saturates and impregnates the upper tier of cheese with moisture and offensive gasses, thereby injuring the flavor of the cheese. If the cheese is properly cured on the table in a room by itself, and then carried to another room, it may be stored in tiers with less danger.

The construction of curing rooms is not well understood. Some means should be devised for preserving an even temperature in curing rooms of about seventy degrees, which has been found by experiment to be the proper range of heat for curing cheese in the best manner to retain a nice delicate flavor. The curing rooms should be well ventilated with openings and wickets at the sides, even with the floor, and shafts running down from ventilators in the roof.

Appliances for Manufacturing.

The machinery or appliances in the manufacturing room consists of weighing can, where the milk of patrons is dumped from the carrying cans, vats for manufacturing, presses, hoops and sinks. The factory vats are usually sixteen feet long, three feet four inches wide, and eighteen inches deep. They are double, the inner one often encased with a wooden vat, leaving a space of about two or three inches at the sides and bottom between the vats, where heat is applied, either steam or hot water, or for cold water to cool the milk.

Vats are made to hold from 500 to 600 gallons. A 500 gallon vat is sufficient for the milk of 100 cows, and perhaps a trifle to spare. If but one or two vats are to be used, vats with heaters attached are the most economical, and will do as good work as any. When several vats are to be employed, the preference is for a boiler or steam engine, when the heat is conveyed to the vats by iron pipes. They are arranged overhead in the manufacturing room, and connect with each vat by a short pipe with stop-cock to turn the heat on or off at pleasure.

The presses are not patented, and are so simple in construction that any one handy with tools can do the wood work for less money than the cost of transportation over long distances. The wooden frames should be made of well seasoned timber, and the parts of sufficient size to be strong, so as not to spring or warp. The sills for holding the hoops are about fifteen inches wide, and four inches thick, and the beams ten inches by six inches thick. The posts are of the same thickness and of the width of the sill at the bottom, slanting to the width of the beam at the top. The posts should be about four feet ten inches long. The sill and beam are let into the posts, say about one-half to three-quarters of an inch. The sills stand about two feet from the floor, and the beams are about two feet five inches above the sills. The posts are set about two feet apart, which gives a space of two feet by two feet five inches for the hoop. Iron rods, with nut and screws at the end, are used for holding the wood work firmly in place, and six or eight frames or presses may be connected together. The screws are attached to the beams at the centre. They are manufactured for the purpose, and may be had at any dairy furnishing store. The late patents have rachets attached to the head of the screw to facilitate turning.

The self-regulating press used in farm dairies is not employed at the factories. The screw presses take up less room, are more substantial, and altogether cheaper. Another reason for their use is that they press evenly, and will do just the amount of pressing desired, and in factories where a number of cheeses are to be made daily they are much more convenient than the others.

Hoops.

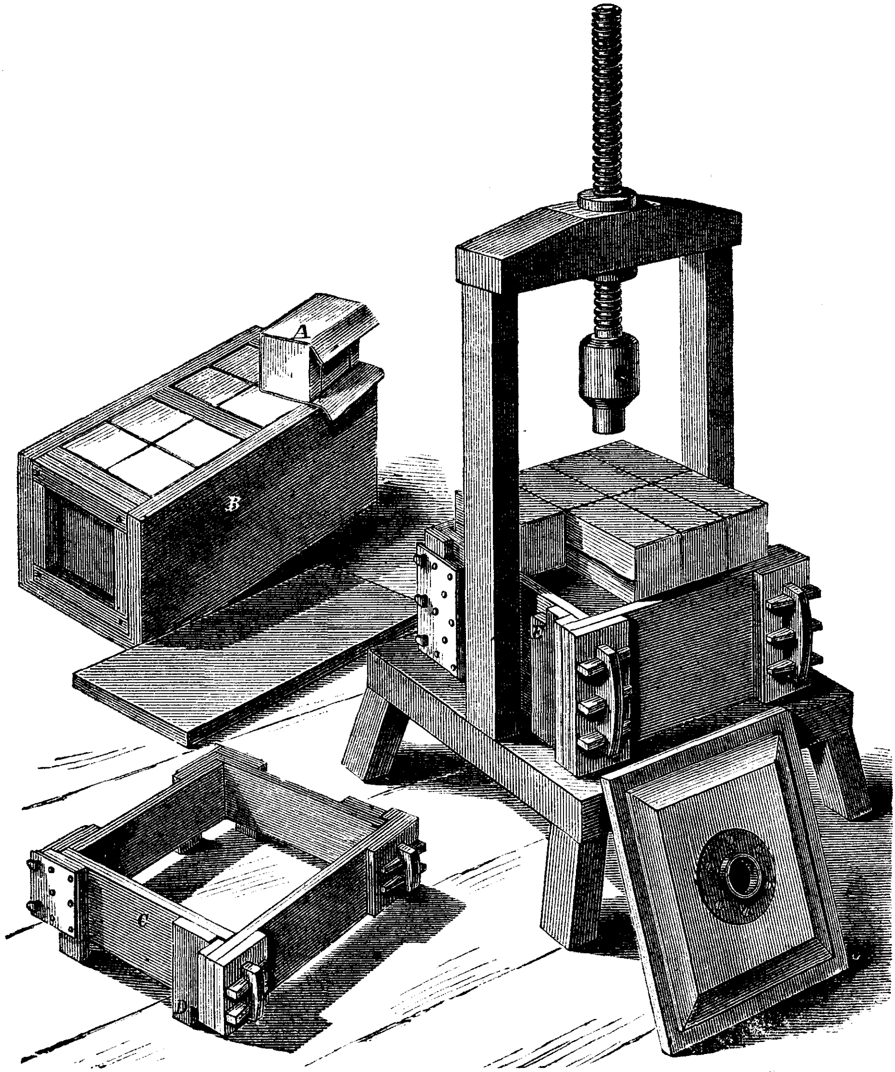
We have a recent improvement in hoops or moulds for pressing the cheese, which promises to be of very great importance. What our people want to-day, is a cheese weighing from ten to fifteen pounds. And to a moderate extent such cheeses could be exported, selling abroad at higher rates than the sixty pound Cheddars, now so popular among manufacturers. We want a cheese that everybody can buy without cutting. Dealers want something that they can sell *whole*, without peddling it out in pieces. There are thousands of persons everywhere who would buy a ten pound cheese at twenty cents, costing only two dollars, who would not purchase one at fifteen cents, costing ten dollars. Persons neglect to eat cheese because of the difficulty of getting it in convenient shape. Poor people, or those in moderate circumstances, would often be induced to take a cheese costing only a small sum, were it complete and whole in itself, and would thus get into the habit of eating this kind of food—convenient and nutritious. Wherever I go I hear this complaint among the grocers: "We don't like the business of cutting cheese; give us something we can sell in a lump, without waste, and we can do a good trade with it." Now, I fully believe that if these small cheeses could be generally introduced into New England, of fine flavor and quality, the home consumption in New England would be more than the home supply for many years to come, and at prices considerably above those received for the large cheeses of New York. But the trouble heretofore has been, the expense and difficulty of making such small cheeses.

Since the inauguration of the associated dairy system there has been a constant effort to introduce labor-saving appliances, so that large quantities of milk may be handled and manufactured in the best manner and at the least expense. The improved cheese vat is a great advance over the old-fashioned tub. The curd knife, the milk agitator, and various other devices used in the cheese-making art, have contributed largely to the success of the system. Recently there has been invented an arrangement for pressing the curds, which has in view a complete and radical change in the style and form of the cheese itself. It proposes to do away with round surfaces and substitute the square or oblong shape. There are several advantages which these shapes have over the present style of cheese. In the first place a less number of hoops or moulds for pressing the curd would be required. Then the cheese could be more easily bandaged; and thirdly, it could be more economically boxed when ready for market. In the manufacture of small cheeses, weighing from ten to fifteen pounds each, there would be a very important saving of labor and in the cost of boxing, by using the square form. The inventor claims several other advantages, but we have named those concerning which there can be no difference of opinion among men who are familiar with cheese manufacture.

But before discussing the question further, it will be proper to explain more fully how the curds are to be pressed, and the cheeses of different sizes put in shape. The moulds which take the place of hoops for pressing the curds, consist of a series of frames made from stout plank, the corners secured by iron clasps, and with one side opening on hinges for the removal of the cheese. These frames may be made large or small to accommodate the quantity of curd. They may be large enough to receive two hundred or more pounds of curd at a single pressing, or for one press and screen. The cheese, therefore, when it first comes from the press is in a large cubical block. It is then sawed up into oblong cakes of any desired size, a bandage wrapped about each cake and put back in the mould in layers separated by thin boards, when pressure is again applied. After remaining in press a proper length of time, the cakes are taken out and placed in the curing room upon the shelf, and turned daily from side to side, a quarter of a revolution at a time. Now, under this process it will be seen that a mass of curd of three hundred pounds weight will require but one mould or hoop; and yet a dozen or more cheeses may be formed out of this cubical block with much less labor and expense than when round hoops are employed for each cheese. Another very great advantage in the oblong cake is the ease with which they may be boxed. The material for making the round wooden box is becoming scarce and expensive, and already inquiry is made as to a substitute. We cannot go on using the round wooden box, for any great length of time, because the scarcity of material or the long distances which it will have to be transported will render this form of box altogether too expensive.

Paper must undoubtedly be used as a substitute for the wooden hoop, and even to-day it is claimed a good substantial paper box may be furnished as cheaply as one made of wood. A square box, on the other hand, is easily made, and is much less expensive than any other form of package. In shipping the oblong cakes a number can be packed together in one case, thus still farther reducing the cost of package.

The demand for a small-sized cheese—one weighing from ten to fifteen pounds—is increasing from year to year. Such cheeses are much needed for home consumption, but hitherto the trouble and expense of manufacturing small cheeses have kept them on the market only in limited quantities. It is believed that the home consumption of cheese could be greatly promoted by a large manufacture of these small cheeses; and Mr. Holdridge, the inventor



CHEESE PRESS AND MOULD FOR THE HOLDRIDGE CHEESE.

A, Cheese with bandage; B, Composite Cheese Mould; C, Square Hoop; D and E, Mortised Slips for connecting the hoops.

of the oblong cheese, claims that these shapes would be more convenient to the grocer, since the weights can be cut by measurement; while at the same time a square or oblong form is more economical to the consumer, because it can be more readily cut without waste for the table than from a round shape.

The oblong cheese is very easily bandaged. A long strip of cloth is damped and laid upon the table, and the cheese simply placed upon it and rolled over until it is completely covered. The cloth is then cut where the lap comes on the cheese, the margin at the ends turned down in place, and this completes the work of bandaging. This, it will be seen, is much more readily done than when the cloth has to be measured in pieces and the ends sewed together and then slipped over the cheese.

Mr. Holdridge claims that the oblong form is of great advantage in preserving the flavor of cheese while curing, inasmuch as the escape of the whey by evaporation is facilitated, for as the whey percolates toward the bottom of the cakes, and the cakes being turned from time to time only a quarter of a revolution, the whey instead of turning back towards the centre of the cheese (as is the case of round cheeses) is turned at right angles thereto, and is consequently always tending towards the outside. The whey, therefore, is so far evaporated and repressed that decomposition is much less liable to take place. The cheese, it is claimed, cures better than round ones, as the gases, if any be generated, escape from the end of the cheese and are not forced back and forth through the cheese, as is the case with round ones. The consumer when cutting the cheese for the table, turns back the bandage from the end and cuts a thin slice of cheese, which is to be returned for the purpose of sealing the cheese. Then any number of slices desired for the table are cut and the cheese closed by replacing the thin slice first taken off, together with the bandage, and setting the cheese on end, when it is sealed and safe as one uncut.

Without indorsing all the advantages claimed for this new style of cheese, I have enumerated some at least which are of sufficient importance to recommend it to the attention of the dairy public. In making any radical change in the style of cheese the market and the tastes of consumers must of course be consulted. If the prejudice of consumers be so strongly set in favor of round cheese that a less price is obtained for oblong shapes, then this must militate against their introduction, notwithstanding the producer may see clearly the several advantages named in manufacturing, etc.

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I am hardly prepared to say what the verdict would be in the English markets regarding a new style of cheese, but in this country, I am informed by dealers who have been handling a limited quantity of oblong cheeses, that they sell readily at a price equal and even better than the round style.

Some factories have been proposing to manufacture small cheeses, but on account of the great number of pressing hoops required, and the extra labor of pressing and bandaging, have been deterred from manufacturing small round cheeses. To such factories the oblong shapes obviate the difficulty, and the change proposed will claim attention.

Before closing the subject of factories I wish to allude to the recent introduction of butter making at cheese factories, where the milk is treated upon a different plan than at the butter factories proper In the butter factories the milk is set in pails eight inches in diameter and twenty inches long, plunged in pools of water. Here it is kept for from twelve to thirty-six hours, when the cream is dipped off and the skimmed milk made into skimmed cheese. A modification of this system is now being introduced to a limited extent in cheese factories, and this plan may be briefly described as follows: The night's milk as it comes in, is spread thinly in the cheese vats and immediately surrounded by cold water, which is left flowing between the vats during the night. In the morning the cream is skimmed off and made into butter, and the morning milk mixed with that which has been skimmed, and made into cheese. By this plan a good meaty cheese is produced, scarcely inferior to that made in the ordinary way, while there is a considerable profit realized from the butter, which when properly made is of the finest quality. This will be readily seen when it is understood that the best cream is that which rises first. The milk being set but a short time, and kept at an uniform temperature of about 60°, all the circumstances are favorable for a nice product. The cream is churned either sweet or slightly acid; when sweet the buttermilk is added to the milk, so that no waste may occur. With skill in manufacturing a superior product is obtained, which sells for a good price. At one of the factories which I visited during the past season, 6,839 pounds of milk in June made 87 pounds of butter and 648 pounds of cheese. This is a larger product in pounds than would result from manufacturing the milk into cheese alone, and the reason will be obvious to the practical cheese maker from the fact that by taking off the butter in the way described it is saved from passing off into the whey, which cannot well be prevented when whole milk is made exclusively into cheese in the ordinary way.

Again, the butter product being always more valuable than cheese, pound for pound, a larger profit is realized at such factories than when cheese alone is manufactured, providing, of course, that the requisite skill is secured for conducting such factories properly. It should be observed, however, that experience and skill are necessary in conducting these factories, since the quantity of cream taken off must not be sufficiently large to leave the cheese so poor in quality as to be inferior. The management of the milk and curds are somewhat different than for whole milk cheese, the operations being conducted at lower temperatures and requiring longer time.

Color.

The butter factories prefer to give color to their butter, by having the cows well fed, and by getting up the cream as quickly as possible after the milk is drawn. Sometimes in winter, however, a little coloring may be advisable, and for this purpose annotto has been used. In cheese manufacture coloring has been in use for years, and it is likely to continue, as the English market, especially London, demands it. Heretofore great trouble has been experienced in obtaining a pure article of annotto for this purpose, and it is only within the past year that a comparatively cheap and reliable preparation has been placed within the reach of dairymen. This material is what is termed annottoine, or dry extract of annotto, and it has given such good satisfaction that it promised to supersede all other preparations.

The modes of preparing annotto for commerce are various and intricate. M. LeBlond, a French chemist, gives an account of its manufacture as follows: He says the pods of the tree Bixa Orellana being gathered, their seeds are taken out and bruised and placed in a vat, called a steeper, where they are covered with water. Here the substance is left for several weeks, or even months. It is then squeezed through sieves placed above the steeper, that the water containing the coloring matter in suspension may return to the vat. The residium is preserved under the leaves of the Banana or Palm till it becomes hot by fermentation, when it is again subjected to the same operation, and this treatment continues till no more color remains. The precipitate is boiled in coppers to a concentrated paste; it is then suffered to cool, and dried in the shade.

The annotto of commerce, as is well known, is often largely adulterated in the boiling process with red ochre, powdered bricks, colcothar, farinaceous substances, chalk, sulphate of lime, turmeric, etc.; while salt and oil are added as preservatives against a bug which is generated in annotto, especially that which has been adulterated with farinaceous substances. Instead of this long process, which engenders disease by the putrefaction induced, and which affords an inferior product, M. LeBlond proposes simply to wash the seeds till they are entirely deprived of the color, which lies wholly on their surface, to precipitate the same by means of an acid, and to boil in the ordinary manner or drain in bags as practiced with indigo. This process it is said has never been successfully carried out on a large scale until now (1870) as no precipitate could be found that did not injure the color. Small quantities were prepared according to LeBlond's theory, and found by the French dyers to be worth four times more than the ordinary annotto of commerce—that it was more easily employed, that it required less solvent, that it gave less trouble in the coppers and furnished a purer color.

The American preparation of G. D. Cordova, under the name of annottoine, or dry extract of annotto, is claimed to be an improvement on the LeBlond and Vaugnetine theories; and as the latter asserts that boiling injures the color, and as this has been clearly proven, Cordova reduces the precipitate to a powder instead of boiling to a paste. As this preparation gives a beautiful color, is very much cheaper than any preparation in the market, and at the same time absolutely free from adulterations, our factories are greatly pleased with it, and it is rapidly taking the place of other preparations. There has been such complaint on account of imperfectly colored cheese, and on account of the difficulty of obtaining good, pure basket annotto, that I feel constrained to recommend this new preparation, having fully tested it both for butter and cheese during the past year.

Relative Profits of Butter and Cheese Dairies.

I have referred to the system of making butter in connection with cheese, or at one factory, and I wish to say here, that when either butter or cheese is made disconnected or alone, as a sole business, the profits from either branch are about the same. It may be well, perhaps, to discuss this point a little in detail. The cheese factory system has been of great advantage to the private or farm butter dairies, since it has drawn many of the butter makers into cheese dairying and thus equalized the two products. Previous to the cheese factory system the butter product of the country was so large and prices so low in consequence that the business was often not very remunerative. It is probable that the profits from either branch will remain hereafter pretty nearly equal, as any great difference in favor of the one will have the effect to draw from the other until prices again become equalized.

If we assume that the annual yield from a good cow is two hundred pounds of butter, or if her milk when made into cheese is five hundred pounds, we can make a sufficiently accurate estimate of the probable receipts from either branch by taking the average prices of the two products the past season. Now, two hundred pounds of butter at thirty-six cents per pound amounts to seventy-two dollars; five hundred pounds of cheese at fifteen cents, seventy-five dollars. The skimmed milk from the butter making would be worth considerably more for producing pork than the whey in cheese making, so that the difference in receipts would not vary so very much. We do not pretend to give the precise average for the two products during the past season, but our figures are sufficiently accurate for all practical purposes.

In 1860, John Shattuck, a noted butter maker of Chenango county, N. Y., reported to the "Country Gentleman" his receipts from a dairy of twenty-three cows, for that year. The total amount of butter made was 5,130 pounds, or an average of 223 pounds per cow. The butter sold at 23 cents, except the spring make, 642 pounds, for which only 17 cents was received. The whole receipts from his dairy (including nine calves raised on skimmed milk, $35, and pork fed on dairy slops, $100,) were $1,286.18.

Mr. E. P. Haynes of Barre, Mass., reports in the same paper the yield of cheese from twenty-four cows (one of them a two year old heifer) to be 15,600 pounds, or 650 pounds per cow. Deducting the make of one cow, so that the number of cows will be the same in each dairy, we have 14,950 pounds as the amount from 23 cows. The average price of cheese that year was about nine cents, which would make the cheese amount to $1,345.50. Mr. Haynes speaks of fattening and raising several calves; and although nothing is said about the disposition of the whey, it is evident its value must be something. This gives the cheese dairy the most money in its receipts, but it must be remarked that the yield of cheese per cow is large, and much more than an average. We suppose the cost or expense account in a butter dairy will not vary materially from that where cheese is manufactured.

The manufacture of cheese is attended perhaps with a little more expense than for butter, but the difference is so small that it need not be considered in the estimate. As to the last question, there can scarcely be a doubt but that the skimmed milk can be better employed for "skim cheese" than as feed for swine. The average price for skim milk cheese the past season has been about ten cents per pound. Some manufacturers have realized higher rates, but any food at ten cents per pound is altogether too expensive for pork making.

At the butter factories it is estimated that fourteen quarts of milk on an average through the season will make one pound of butter and two pounds of skim cheese. But, suppose a given quantity of milk yielding a pound of butter, will, after the butter is taken out, give a pound and a half of skim cheese, then a cow that would produce two hundred pounds of butter for the season should yield also three hundred pounds of skim cheese. Her product, therefore, would be as follows:

Two hundred pounds of butter at 36 cents	$72 00
Three hundred pounds of skim cheese at 10 cents	30 00
Making a total of	$102 00

But the whey from the manufacture of the skim cheese can be used for feeding hogs, and if four hundred pounds of meal be added to it the hogs will probably gain quite as fast and make as much pork as they would had they been fed the skimmed milk alone.

If our reasoning is correct the dairyman cannot afford to feed hogs on skimmed milk, since it will pay him better to manufacture it into cheese, feeding the whey and substituting meal or some cheap food for the cheese extracted from the milk. But whatever system of dairying is adopted, let the goods manufactured be of fine quality. Choice butter and cheese always brings more money in the market than poor stuff, and as the expense of manufacturing the good is no more than for an inferior article, the extra price received makes a very satisfactory exhibit on the balance sheet at the close of the year's operations.

In the management of milk during hot weather, there is generally far too little care given for securing it in good order. That milk is in the highest degree susceptible to the influence of bad odors, and is injured by filth, nothing it would seem is of more common observation at least among dairymen. That there should be such gross neglect in allowing putrescent matter in and about milking stables and milk rooms, with uncleanly habits of milking, and want of care in the general management of milk, can only be accounted for on the ground of a general lack of knowledge or want of due appreciation as to the causes producing milk taints. The evidence is abundant and of the most undoubted character to them that one of the most essential requisites in the manufacture of fine-flavored cheese is pure, clean, healthy milk; and the same condition of the milk, it is needless to say, is required for a fine quality of butter. Some of our butter dairymen, who have become noted for producing a high-priced article, seem to have learned this secret, if secret it be; and to their extreme care for securing milk at all times in the best condition as to cleanliness and freedom from absorbing putrescent emanations from without, is due, more than anything else, that peculiar fine flavor and aroma which gives their butter a name and a high price in market.

Prof. Caldwell, in his recent address before the American Dairymen's Association, affirms that—"Microscopic examination has revealed the fact that every case of fermentation and putrefaction is attended with the development of living organisms, and that these organisms are the cause of all fermentation and putrefaction." And further, "that the dust of the atmosphere, as well as all fermenting or putrefying matter, contains either the germs of the microscopic fungi, or the fungi themselves, in one stage of development or another; that these germs fall on all substances exposed to the air, and that if the substance so exposed is one that can nourish their further development, they will vegetate and increase, and in so doing cause the substance to decompose."

Now, milk is a substance not only admirably adapted to the nourishment of these fungi, but its liquid condition fits it to take in and retain every germ that comes in contact with it. It will be seen then how important it is that not only the utensils used in the dairy be kept absolutely clean, but that the atmosphere surrounding milk be pure and sweet. If milk catches the foul odors of the pig-sty, the putrefactive emanations from decomposing manures in and about the stables, or from carrion thrown upon the dung heap, or the putrid odor floating over sink holes or cesspools; all these mean innumerable fungi, which stand ready and eager to take possession of the milk, carrying their foul and putrid elements into it and making all haste to convert it into that filth and nastiness which is their natural home and employment. Some idea of the rapidity with which these organisms increase and multiply will be gathered from the fact that from one single spore to start with it has been estimated the number will have increased in twenty-four hours to four hundred millions! Now when the air is filled with these germs, as is often the case when animal matter is left to putrify until it becomes a stench to the nostrils, and if thousands and millions of the germs fall upon the milk or are absorbed by it, their increase and multiplication are so enormous that they may be said to take complete possession, and we have what is known as tainted milk, intolerable butter, and nasty cheese.

Again, when milk pails and dairy utensils are not properly cleansed, particles of milk left in the corners and cracks decompose and become a mass of these germs, which thus find an easy entrance to the milk from day to day. And as these germs are not killed by coming in contact with hot water short of 212° or boiling heat, it will be readily seen how milk may be contaminated, even in dairies where a good deal of attention is paid to cleanliness, by the neglect in using water *boiling hot*. I have urged upon dairymen, from time to time, for years the necessity of discarding the old wooden pail in milking and substituting instead one made of tin. The difficulty of keeping the wooden pail clean is so great that it becomes a perfect nuisance in the dairy, and should at once be abandoned.

The proper cleansing of the carrying can is another important matter which demands attention in almost every dairy. We have seen these cans cleaned in hundreds of instances, and not once in a hundred has water *boiling* hot been used. A great many dairymen will not be convinced that there is any necessity for scrupulous care in this particular, and so we continue to have bad milk at the factory, and of course cheese more or less "off flavor."

Again, some are careless or in a hurry, or trust the cans to incompetent help, and thus trouble continues. And it will be likely to continue from year to year until the factories adopt Gail Borden's plan of cleaning all the cans at the factory. It would be of almost incalcuable benefit if this plan were at once adopted at all the factories. Nor with the proper appliances would the work of cleaning be very much. In Borden's plan there is a vat kept filled with cold spring water; here the cans are rinsed. Then there are two pipes coming up at one end of the vat, the one throwing a jet of cold water the other a jet of steam. After the can is rinsed, it is put over the jet of cold water, which washes the inside thoroughly. It then goes over the jet of steam, which scalds it out perfectly sweet, and another application to the jet of cold water cools it off. Now the whole operation may be performed in a minute, and how much better would it be for farmers to have this done at the factory, even at a trifling cost, than to set hired help at the work at home. The gain in securing a better product of cheese would be large, and we hope to see it adopted.

Then there is another point which I have often urged, and which cannot be urged too often—*the cooling of the milk as drawn from the cow at the farm*, and before it is started for the factory. We shall never be able to get a really fine flavored product in extremely hot weather till this course is adopted. There are factories in some of the new sections that will not receive milk from any patron unless it is properly cooled at the farm, and those factories have at once sprung to the first rank for fine flavored products. Why old factory and old dairy neighborhoods will still continue in the old stupid practice of not cooling,—still continuing to turn off an inferior product, which sells at from two to three cents a pound below a good article—it is not easy to see.

An improvement could be made I think in milk wagons. They should be provided with awnings or roofs of some kind to protect the cans from the rays of the sun. Then the reckless driving of cows from the pasture to the stable by thoughtless boys or by dogs needs correction at once. The trouble from over-driving cows, and the over heating of the milk by this means, has of late in some districts assumed monstrous proportions. And this alone is seen to a large extent among tenant farmers, men who consider it perfectly legitimate, not only to dog the cows from the pasture to the stable, but who seem to enjoy the pastime of kicking, beating and pounding cows, thus relieving themselves from a fit of bad temper. The number of cows annually ruined from this cause is much larger than many imagine, and if much of the bad milk at cheese factories were traced up it would be found to come from the source we have named.

I advise, that in every factory association there be a committee appointed, whose duties shall be to have all these matters in relation to milk coming to the factory in charge. And the committee should from time to time examine the premises and see that negligence or abuse be corrected. And any patron refusing to comply with such instructions for securing good milk at the factory should be excluded from delivering milk.

Delivering Milk at Factories.

One of the most serious objections to the factory system of dairying, is the hauling of milk. At most of the factories milk is delivered twice a day, morning and evening. On small farms, or when but one span of horses are kept, the hauling of milk not only breaks into the labors of the day, for the hand that hauls the milk, but requires the team to be in readiness at just such an hour night and morning. Whatever urgent necessity there be of farm work, or of business off the farm, all must give way to these regular journeys with the milk. The morning's drive is not so objectionable, perhaps, as that of the evening, since the labors of the day for the man and team may be arranged to commence an hour or two later to suit circumstances. But to break off work at three or four o'clock in the afternoon in order to stable the herds and get through milking in time for the delivery of milk at the factory makes considerable inroad upon the economy of farm work, and often seriously deranges the operations of the day. The hauling of the evening's milk is particularly inconvenient and annoying when there is a press of work, as in "haying and harvesting," since a couple of hours labor towards the close of the day at this season may often be the means of saving property of much value. Again, it not only confines the team to the farm, but often taxes necessarily with too much work; while if an extra team be kept on the farm merely to haul milk it must entail upon the farmer a heavy expense.

Now in what way can the difficulty be obviated, and the farmer be relieved, at least in part, from this continual drudgery? There are two methods that may be adopted; the one relieving him wholly from carting the milk, the other reducing the labor of hauling one-half that in ordinary practice. In certain neighborhoods, where the patrons are conveniently located in respect to the factory, it is undoubtedly a good plan to establish a milk route, and have a milk carrier whose duty it is to go from patron to patron, gathering up the milk and delivering it at the factory. Of course this makes extra expense to the dairymen, still where the surface of the country is tolerably level, the roads good, and the patrons so situated along the route that the milk may be conveniently gathered without extra travel, a regular milk carrier can often be employed for less than the expense for the patrons to cart the milk individually.

The cost of running a team for gathering up the milk and delivering it at the factory, varies in different localities, according to the condition of the route and location of patrons, from one to three dollars per cow. When the sales of cheese are low this expense added to the cost of manufacturing, boxing, etc., takes from the gross proceeds of the dairy quite a little sum. But there are many situations where milk routes cannot be established at anything like reasonable rates, and the heavy roads, the wear and tear of wagons, harnesses and teams, together with the time taken in the delivery of the milk, is so great that farmers can see no advantage in the factory system, finding it more profitable as well as more agreeable to go back to the old system of farm manufacture. Now if the plan of delivering milk at the factory once a day could be adopted, the expense in any case would be greatly reduced, while to those farmers delivering milk with their own teams the relief would be of the highest consideration, to say nothing of the expense saved. And with the improved apparatus for cooling milk at the farm, it would seem that the plan could be readily adopted.

The importance of cooling milk as soon as drawn from the cow, or before it is placed in the can for hauling to the factory, is now pretty generally recognized by those who have had experience in factory management. I have repeatedly discussed this point, and shown that milk put up warm in the cans and then hauled to the factory is liable to decompose and taint in hot weather, and that much of the bad flavor in cheese is to be attributed to this cause. And our factories will always have more or less trouble of this kind until the system of cooling milk at the farm be put in practice.

Now, if the night's milk be cooled at the farm, it may be kept there in good order until morning, and when the morning's milk is ready both messes can be delivered at the factory, thus making but one journey for the day. It may be objected that there will be some cream rising on the milk; but this may be prevented by arranging an agitator on the same plan as at the factories, and where the farm is supplied with running water this can be readily effected at a very trifling expense. But if the milk is properly cooled as soon as drawn from the cow, and then placed in the cans set in a water-box and surrounded by water, the cream that rises will be mostly incorporated in the milk by the agitation while carrying it to the factory. There can be no doubt but that the evening's milk can be kept in better condition at the farm than under the present system at the factories, because the quantity massed together is smaller and not mixed up with different dairies. The plan proposed is a relief also to the manufacturer, and gives him and his hands a little rest, which it would seem is justly due to that class.

There is perhaps no business more confining and which requires such constant skill and watchfulness as with those who have the management of cheese factories. The labor itself is very considerable, while the responsibility and oversight in the management of milk and the operations of cheese making must be excessively wearing and annoying. But under the plan proposed, manufacturers can look forward to a brief respite, at least, each day from their labors. If this plan be adopted, when the cheese is in the press at the factory the day's work is at an end, and the few hours of leisure thus given are no more than conduce to health and a reasonable share of enjoyment, which it would seem all who labor are justly entitled to.

It is true in the plan proposed there would be a slight additional expense to the farmer over the old system, for extra cans, and it would impose upon him the care of the evenings milk at the farm, but all this would be more than met in the bare cost saved of hauling the night's milk, to say nothing of the inconveniences that arise from being obliged to deliver milk in the evening under all circumstances of unfavorable weather, or other causes constantly occurring to render such delivery objectionable. It must be evident then that an arrangement of the kind proposed would be an advantage to both parties, the dairyman and the manufacturer, and I hope to see it largely put in practice.

Cheese Manufacture.

It would be impossible in the brief limits of a single address to even touch upon all the points of interest connected with cheese and butter manufacture. I can only offer in conclusion a few suggestions in regard to cheese manufacture, when that branch is followed by itself as an exclusive business, or when butter making is not connected with it.

What the markets demand, is a cheese of solid texture, that is mellow under the finger, but yet of sufficient firmness to be safely handled, that will not decay and fall to pieces while in the hands of the dealer; that is of a clean, nutty flavor, melting in the mouth, and having that delicious aroma that forces itself upon the attention of consumers. A bad or poor flavored cheese does infinite mischief by cloying the appetite and disgusting those who try to eat it. Just as a bad oyster taken by chance in the mouth will make you sick of oysters for a long time.

Now, what are the requisites on the part of the manufacturer for the production of a fine article? In the first place the night's milk will be improved by the use of an agitator, which throughout the night gently moves the milk at intervals, exposing its particles to the atmosphere. These agitators work on the top of the milk, carried by the waste water of the vat, and not only serve to cool the milk but prevent the cream from rising. Then in setting the milk, high temperature should be avoided.

We should remember and understand the principle that ferments are most active between 90° or 100°. It is an object, therefore, for the cheese maker to keep his milk out of the range of active ferments as far as possible, for these induce decomposition, bad flavor and ultimate loss. This principle is not generally understood, even by our best dairymen, and I am convinced that great losses are entailed on this account. Manufacturers are often careless about shutting off heat at the proper moment, and the milk is raised into the range of active ferment, where, if there happen to be any germs from bad milk mingled in the mass, they are developed with great rapidity, and decomposition has set in and been carried too far even before the curd is ready to be cooked. The heat applied in the scalding process still further promotes this ferment, and so during the heat of summer in bad curing rooms the cheese is almost certain to get out of flavor.

The cheese maker it will be seen has to deal with that class of organism imperfectly understood by scientific men; for the nature of it is still a puzzle to the learned. We know that cold arrests, and that boiling heat completely destroys the germs. If we always had perfect milk, or knew precisely the progress of ferments, the cheese manufacturer would be able to conduct his operations in such a manner as to secure desirable results. But this cannot be known, and hence the constant care must be to keep this low organism in abeyance, for so sure as it is once allowed to measure arms with the cheese maker he is lost, and it will be impossible for him to regain his position and produce a fine product. You will understand then under what disadvantange it is to introduce such a ferment as rennet in the milk that is already innoculated with another active and vicious class of ferments, especially at high temperature, when these germs spring into giants with fearful rapidity. It will be safer then to set the milk at a temperature no higher than 78° to 82°. After coagulation is perfected, and the gang of steel knives has divided the mass, it should be left a sufficient length of time for the whey to form ; then the horizontal gang of steel knives may be used, dividing the mass into cubical blocks. This will finish what is understood by the term "breaking," and it should be accomplished before any additional heat is employed. We use heat in the subsequent operations, not for the purpose of "cooking the curd," but in order more readily to expel the whey and develop a chemical change for breaking down the caseine so that it may be in a condition to be easily transformed into a mellow, flaky and delicious morsel that melts under the tongue, leaving a clean, nutty, new milk taste in the mouth. But we cannot spare the time nor labor, and so we use heat, and if we employ it properly we get the most desirable results.

If we watch the artizan tempering steel to make it tough, elastic, and of the true stuff, you will see that he proceeds leisurely with the heated metal, cooling it by degrees, touching with a little water, and watching every change till it assumes the right color, when he plunges it into the water to check any further change, and lets it cool off slowly. So in cheese making the work must not be hurried, the heat must be slow and gradual, giving the curds time to do their own work, the cheesemaker meanwhile watching all the conditions and standing ready at any time to hold in check the curds, when the proper changes are perfected and developed.

The heat should never be higher than 100°, and perhaps 96° to 98° will give the best results. It is always best to draw the whey early, at the first sign of any perceptible acidity, since you cannot tell what taints you have to contend with. Then the curds may be left exposed to the atmosphere until the proper degree of acidity is reached. Much cheese is spoiled in flavor by being put in the press too warm, as a large bulk of warm cheese promotes undue fermentation and decomposition. Curd should never be salted or put to press above a temperature of 75° to 80°.

In the treatment of floating curds, the principles to be observed in checking fermentation should be observed, and such curds should be passed through a curd mill, as by this means the particles are broken up, allowing the free egress of gasses. Cheese is often spoiled by over salting, as the curing process is checked and held back so that the transformation never becomes perfect.

The curing room should be kept at a temperature of about 70°, and in order to secure uniformity, the walls should be filled with some non-conducting material like straw or tanbark. Then there should be two or three divisions, with air chambers in the ceiling above, and ventilators for conducting off moisture and gasses arising from the cheese during the process of curing. Every curing room should be provided with the means of heating—hot water pipes running round the ceiling are best, for at no time should the temperature fall so low as to check fermentation while the cheeses are young. If the curing process is often checked at this early stage there will always be a tendency to imperfection, both in texture and flavor.

Premium Cheese.

At the late New York State Fair, the premium on the best factory cheese was awarded to the Whitesboro' factory. The process of manufacture may be briefly described as follows:

Preparation of the Rennets. Three earthen jars are procured, numbered, and placed in a line three days before the preparation is needed. In No. 1, as many rennets are placed as are found by experience to be needed each day, which is about one good rennet for each vat of milk of four thousand pounds. A small quantity of sour whey in one half pint of salt is placed in each jar. The next day the rennets are rubbed out and placed in jar No. 2, with whey and salt. The third day the rennets in No. 2 are rubbed out and placed in jar No. 3, with whey and salt, and those in No. 1 are placed in No. 2, and the same number of fresh rennets are placed in jar No. 1. We now use the liquid from jar No. 1 each day, at the same time rubbing out the rennets and putting them in the other jars as before; and dipping the same quantity of liquid as used from jar No. 3 to jar No. 2, and from jar No. 2 to jar No. 1, each day putting the same number of rennets into jar No. 1, and the same quantity of whey and salt in jar No. 3. The rennets in jar No. 3 are rubbed out and rinsed every few days.

Mode of Making Cheese. The night's milk is drawn into the vats and cooled to 65° by Austin's agitator and running water, the morning's milk is run into the vat, and the whole heated to 84°, when the rennet and annotto are stirred in. As soon as the coagulated milk will break smoothly over the finger, and before it is very hard, cut and cross-cut, but rather coarsely. Heat to 96° or 98°, in the meantime stirring with rakes to prevent packing. Let it remain until the whey is slightly acid. Draw off the whey to pack the curd on each side of the vat to drain, air and acidify. Next, cut the curd in square pieces and reverse those next to the side of the vat, placing the others on them, also reversed. When the curd is quite acid, pass it rapidly through a curd mill, using steam power, and immediately salt, using from two to two and a quarter pounds of salt to one hundred pounds of curd, thoroughly incorporating the salt, and put to press directly. Press twenty-four hours, and remove to the curing room, turning daily for three weeks, and then every other day.

Prof. G. L. Goodale presented the following results of ANALYTICAL RESEARCHES TO DETERMINE WHETHER THE NATURE OF THE FOOD CONSUMED BY THE COW AFFECTS THE PROPORTION OF BUTTER CONTAINED IN THE MILK, by M. Boussingault, which he had translated from AGRONOMIC, CHEMIC, AGRICOLE ET PHYSIOLOGIE, par M. Boussingault. Paris, 1868.

Two cows were placed so as to show exactly the amount of fodder consumed in twenty-four hours; the fodder was weighed at six o'clock, A. M., placed in a rack, and on the next day at the same hour what remained was weighed.

A white cow, July 4, 1858, weighed 565 kilograms* (1245 lbs.) She had calved for the fourth time on February 21st.

I. *Ration consisting wholly of Hay.*

Dates.	Hay consumed.	Milk.		
		Morning.	Night.	Total.
July 4	12.0 kilograms.	–	–	–
" 5	13.2 "	–	–	–
" 6	15.0 "	4.05	4.04	8.09
" 7	11.0 "	–	–	–
" 8	14.0 "	4.05	4.17	8.22
	65.2 kilograms.		Average,	8.15
Daily ration	13.07 "			

* A kilogram is about two and one-fifth pounds avoirdupois.

The milk of July 8th was analyzed:

		Morning.	Night.	Mean.
Density at 15° C.		1031.5	1031.5	1031.5
Composition.	Butter	3.51	3 69	3.60
	Milk sugar	5.18	5.01	5.10
	Caseine and Albumen	3.59	3.49	3.54
	Mineral substances	.62	.68	.65
	Dry constituents	12.90	12.87	12.89
	Water	87.10	87.13	87.11
		100.00	100 00	100 00

II. *Addition of rape-seed cake to the ration of hay.*—The ground cake was thinned with water, with the addition of a little salt. This was given twice a day.

Dates.	Consumption.		Milk.		
	Hay.	Colza cake.	Morning.	Night.	Total.
July 9	14.5	2.0	–	–	–
" 10	14.0	1.0	–	–	–
" 11	15.0	1.0	–	–	–
" 12	15.0	2.0	–	–	–
" 13	14.0	1.0	–	–	–
" 14	10.0	2.0	–	–	–
" 15	10.0	1.5	–	–	–
" 16	14.5	2.0	4.70	4.65	9.35
	107.0	12.5			
Average	13.37	1.56			

		Morning.	Night.
Density of milk at 15° C.		1031.0	–
Composition.	Butter	3.34	–
	Milk sugar	4.92	4.86
	Caseine and Albumen	3 51	–
	Mineral substances	.62	–
	Dry constituents	12.39	
	Water	87.61	
		100.00	

Under the influence of the rape-seed cake added to the hay, the production of milk was sensibly increased, but the composition remained about the same. The cake, notwithstanding the 80 to 160 grams of oil which it introduced each day into the nutriment of the cow, did not increase the proportion of butter in the milk.

III. *Addition of bean meal to the ration of hay.*—The meal, thinned in eight litres * of tepid water, was given thrice a day, at six in the morning, noon, and six o'clock at night.

Date.	Hay.	Bean Meal.	Yield of Milk.		
			Morning.	Night.	Total.
July 17	14.00	3.3	–	–	–
" 18	10.85	3 2	5 30	5.15	10.45
" 19	10.85	3.3	5.25	5.00	10.25
" 20	15.00	3.3	5.50	4.80	10.30
" 21	15.00	1.1	–	–	–
" 22	15.00	1.1	4.75	4.90	9.65
" 23	15 00	1.1	5.10	5.00	10.10
" 24	15.00	1.1	4.75	4.60	9.35
" 25	15.00	1.1	5.30	4.55	9.85
" 26	15.00	1.5	4.80	4.80	9.60
	140.7	20.1		Mean....	9.97
Each day	14.07	2.01			

Composition of Morning's Milk.	July 20.	July 21.	Mean.
Density at 15° C	1032.5	1031.0	1031.7
Butter	3.29	3.49	3 39
Lactine (milk sugar)	5.30	4.93	5.10
Caseine, Albumen	3.14	2.84	2.99
Mineral substances	0.62	0.62	0.62
Dry constituents	12.35	11.88	12.10
Water	87.65	88.12	87.90

The bean meal added to the ration of hay had the effect to increase the production a little without modifying the composition of the milk.

IV. *Ration of hay alone.*—In order to see if the increase of secretion of the milk shown in the Experiments II. and III. depended

* The litre is a measure of liquids. One litre of water weighs one kilogram—that is, two and one-fifth pounds, or not far from one quart.

upon the additions of Colza cake and the beans to the ration, the cow was put back on the former diet of hay.

	Hay.	Milk.		
		Morning.	Evening.	Total.
July 27	15.0	4.75	4.60	9.35
" 28	15 0	4.85	4.50	9.35
" 29	15.0	4.60	4.35	8.95
" 30	15.0	4.35	4.65	9.00
" 31	15.0	4.50	4.50	9.00
Aug. 1	15.0	4.10	–	–
" 2	12.5	4.40	4.10	8.50
" 3	12.5	4.00	4.20	8.20
" 4	12.5	4.40	4.10	8.50
" 5	15.0	3.85	4.10	7.95
" 6	12.5	4.10	4.50	8.60
	155.0			
Each day	14.09		Mean	8.74

The morning milk of the first of August was analyzed.

Density at 15° C	1031.2
Butter	3.66
Milk sugar	5.11
Caseine, Albumen	3.40
Mineral substances	0.65
Dry constituents	12.82
Water	87.18
	100.00

The milk had evidently diminished as we should have concluded, since the food was less nutritive. But then we must not attribute all this difference to the withdrawal of the cake and beans. The diminution was due in part to what we may call the age of the subject, the time since calving.

V. *Fresh diet.*—The cow was then fed with green clover, cut twenty-four hours before it was put in the manger.

Date.	Forage consumed.	Milk.		
		Morning.	Night.	Total.
Aug. 7 Clover	57	4.80	4.10	8.90
" 8	44	4.50	4.30	8.80
" 9	45	4.60	4.70	9.30
" 10	51	4.72	4.55	9.27
" 11	52	5.00	4.70	9.70
" 12	54	4.15	4.65	8.80
" 13	20*	4.10	4.00	8.10
	323			
Each day	46		Average	8.98

There was thus an increase in the production of milk.

* The cow left 34 kilograms of fodder out of the 54 put into the rack.

VI. *Ration of hay.*—The cow was again put on hay.

Date.	Hay.	Milk. Morning.	Milk. Night.	Milk. Total.
August 14	15.	3.70	3.85	7.55
" 15	15.	4.10	4.20	8.30
" 16	15.	3.80	3.75	7.55
" 17	15.	3.70	3.90	7.60
" 18	15.	4.00	3.75	7.75
" 19	15.	3.75	3.75	7.50
" 20	15.	3.90	3.70	7.60
" 21	15.	3.65	3.50	7.15
" 22	15.	3.75	3.70	7.45
" 23	15.	4.00	3.80	7.80
" 24	15.	3.60	3.85	7.45
" 25	15.	3.75	3.70	7.45
Each day	15.		Mean	7.63

Analysis of the morning's milk drawn on August 20th.

Density at 15° C.	1031.00
Butter	3.72
Milk sugar	5.12
Caseine, Albumen	3.26
Mineral substances	0.65
Dry constituents	12.75
Water	87.25

This composition does not differ appreciably from that of the milk analyzed previously. There is a decline in the secretion of milk too decided to be attributed exclusively to the age of the subject.

VII. *Addition of wheat meal to the ration of hay.*—The meal was given in a mash, one kilogram of meal in four litres of water.

Date.	Hay.	Meal.	Milk. Morning.	Milk. Evening.	Milk. Total.
August 26	11.7	2.	3.35	3.50	6.85
" 27	15.0	3.	4.10	4.20	8.30
" 28	7 5	3.	4.65	4.50	9.10
" 29	12.0	3.	4.65	4.50	9.10
" 30	12.0	3.	4.55	4.00	8.55
" 31	14.0	3.	4.50	4.00	8.50
Sept. 1	15.0	3.	4.25	4.00	8.25
	87.2	20.		Mean	8.38
Each day	12.46	2.86			

Analyses of morning's milk September 1st.

Density at 15° C	1032 6
Butter	3.30
Lactin	5.11
Caseine, Albumen	3.94
Mineral substances	0.58
Dry constituents	12.93
Water	87.07

The secretion of milk was increased remarkably by the addition of meal to the ration of hay. The composition of the milk was not changed.

VIII. *Ration of hay.*—It was then thought best to put the cow back on a diet of hay, in order to determine whether in experiment VII. the increase of milk was due to the influence of meal.

Date.	Hay.	Milk.		
		Morning.	Evening.	Total.
Sept. 2	15.0	4.05	3.90	7.95
" 3	15.0	4.00	3.80	7.80
" 4	12.7	4.00	3.48	7.48
" 5	11.0	4.20	3.48	7.68
	53.7		Mean	7.73
Each day	13.42			

Analysis of morning's milk September 5th.

Density at 15° C	1030.00
Butter	3.96
Lactine	5.46
Caseine, Albumen	3 13
Mineral substances	0.60
Dry constituents	13.15
Water	86.85

The production of milk was diminished. The composition was about the same as experiment VII. There was, though, a slight increase in the proportion of butter.

IX. *Linseed meal added to the ration of hay.*—This experiment was made in order to determine whether a substance so rich in fatty matter would increase the proportion of butter in the milk. The crushed linseed was thinned first in boiling water. Then enough cold water was added to reduce the temperature to 30° or 35° C. The mash consisted of one part linseed and two parts of water. The cow received this twice a day, morning and night. With each kilogram of meal she took also two litres of water.

Date.	Hay.	Linseed.	Milk.		
			Morning.	Evening.	Total.
Sept. 6	11.0	1.	3.70	3.40	7.10
" 7	11.0	2.	3.50	3.40	6.90
" 8	11.0	2.	3.40	3 50	6 90
" 9	12.0	2.	3.25	3.35	6.60
" 10	10.5	2.	3.50	3.35	6.85
" 11	10.5	2.	3.40	3.30	6.70
	66.0	11.		Mean....	6.84
Each day	11.	1.83			

Analysis of morning's milk, September 11th.

Density at 15° C.	1031.6
Butter	4.01
Lactine	5.25
Caseine, Albumen	3.45
Mineral substances	0.62
Dry constituents	13.33
Water	86.67

The cow, on this diet, consumed less hay. The composition of the milk did not differ materially from that of the milk obtained in experiment VI.; and it is remarkable that the proportion of butter was not increased, although in 1.83 kilograms of linseed consumed each day by the cow there were 300 to 400 grams of oil. The secretion of milk was diminished. Was this because the 1.83 kilograms of linseed did not nourish so much as the 4 kilograms of hay which the cow left in the rack? Or was this diminution in consequence of the age of the subject?

X. *Ration of hay.*—In order to determine whether the diminished production in experiment VIII. depended upon the age of the subject, we put the cow back on hay again.

Date.	Hay.	Milk.		
		Morning.	Evening.	Total.
Sept. 12	12.5	3.65	3.10	6.75
" 13	12.5	3.10	3.15	6.25
" 14	12.5	3.20	3.10	6.30
" 15	12.5	3.45	3.10	6 55
" 16	12.5	3.20	2.45	5 65
" 17	12.5	3.10	2.95	6.05
Each day	12.5		Mean....	6.26

The production continued to decline. On the 30th of September the cow gave 6.50 litres of milk, consuming about the same quantity of hay. On October 3d the milk was analyzed.

Density at 15° C.	1031.0
Butter	3.80
Lactine	4.74
Caseine, Albumen	3.89
Mineral substances	0.65
Dry constituents	13.08
Water	86.92

The cow had calved February 21st, that is to say, 225 days before. As the period of gestation in a cow is 40 weeks, she ought to calve about the 27th of November. She was, therefore, now near calving. The milk still continued to diminish.

It was interesting to observe whether the composition of the milk was modified by this circumstance. We therefore analyzed the milk of a cow of the same breed, who was to calve in a month. The fodder was green clover; the yield of milk was about 2 litres in 24 hours.

Density at 15° C.	1031.6
Butter	5.47
Lactine	5.41
Caseine, Albumen	3.74
Mineral substances	0.85
Dry constituents	15.47
Water	84.53

We also analyzed a milking, taken some days before calving. The cow had so nearly dried up that it was only with difficulty that we obtained one litre. She was of the mountain breed, small, bony, but an excellent milker.

Density at 15° C.	1028.6
Butter	6.20
Lactine	2.89
Caseine, Albumen	5.31
Mineral substances	1.00
Dry constituents	15.40
Water	84.60

These two milks had this in common, that they contained a large proportion of butter. The age of the subject introduces an element of uncertainty into these researches upon the influence of alimentation upon the secretion of milk.

I have, elsewhere, made observations upon the relation which the yield of milk, by a cow with calf, bears to the period of gestation; I will now give their results.

	Milk measured.	
1st month after calving, 2d June....................	280	Each day, 10
2d " "	310	" 10
3d " "	310	" 10
4th " "	292	" 9.7
5th " "	304	" 9.8
6th " "	229	" 7.6
7th " "	204	" 6.6
8th " "	191	" 6.2
9th " "	165	" 5.9
10th " "	90	" 2.9
11th " April, 20 days, ...	20	" 1.0

Instead of relating the second series of experiments in detail, both series are here presented in a condensed tabular form.—S. L. G.

The second series was made on a black cow, of the Fibourg breed, weighing 538 kilograms (1,184 lbs.) This cow calved June 14th at midnight. At five o'clock she was milked, and gave about six litres of milk (or colostrum) of a yellowish white color.

These experiments commenced July 24th.

Experiment.	Food consumed each day.		Composition of the Milk.							Milk in twenty-four hours.	Age of the subject.
	First Series.	Kilograms.	Butter.	Lactine.	Caseine, Albumen.	Mineral substances.	Dry constituents.	Water.			D'ys
I.	Hay..................	13.07	3.60	5.10	3.54	0.65	12.89	87.11		8.22	135
II.	Hay..................	13.37	3 34	4.92	3.51	0.62	12.39	87.61		9.35	142
	Oil cake..............	1.56									
III.	Hay..................	14.07	3.39	5.10	2.99	0.62	12.10	87.90		9.97	151
	Bean meal...........	1.56									
IV.	Hay..................	14.09	3.66	5.11	3.40	0.65	12.82	87.18		8.74	160
V.	Clover................	46.00	–	–	–	–	–	–		8.98	170
VI.	Hay..................	15.00	3.72	5.12	3.26	0.65	12.75	87.25		7.63	180
VII.	Hay..................	12.46	3.30	5.11	3.94	0.56	12.93	87.07		8.38	189
	Meal..................	2.86									
VIII.	Hay..................	13.42	3.96	5.46	3.13	0.60	13 15	86.85		7.73	195
IX.	Hay..................	11.00	4.01	5.25	3.45	0.62	13.33	86.67		6.84	201
	Linseed..............	1.83									
X.	Hay..................	12.50	3.80	4.74	3.89	0.65	13 08	86.92		6.26	206
	SECOND SERIES.										
XI.	Hay..................	15.00	3.42	4.85	3.02	0.69	11.98	88.02		14.12	43
XII.	Hay..................	14.25	4.91	4.89	2.80	0.80	13.40	86.60		13.88	47
	Barley................	1.83									
XIII.	Clover................	53.67	5.06	5.22	2.71	0.70	13.69	86.31		13.83	55
XIV.	Hay..................	15.00	3.74	5.12	2.48	0.70	12 04	87.96		12.38	63
XV.	Hay..................	13.65	2.55	5.08	3.01	0.63	11.27	88.73		11.67	72
	Molasses.............	2.13									
XVI.	Hay..................	14.00	3.08	5.45	2.91	0.64	12.08	87.92		11.40	78
XVII.	Hay..................	11.48	3.84	4.86	2.98	0.69	13.37	87.63		9.97	85
	Linseed..............	1.83									
XVIII.	Hay..................	12.50	3.74	4.97	2.80	0.69	12.20	87.80		9.13	95

Mr O. S. Bliss, Secretary of the Vermont Dairymen's Association, gave the following address on

BUTTER MAKING.

The production of good butter is the most profitable of all farming operations in those regions peculiarly adapted to it, and there are no really insuperable barriers to its profitable production throughout the entire North. The demand for a choice article is always so far in excess of the supply that it matters but little what price is put upon it, within the limit of say a dollar a pound, provided only that it be really choice.

There are several great obstacles to the general production of good butter. The first is the very general—almost universal—low standard of excellence. It may safely be said that not one dairy man or maid in one hundred knows what is good butter, yet, each thinks his own, like his timepiece, quite perfect.

The second great obstacle is the unwarranted tenacity with which people adhere to old notions handed down from past generations. This is not peculiar to butter makers, however, though it does seem sometimes like a Herculean task to make them see the propriety of a new practice, however well founded upon old and well established philosophical principles. They will not see the better way. They will not try to see a better way, for they think it quite unnecessary.

The method of marketing the product is an obstacle to improvement. In most of the county markets there is very little discrimination in regard to quality, the best and poorest bringing about the same price; and with a majority of dairymen there is no other evidence required to satisfy them that their product is perfect than that they get the highest quoted price. To them all the stories they hear about fancy prices are fictions, and if evidence be produced then they summarily dispose of the matter by quoting the old saw, "kissing goes by favor."

There is really very little difficulty in the matter, if only the ambition to excel prompts unprejudiced and careful investigation of how to do it. Wherever suitable feed may be grown there good butter may be made by the intelligent exercise of proper care; but it is idle to hope for uniformly good results without. Care must be taken to supplement any defects in the feed, as only good rich feed, without any noxious flavors can be relied upon for the production of butter with an acceptable aroma. Care must be exercised in the suppression of all offensive odors in the pastures, in the stables, and in all the places and processes through which the milk, cream, or butter pass, for of all absorbents they are the readiest and most tenacious. Indeed, it has been demonstrated past a doubt that the absorbent powers of milk in any of its conditions, but more especially when fresh drawn, are such that diseases of a contagious nature, such as scarlet fever, measles, small pox, and various others, have been carried in it from one person or place to another. Care must also be exercised in counteracting injurious climatic influences; and to this end it is desirable that a very great reformation be effected in the construction of milk rooms and apparatus for setting milk. The entire practice and much the greater part of the theory of the past, bearing upon this subject, have been faulty, as the most abundant and very carefully conducted experiments have proven.

The milk room should be remote from all sources of effluvia, and so constructed that the temperature may be controlled. The ventilation should be under perfect control, but currents of air are not desirable under any circumstances. An abundant supply of water for cooling the milk soon after it is drawn is a desideratum. Economy requires that it be running water, yet in dairies of moderate size a supply of well water may be raised without great expense or trouble. Deep vessels for setting the milk are every way superior to shallow ones, provided the arrangements for surrounding them with cold water as high as the surface of the milk are ample. The shape is not material. The earliest factory vessels were pails, twenty inches deep and eight inches across, with bails for handling them. One successful butter maker of my acquaintance uses them thirteen inches deep and thirteen inches across at the top and some three inches less at the bottom. His vats or tanks for the water are of plank, and just high enough to permit the convenient skimming of the milk without removing the pails from the tank. He does not change the water, but puts ice in it at every milking. Others use vessels twenty-eight by forty-two inches, but it requires too much time to cool the milk in such to secure the best results. The most economical arrangement of which we have any knowledge consists of a vessel made from a single large sheet of tin, except the ends, and is six feet long by ten inches deep and ten wide, or eleven inches deep by eight wide, with a tin jacket made to and surrounding it for the water.

Experiments carefully conducted, and often repeated, have proven that the very best results are attained by cooling the milk within the first hour after it is drawn to about 58°, and subsequently permitting the temperature to rise to about 65° within about thirty hours. To attain this end it is necessary that the temperature of the room should stand at about 65°, and we do not apprehend any injurious results if it is permitted to rise to 70°.

The old theory that the room should be very cool and the milk spread out very thin, in order that the animal heat might be more expeditiously expelled by contact with the air, was very faulty; but the very common inference that cream cannot rise through more than two inches of milk is, to say the least, supremely ridiculous. That such a notion should have obtained among that class of persons who adopt the practice of their elders "without a why or wherefore" is not strange, but that a man of science, a Professor in an Agricultural College, should attempt to support such an absurd theory in the face of hundreds of practical experiments, not one of which has failed to prove the contrary, cannot but tend to increase the feeling of distrust with which practical men look upon the teachings of the merely scientific agriculturists. The gentleman alluded to says, "The weight of authority certainly is in favor of shallow pans." He mistakes in the use of the term "*authority*;" he means the weight of *opinion*, for we are unable to learn of a single instance where any party having experimented sufficiently to enable him to speak "by authority," has reached any such conclusion. The opinion is simply the result, as we have before suggested, of an *inference*, and is entirely erroneous.

Under the old system of shallow pans, it becomes necessary that the milk should become loppered, and the cream filmy, in order that they may be separated, so inconsiderable is the thickness of the cream. Portions of the caseine of the milk become dried to the cream, and it is impossible to separate them in any of the after processes. Those very obnoxious white specks in cream and butter of which we see and hear so much are the direct results of this system of setting the milk. By the new system the cream retains its fluid state, and on being dipped off while the milk is yet sweet is very nearly pure, with only a very slight admixture of milk, also in a fluid state, which may mostly be worked out of the butter instead of becoming incorporated into it, as in the former case. It is practically impossible to make as good butter by the former as by the latter system, though by *much* pains-taking many of the defects of the old system may in a very large measure be overcome.

The implement for dipping off the cream which is in most general use is of the form of an inverted cone, the point of which is made sharp and the edge also left sharp. An upright straight handle is attached to one side. The more common size holds about a pint. It is pushed down through the cream just enough for the surface cream to break over the edge all around and run in. Of course it cannot be used to remove filmy cream from loppered milk.

The milk should stand from twenty-four to thirty hours before the cream is removed, though some makers of "fancy" butter prefer taking it off even earlier. If a very choice article is so desirable that the dairyman can better afford to lose a small amount of the last and poorest of his cream, he may possibly find it for his interest to skim as early as eighteen hours. In some few cases the experiment of skimming twice has been successful, but it is quite doubtful if such a scheme is practicable. The only possible objection to keeping milk, which has been well cooled in a properly constructed room, for thirty hours, is in the poorer quality of the additional cream which rises.

The cream should be kept at a temperature of from 60° to 70°, according to the season, until slightly acid, and churned at a temperature ranging from 55° to 62°, according to the season; and even several degrees higher may be necessary in winter if the cows are not in good condition or are kept on poor feed.

It is desirable that the style of butter as well as the quality should be uniform throughout the entire season, which can be accomplished only by coloring it. There cannot be any possible objection to the use of good annotto for this purpose beyond the very small cost of it and the little labor of using it. We therefore recommend to every butter maker to abopt some standard of color and bring his whole product up to it. The desirable color for butter is yellow, and not red nor reddish. In the preparation of annotto for this purpose, the acid principle which gives to the butter the objectionable shade should be neutralized by the use of an alkaline substance, and it is found advisable to use potash and sal soda for that purpose. But very little of the annotto is required, and it is the better course for small dairymen, and indeed for all, to buy an article ready prepared, though the dry extract of annotto, called annotto-ine, an American production, is sold, with directions for preparation, and its absolute purity is guaranteed by the agents, who are men of good business standing. It is put into the cream before churning. From thirty to eighty minutes is the most approved time in which to bring butter. Many circumstances affect the operation of churning which we may not discuss in this connection for want of time. Indeed, there is but little absolute knowledge on the subject, and many of the prevailing theories are just as well and no better established than others diametrically at variance with them.

If a churn which will permit it is used, and we would not use any other however venerable, the buttermilk should be drawn off as soon as the butter forms little pellets as large as field peas, and the butter rinsed with clear cold water till no appearance of milk remains, when it may be gathered, and after the water is carefully worked out the necessary salt to flavor it may be put in. The amount of salt is a mere matter of taste. The best paying customers prefer about one-half an ounce to the pound, but the more generally accepted standard is an ounce to the pound. No saltpeter or sugar or any other drug should be permitted to touch it. Butter that needs anything of the kind to preserve or flavor it, or to cover up some of its defects, is already too far gone,—"Saltpeter can't save it."

Our own impression has been, and we have until lately practiced accordingly, that butter should be worked the second time before being packed; but some of the best butter makers with whose practice we are acquainted pack directly from the churn, taking especial pains to pack so closely that no interstices for air remain. Over-working butter is an evil much complained of by dealers and consumers, and the washing and packing process recommended is on that account very much to be preferred to the former practice of *working* out the buttermilk, and *working* it the second time to secure the benefit of what little aid the salt affords in extracting the residue which may not be worked out at the first working.

An enthusiastic cheese maker, but lately comparing cheese and butter making, says butter making is a fixed science. It must be confessed that but a few years ago it looked very much as if that might be the case in one sense at least, but that delusion is now happily dispelled, and the wonderful progress which has been made in this department of our domestic industry in the last five years augurs much and well for those who will profit by the means of improvement at their command.

The principle of coöperation which has done so much and is still doing, and promising to do, for cheese making, is freighted with even more of hope for the butter maker and the butter eater; and we hopefully trust that the day is not distant when most of the butter will be made in factories.

I have been deeply interested in the paper presented by Prof. Goodale, giving the results of foreign analytical researches regarding the best food for milch cows. The primary cause of failure to produce good butter, with us in Vermont, as I doubt not it is with you also, is the lack of a sufficient amount of the right kind of nutritious food. There is a large field of inquiry here, and the question, What constitutes the best food for the production of good butter? is one to be settled by the joint labors of the dairyman and the chemist. We assume, however, that good June grass is the standard of acceptable food for the production of butter, and deem it only necessary to bring all our food to that standard to secure the desired result. The production of poor butter in June, butter that lacks keeping qualities, is well known to be common in bad seasons. We assume that is only the result of bad feeding, and that a dairyman who aspires to be a successful producer of "gilt-edged butter," needs only to take such care of his cattle as will keep up the feed to the standard of good June grass, necessarily, in wet and sour weather, supplimenting his feed, whatever it may be, with a suitable quantity of good meal.

There are some figures upon this table of Prof. Goodale which are to me very strikingly illustrative of the position I have long maintained in regard to the matter of feed. The standard here, I perceive, is hay. That is a very indefinite standard. We do not know anything in regard to the quality of the hay, and very much depends upon that.

The first experiment is with a feeding of $28\frac{3}{4}$ pounds of hay a day, and the production of 8.2 quarts of milk; 3.6 per cent. of that stands on the table as butter. From the feeding of hay, the experimenter proceeds to the feeding of colza, an oil cake of which I have no personal knowledge. I am struck with the result. There is a yield of 3.34 per cent. of butter only. I had supposed that colza was a rich oil cake, full of oleaginous matter, and would furnish more butter. Next, feeding 31 pounds of hay and 4.42 pounds of bean meal. The result surprises me. There is in that case only 3.39 per cent. of butter, when I would look for very much more than that, though I think bean meal is a nitrogenous article, tending rather to the production of caseine, the basis of cheese, than butter. We have not fed that much ourselves, but it is claimed about Montreal to be a very fine butter producing meal.

The analysis of clover I regard as not complete. I have a very favorable opinion of clover, both red and white, although butter makers generally repudiate the use of red clover for butter that is to be kept any length of time.

The use of wheat flour in connection with the hay does not present a striking illustration. I have made some practical experiments, lacking, of course, the means of making chemical tests, and I have deduced from them the result, that wheat flour was not a good food for butter producing. We feed some spoilt flour, but prefer feeding it to anything else than our milch cows. Middlings, shorts, or bran, are either of them better for the production of butter than flour.

The result of the linseed experiment in this case is in accordance with our experience. Linseed produces butter largely, but we are troubled to keep linseed butter, and do not consider it the best in quality.

The last analysis, two hundred and six days from calving, shows a very remarkable result. The quantity of milk produced was 6.26 quarts. The reduction, in about eighty days, had been very considerable, although much less than we ordinarily experience; but the increase in the proportion of butter is very large—twenty per cent. This is unlike the general experience in our section. We consider the poorest milk for butter that which we get as the cow nears the time of drawing off, and not necessarily the product of winter feeding. In our region, we are making winter butter that vies in the market with our summer butter, and our dairymen are selling at this time some winter butter which passes in the market as fall butter. Our buyers make that distinction, and decline paying full prices for winter butter; but our butter producers sell fall butter all winter—or some of them, who know how to do it—and it is not much of a trick either.

The feeding of linseed is not practiced with us for butter producing, for the reason I gave, but the feeding of corn meal is becoming very general.

I have been of the opinion, that in your section all you need to make good butter is an abundance of care, and to supplement your coarser feed with a little meal. I do not assent to the view that your rich grasses are more advantageous for the production of cheese than of butter. I do not see that there is any occasion for antagonism in the production of butter and cheese. I think they should both be produced together. The best butter comes from the first risings of the cream, and if a factory is employed, you can make both good butter and cheese, and can secure better results, probably, than from the production of either alone.

I have had handed to me several questions to which I attempt a reply. The first is in reference to a model room, with apparatus for setting milk, ventilation, etc. I do not know that I could describe a model room, any further than that I find it convenient to have a room, the temperature of which I can control. Last year I undertook an investigation of the subject of milk rooms, and recently arranged a series of rooms in which the temperature was controlled by the use of water. From experiments of my own and some conducted by others, I am led to believe that it is essential that the application of the water should be made to the vessels holding the milk, instead of to the room. I am clearly of opinion that the rooms should be kept much warmer than I have heretofore supposed desirable, to secure the best results. The best butter maker in my neighborhood keeps his room, at all seasons of the year, up to 65°, preferring to raise it rather than allow it to fall below. In that case, however, it is necessary to cool the milk immediately after milking, to about 58°. For cooling milk there are many kinds of apparatus now in use; one is a patent pan, with channels running across the bottom. In that the milk is set shallow, as in the ordinary tin pan. Another is in use in Lawrence county, New York, which is calculated for a dairy of forty cows. That pan or vat is 28 by 42 inches, surrounded by a wooden vessel into which water is pumped from the well, which cools the milk.

The next question is upon ventilation. Mr. Willard remarked to-day that very few curing rooms were properly ventilated. The same may be said of rooms for setting milk. Very few understand the evil effects of a current of air upon the surface of milk. A room for setting milk should be supplied with pure, fresh air, but there is no occasion for frequent change of the air in it, as in the case of a living room, and I would avoid any current which could disturb the surface of the milk. It is an erroneous idea that a current of air cools a room. More often, in warm weather, it heats than cools it.

The next question is in regard to churning. I would churn cream when it *begins* to sour. I would let it become *slightly* acid, but not what most persons would call sour.

The next question is as to the standard of good butter. I would like to have Mr. Willard answer that question.

MR. WILLARD. The standard of good butter may be embraced under three heads—color, texture and flavor. The color should be a rich golden yellow. The texture should be solid, approximating to a waxy consistency, rather than to a greasy, salvy one, so that, when you cut it with a knife, it will not soil the blade. The flavor should be that sweet, nutty, new-milk flavor, filled with aroma, which gives such pleasure in eating. It is hard to describe, but we know it when we find it.

MR. GEORGE. Are butter and cheese ever improved by the addition of annotto, or annottoine?

MR. WILLARD. In regard to cheese, that is a matter of taste. The London standard is a high-colored cheese. In Manchester, England, they prefer a white cheese. It is a good deal as persons are educated in that regard. But I think we all like color in butter. If two samples of butter, of equal quality and goodness, were set before us, one colored and the other not colored, most of us would take the colored butter. If one fancies a thing is very nice, the imagination does something towards making it taste nice. A thing may be perfectly pure and sweet, but if one fancies it is dirty or disagreeable, he is apt to imagine that there is something wrong about it. So it is with regard to the color of butter. At least, the markets generally demand a nice color in butter.

MR. BLISS. There is a sympathy between the senses of sight and taste which must be recognized.

MR. THING. Are carrots ever used for coloring?

MR. WILLARD. Yes, sir, butter is frequently colored with carrots, both in this country and in Europe. They are used, not only by feeding the carrots to stock, but by grating the roots and extracting the color.

MR. LUCAS. What breed of cows do you prefer?

MR. WILLARD. In my own locality, for butter purposes, I should breed grade Ayrshires. That may be a matter of fancy. Some of the most profitable dairies in our section consist of what we call "native" cows. The dairies that pay best through our section just at this time have a large sprinkling of Canada cows.

MR. LUCAS. What kind of food would you prefer for butter making?

MR. WILLARD. For summer feed, I would put them on one of the Vermont hills, and let them get what they could there, and if it was very wet weather in June, and all through the summer, I would put them up at night and give them early cut and well cured hay, herds-grass, clover and red-top—all the various kinds of grass that would grow upon the soil. One of the greatest errors of dairy farming is that our people do not study the capabilities of their soil, and do not sow a sufficient variety of grasses to get a good turf and secure the best results in hay. It is a good deal so in pastures, also.

SEC. GOODALE. When do you cut grass?

MR. WILLARD. Just in the early bloom.

MR. BLISS. The next question relates to the difficulty of churning in winter. A few days ago, I received a letter from the editor of the "New England Farmer," saying that one of his correspondents complained that he could not make his butter come; he had churned two days and a half and couldn't fetch it. I asked a friend what the trouble was, and she said he was probably feeding his cows on straw or other poor fodder. Cream that is so poor that it won't make butter in less than half a day is not worth churning.

The next question has reference to working butter. The best butter I have seen this year was churned in a box churn, and when the granules of butter came, about as big as the end of my finger, the milk was drawn off and water thrown in, about 52°, the churn revolved again, the watery portions drawn off a second time, a second application of water made, and then the butter gathered. After that, the water was drained off, the butter dashed a few times in the churn, the salt put in, and almost entirely worked in by that process. It was then taken out upon the table, a lever worker applied to it, for a very few minutes, and the butter put away for twenty-four hours, when it was put into the tub, and firmly pressed in. The hand was never touched to the butter, and there was no second working. I use the Blanchard churn, and work the butter with the dash of that churn, and it answers a good purpose. The only reason why I would use the Blanchard instead of the box churn, is that it is an excellent butter worker—one of the best that has ever come under my observation.

To illustrate my remark that comparatively few butter makers really know what the best quality of butter is, I may say:

Last year, at the meeting of the New York Dairymen's Association, Mr. Lyman, of the "N. Y. Tribune," read a paper upon marketing butter, and remarked, in the course of his paper, that he had brought a specimen of the famous Philadelphia "Prince" butter for exhibition. It was passed round among the audience of dairymen, a thousand in number. All expressed themselves highly pleased with the sample, not one made any unfavorable criticism upon it. But when it got back to the table, he took out another specimen, and told them that this was the dollar butter, the other which they had tasted was only fifty cents. He passed round the dollar butter, and all were struck with the difference. There was not a person in that audience, so far as I know,—and I was upon the stand and watched with much interest,—who discovered that the first specimen was not choice butter, but the moment the second sample was sent round, they perceived a very great difference.

Prof. Peckham. Will Mr. Willard tell us how the best Philadelphia butter is made?

Mr. Willard. The Philadelphia butter is made on the same principle as the Orange County butter. The milk room is on a side hill, perhaps fifteen or twenty feet high, and six or eight feet under ground on the back side, and six feet under ground in front. The walls are of stone. Water flows over the floor of the room, which is cemented, and there are raised walks, so that they can set the milk. They use deep pans, with bales, and they take the cream off when it is thin. This is an important matter. When you set milk in a room through which is a current of air, the cream is apt to get thick, and on the top a thin pellicle, or skin, forms, which is very objectionable in butter; you cannot work it in. Where cream is thick, before going into the churn, it should always be passed through a seive, and broken up fine. They claim that where the cream is thin, so that they can dip it off with a cup instead of skimming it, they get a nicer cream, and in better condition to churn. That is one of the secrets of their making a very nice, aromatic article. The most extreme and perfect cleanliness is observed in all the operations from the drawing of the milk to the selling of the product.

Rev. Mr. Gurney. Does the milk room need to be well lighted?

Mr. Willard. The milk room is lighted, and it is ventilated *at the top*, with wire gauze over the openings, to keep out insects of every kind.

Mr. Bliss. When I first went among the Philadelphia butter makers, a spring-house was regarded as essential to the making of good butter. Of late, the spring-house is going out of fashion, and they are using instead what they call a dry vault. The top of the vault is usually built of stone or brick, with ventilation eight or ten feet from the surface of the milk. They use pans more nearly like the ordinary shallow pans than the deep pail, and these are set upon the floor or upon stone shelves. But in most instances, no special pains are taken to keep the vault dry, and in many cases there is a flow of water through the vault; or, in the absence of flowing water, they sprinkle the floor so as to keep up a slight moisture, the object being to prevent evaporation from the surface of the milk, so that a pellicle, or "leather apron," as I have heard it called sometimes, will not be formed. They use no skimmer; but prefer to dip the cream off; and I understand that to be the practice at the butter factories in Cortland, Dutchess and Orange counties. They keep the atmosphere so moist that the cream may be dipped instead of skimmed; and I conceive that to be one of the advantages of setting milk as I have described, that the quantity of water present is sufficient to prevent much evaporation from the surface of the milk.

Mr. Willard. I wish to add one more suggestion. It is very important in churning, that *all the cream should come.* If particles of cream are left in the butter, if part of it comes and part of it does not come, you cannot wash them out, nor can you work them out. Butter containing particles of cream will not keep.

Adjourned to next day.

THIRD DAY

Friday, January 6th.

The Board met at the appointed hour. The first paper presented was the following by Mr. Brackett of Waldo county:

ON SOME PARASITIC INSECTS INJURIOUS TO FARM STOCK.

The subject of insects injurious to farm stock is a branch of Entomology but little known and studied. These parasites are numerous, and in some cases very injurious to the health of the animal upon or in which they live; but in this paper I have space to treat only very briefly of some of the best known and most injurious species, and for much of the data regarding their history, &c., I am indebted to the labors of others.

The study of this subject presents an opening for some enthusiastic student of Natural History which would well repay his labors, and it is to be hoped some one may enter upon and work up this field, and thus not only add to scientific knowledge, but greatly benefit himself and the community.

THE SHEEP BOT-FLY. One of the most widely known insects affecting or preying upon farmyard animals, is the Sheep Bot-fly, (*Æstrus ovis*) which is found all over our Northern States, and causes what is often termed by farmers the "grub in the head," which is very injurious and sometimes causes the death of the sheep. This fly or perfect insect, *Æ. ovis*, is not quite half an inch long, of an ash color, spotted and striped with black. They appear during the whole summer and deposit their eggs—some say larvæ—on the nostrils of the sheep while they are at pasture. These larvæ immediately ascend into the nose and its cavities to which they firmly attach themselves, causing irritation and an increased secretion of mucus upon which they feed and grow. When full grown, they are about an inch long, and of a brownish white color. When thus full grown, they leave the nostrils of the sheep and fall to the ground among the grass and light soil, where they change to pupæ in a couple of days. They remain in this dormant state from six to eight weeks, when the end of the pupa-case is pushed off and the fly emerges, which, after pairing, deposits its eggs for the perpetuation of its kind. Such is its history.

The amount of injury caused by these parasites is in proportion to their numbers. If but few are present on an animal their effects are hardly apparent; but when in large numbers, as is often apt to be the case, they are very injurious and frequently cause the death of the sheep.

Every farmer and sheep grower knows what a commotion the appearance of these flies causes among his flock. When a fly touches their nostrils they skake their heads, strike violently with their fore feet, hold their noses closely to the earth, and often gallop back and forth over the pasture in their endeavors to rid themselves of the fly or parasite which is trying to deposit its eggs or larvæ. They will often thrust their noses into the dry dirt or soil to prevent the insect effecting a lodgement. It is because of this habit and fact that some sheep raisers plow a few furrows in their sheep pastures, thus furnishing the sheep an opportunity to protect themselves.

These larvæ or "sheep bot-worms," if present in large numbers will force themselves into the various apertures of the head connected with the nostrils, and even into the more remote cavities in the bones of the forehead and beneath the bases of the horns, causing excruciating agony to the animal. Sometimes they will follow the nerve openings into the brain which of course causes immediate death.

There seems to be no remedy known that is entirely effectual to stop the ravages of this parasite. Whatever will keep the fly from depositing its eggs or larvæ in the sheep's nostril will be a preventive, but after the bot has once effected a sure lodgement in the upper frontal cavities of the head it is not much use to try to dislodge them. While they are young and small and located in the lower part of the nostril, any substance which will cause the sheep to sneeze may force them out. Lime, pepper, snuff, &c., are sometimes used for this purpose with good results.

A multitude of preventives and remedies are recommended by as many persons, but perhaps none of them can be fully relied upon. What in some cases will be effective in others proves to be of no use. The best and to me the most reasonable preventive seems to be to smear the sheep's nose with tar which is usually effectual if applied often. Some sheep raisers bore large auger holes into logs of wood in the pastures and fill the holes with salt, smearing the sides with tar. By this method the sheep will keep their noses continually smeared in obtaining the salt. Where any numbers of the larvæ can be detected in the nostrils they may be removed by introducing into the nostril a feather wet with turpentine or weak carbolic acid.

What is often termed the "blind staggers" in sheep is no doubt frequently caused by these bots or grubs in the head, which are by far the most troublesome insect or parasite which is found preying upon the sheep, and it is the hardest for which to find a remedy or preventive.

THE CATTLE-LOUSE. There are several kinds of lice *(Pediculi)* which are found parasitic upon cattle, but the most common is the Cattle-louse, *Hœmatopinus vitali*, which is the palish brown colored one so often found upon cattle while at the barn, and with which every farmer is familiar. It is what entomologists term a degraded insect—that is, one which does not pass through the regular changes, but somewhat like the ticks of various kinds, being without wings in the perfect form and procreates viviparously.

This species is about one-tenth of an inch long, with a small narrow head, and is parasitic on both cattle and horses. They are furnished with a sucker instead of jaws, by which they suck out the blood and juices of the animal, causing an itching and irritation, and of course injuring them more or less, according to their numbers and time of continuance.

Nearly every remedy of the various kinds proposed and in vogue will prove effectual; but perhaps the simplest is to anoint those parts of the body where the lice congregate in the largest numbers with some soft grease or oil. Lard well rubbed in, or an application of lamp-oil—whale-oil, will answer all purposes, for these lice cannot live where grease or oil is found in any quantity. Do not apply strong alkaline preparations, or ashes, lime, &c., nor benzine or kerosene, as these oils or fluids are dangerous. The same with *unguentum*, which is a dangerous poison.

Lice of different species are found peculiar to all animals, man not even being an exception. Hogs, hens, turkeys, &c., are each annoyed by certain species. Thorough cleanliness is usually a preventive in most cases. The louse family is a very numerous one and is found parasitic to both animal and vegetable life.

THE SHEEP-TICK. The sheep-tick, *Melophagus ovinus*, is perhaps the most common, numerous and best known of the various insect parasites which infest farm stock. They are often very troublesome on sheep and lambs, as every farmer knows, and injures the animal by sucking out the juices of its body.

The sheep-tick is one of the few insects that never acquires wings—a degraded or low type of insect life. It is so well known to every farmer's boy that an extended description is unnecessary. It is about a quarter of an inch or less long, of a brownish color, has a hairy body, a large abdomen, and its head is armed or furnished with a proboscis or sucker as long as its whole body and with which it sucks or pumps out its food, the juices and blood of the sheep or lamb, upon which it lives.

The sheep-tick is what naturalists term a viviparous insect, that is, it is perpetuated without passing through those changes or metamorphoses peculiar to nearly all species of insects. It produces full grown larvæ instead of depositing eggs.

Various methods are recommended for exterminating them from sheep and lambs, but the most practical and successful seems to be by immersing the animal in a bath composed of a weak decoction of tobacco, made from an article which is usually found for sale by the name of "sheep dip." After the sheep are sheared in the spring the ticks nearly all leave them and take refuge in the lambs' fleeces. It is then the lambs should be dipped, care being taken that the head and face is not immersed and that the "dip" is not too strong. Two pounds of tobacco steeped in about ten gallons of water is recommended as the right proportions. Poke root solution, petroleum water, and very weak carbolic acid water, are also used for the purpose. Snuff or fine sulphur rubbed into the wool in the winter will sometimes rout them, and fumigation by tobacco smoke is often successfully employed.

Every farmer who has the care of sheep, especially in lambing time and at the shearing season, becomes practically acquainted with these somewhat disgusting insects, as they often get upon their clothes and body. Sheep are sometimes so infested with these parasites, or "ticky" as it is termed, during the season they are at the barn, that they will keep poor with the best of feed, because of the continual drain from their bodies to supply these insatiate insect pests. In such cases measures should be taken to rid them of these parasites which prey upon them.

THE HORSE BOT-FLY. The insect or animal parasite which causes what is popularly known as "bots" in horses, is the larvæ of the Horse Bot-fly, *Gastrophilus equi*, which is very common, widely disseminated and well known.

The fly or full grown perfect insect—the imago, as naturalists term it—is about three-quarters of an inch long, very hairy and of a whitish brown black color, with jet black eyes and black dots on the wings. They deposit their eggs from June to September, and generally upon the hair on the inner or back side of the horses fore legs, though they are often found about the shoulders and on the ends of the hairs of the mane. The egg adheres very firmly to the hair by a glutinous secretion which covers it where deposited. These eggs are taken into the horse's stomach by adhering to the tongue while licking or biting themselves or their mates. The animal warmth and moisture hatches the egg and the minute larvæ or "bot" which comes forth attaches itself firmly to the lining of the stomach where it remains and grows to a full sized "bot worm," varying from three-quarters to over an inch in length, of a dirty white color and furnished with double rows of reddish spines upon each segment of the body.

These remain in the horse's stomach during the winter, and get their growth in early summer when they loosen their hold upon the membranes of the stomach, pass off through the intestines, and fall to the earth with the voidings. They then enter the earth to a small depth, change to pupæ, in which state they remain about forty-five days, and then the full grown fly emerges ready to pair, and the female deposits eggs which if not destroyed go through the same changes as above enumerated.

It is still a disputed question whether or not "bots" injure horses, some writers asserting that they are very injurious, and others claiming they are harmless and even beneficial. But it is most reasonable to suppose they are injurious to some extent, and that a horse cannot be healthy when "full of bots."

The most reasonable preventive is to remove and destroy the eggs, and thus keep the larvæ from the stomach. Many drugs and doses are recommended and in use to expel or kill them, but they are dangerous to use, and those which can be relied on to kill the insect will be pretty likely to kill or injure the horse. Keep the horse in good health and flesh and he will be the better able to withstand their attacks. In severe cases special medicines may be used to advantage, but if possible they should be given under the direction of an experienced person or a veterinary surgeon.

THE RED-TAILED HORSE BOT-FLY. Among the several species of bot-flies parasitic to the horse is the Red-tailed bot-fly, *Gastrophilus hæmoirhoidalis,* which is a much smaller species than the *equi,* which is the most common, and is termed *the* bot-fly. This fly is of a greyish black color, with a bright orange red tipped abdomen, which gives it its specific name. The larvæ have the same general habits and are found in the same situations as the common "bot," but they are smaller and whiter. The pupæ are deep red and change from the larvæ in two days from leaving the horse. In about two months the fly emerges from the pupa-case and deposits its eggs. The period of time during which the fly is found is from June till cold weather.

This is the fly by which the horse is often so much frightened. When the *equi* is depositing its eggs on his legs he does not notice its presence, but let one of these red-tailed flies come near and they exhibit signs of the utmost fear. This fly places its eggs upon the lips and nose of the horse, which is effected by darting suddenly forward and almost instantly affixing the eggs to the hair, notwithstanding the movement of the horse to prevent it. When a horse is seen to stamp violently, throw his head up, down and sidewise, with sudden motion, and run in the pasture as if to get away from some pursuer, it is because of the presence of this fly. I have had a horse exhibit such fear at the approach of one of these little insects, that it was almost impossible to hold or control him.

There are two other species of bot-flies which trouble horses to some extent, viz: *G. nasalis* and *G. pecorum*, whose habits are somewhat similar to *G. equi*, but they are not sufficiently numerous to cause much trouble or injury.

THE CATTLE BOT-FLY. Cattle are very often troubled with an insect called the Cattle Bot-fly, *Hypoderma bovis*, or what farmers term the "screw-worm," and sometimes the "back-worm," because it is invariably found in the flesh of the back of the animal.

These worms are found only in neat stock; they do not trouble horses, sheep or hogs, and they are well known to every farmer and stock-grower, while in the "worm" form or larval state. They are the most commonly noticed in the spring and early summer by the swellings or protuberances they cause upon the animals back and in which they are lodged. They can then be easily removed.

This insect passes through the regular status or stages of insect transformation: 1st, the egg; 2d, the larvæ; 3d, the pupæ; 4th, the imago or perfect winged insect. This insect, in the perfect state, is a fly, about half an inch in length, and of a variegated color, black and grey predominating. Its abdomen is banded or ringed with white, black and orange. The larvæ when full grown is nearly an inch long, white when young, but dark brown when fully grown. The pupæ is a little less in size than the larvæ and of a coal black color.

The following is the history of the insect as nearly as I can learn from observation and the records of others: The fly or perfect insect above described, appears during the summer season from June to September, and the females, after pairing, lay their eggs in the hair, near the skin, on the backs of the cattle. The larvæ soon hatch from these eggs and eat their way into the flesh of the animal, where they remain during the winter. After entering the skin and flesh, they gradually increase in size in their burrows, and living upon the matter formed by the inflammation caused. In this way they produce tumors or abscesses in the flesh under the skin, their burrows always running directly downward, with the posterior portion of the body, in which their breathing pores are situated, near the opening, to obtain air. The mouth is situated at the lower end of the larvæ, and is furnished with minute suckers, by means of which it takes up or sucks in the juices or food upon which it lives.

It is in this form or condition, or when nearly or fully grown the following spring, that they are most commonly noticed. At this time they can be easily removed by squeezing the flesh surrounding them. I have found them on yearlings more frequently than upon other cattle.

After these larvæ are fully grown, as just described, they work themselves out of their burrows, backward, through the opening, and fall to the earth, where, in a few days, they change to pupæ or chrysalides, the dried up skin forming a covering or pupa-case. In this case, imbedded slightly in the earth, they remain in a dormant state for several weeks, then the top of the case comes off and the full grown perfect fly above described comes forth. This fly deposits its eggs as explained, and the insect continues on its course, perpetuating its kind.

These insects do not seem to cause any permanent injury to the animal. The best way to remove them is to press the larvæ out from their burrows with the thumb and finger. Some kill them by inserting a hot needle or wire, but this method is not the best, as it may cause a sore, for if they are squeezed out the flesh soon heals. I have never seen them anywhere on the animal but in the flesh of the back, near the backbone, between the shoulders and hips, but have supposed the reason was because the eggs could not be easily dislodged from those places by licking and rubbing. A little care and attention at the proper time will keep the animal free from this parasite.

A. M. Robinson, Esq., delivered the following Lecture on

LABOR.

I remember when a lad, at the close of a sultry Autumn day, meeting a decrepit old man, wearied out with labor. The old man murmured at his hard lot, which he said had followed him through all the days of long life; and at length closed a catalogue of grumbling complaints by heaping invectives upon the unconscious head of Adam, whose misconduct he gravely informed me was the prime cause of all his misfortunes. But for Adam, such was the logic, he would have been young with perennial youth, and buoyant and vigorous, instead of being as he was, bowed with labor, and old, and wrinkled and gray.

I had of course heard all this theory before, but now for the first time the thought occurred, how it was possible that this old man could have been so fatally complicated in an act occurring so many thousand years before he was born—one with which he could not possibly have had the least connection and over which he had not the slightest control. The thought puzzled me, and the inquiry arose, whether there was not some other and better solution, some standpoint from which a brighter and more satisfactory view of the subject presented itself. Advancing thought with marked unanimity has come at length in this particular fully up to the rescue of our great ancestor, the victim, as we are taught, of the art of the woman and the more subtle art of her companion in mischief; and discovering that labor is an indispensable necessity to the happiness of man in all his relations in life, has reversed the former judgment and decreed it an indispensable blessing. What man was before his first introduction into myth or history is the subject of speculation; but since that date I am not aware that it is pretended that man in his organic structure has radically changed; that great improvements appear in the physical, and vast advances in the intellectual, is admitted by all theorists. Physical labor hardens the muscles to healthful endurance, broadens the chest, strengthens and expands the lungs, quickens the blood, and gives tone and vigor to the system.

Intellectual labor expands and sharpens and refines the powers of the mind. Both forces combined tend to perfection to-day, and are the incentive to the grand onward march to the higher development and the nobler purpose of to-morrow. That labor which woos to its embrace and turns to practical account most of the elements of nature—the sunshine, the gentle rain, the dews of heaven, the wealth of the generous earth—would seem in the order of events logically to be the most congenial pursuit of man, the highest development of the great author of nature,—this is agricultural labor. Hence it is that the pursuit is as broad as civilization and older than written history; indeed, the early progress of civilization is traced mainly in history, by the advance in agriculture and the mechanic arts; trade, inventions, manufactures, exchanges, money and its commercial representatives come in afterwards in regular succession, and are but the offspring of these. In all the varied and multiform diversities of labor, that of agriculture engages the attention and commands the industry of a vast majority of the people of the world. It represents to-day in this country alone, in its leading products, the vast sum of more than three and a quarter thousand million of dollars. It in fact lies at the base of all the activities and pursuits I have enumerated, and is the broad foundation on which they all securely rest; without this base no one of them could in the order of things have existed.

This statement, broad as it appears, is one susceptible of easy proof. If to-day the plow and the spade should cease their labor, hunger would paralyze all the activities of life; if their productive energies were limited to the wants only of those engaged in their use, throwing off no surplus, all other laborers would be driven back to mother earth for the means of subsistence. It is a great and significant truth, this one—that the furrow marks the exterior boundaries of civilization. On the great globe there are certain parallel lines, imaginary and arbitrary to be sure, but well enough defined to the understanding. Without these lines no telescope scans the heavens—no keel, except as a wanderer or adventurer, plows the sea—no crucible tries the metals—no pen traces a thought or law. Within these boundaries are all the developments of thought and labor—the astronomers, philosophers, the chemists, the statesmen, the sculptors, the painters, the orators, poets, inventors and manufacturers. On the one exterior of these lines the sterile, frost-bound soil and piercing atmosphere, repels the hand of culture as fruitless, and scattered savage population maintain a precarious subsistence drawn from the stunted forest and the frozen sea, endowed with intelligence scarcely superior to the seal, the walrus and the polar bear, on which they subsist. On the other extreme is the land of the tropics; on beautiful islands, fanned by ocean breeze and washed by ocean wave,—where nature in her very profusion of wealth spurns the hand of culture as useless,—where the tropical fruit abounds, and bread is not eaten "in the sweat of the brow," but is of spontaneous growth,—on such a spot as this, it would seem, we should meet the type man, physical and intellectual, if without labor such a thing was possible. No such type man appears, but the pointed reverse. The native is but a fragment of anarchy, without polity, or law, or morals. He sails no ship—he carries no flag—he is a naked savage, fierce and wild almost as the wild beast he hunts—a cannibal, devouring human flesh, his very curse the profuse wealth of nature with which he is surrounded.

The condition of active labor is not confined to man; it abounds in all the works of creation. All nature is active, motion, labor; within prescribed limits all its great forces have their allotted tasks, their fixed duty to perform; since creation's dawn the unwearied earth has made its constant round, without so much as a single pause; vegetation presents the phase of unremitted action, of constant labor; production and reproduction, growth and death, are but so many changes developing new forms of beauty or usefulness. The lichen is parent to the oak; the tiny vine creeps upon the moss-clad rock and lives its brief plant life and dies, only to be succeeded by stronger and more succulent vegetation in long line of succession of life, growth and death, until at length the soil is formed which rears the solid oak. In nature's economy the despised weed in its time and place is as useful as the flower, as the "corn fully ripe." The thorn and the thistle cut down by the hoe enriches the earth which makes its grave. The very ashes of the burnt tare quickens the germinating wheat. The noisy, sparkling, dancing brook; the more staid and peaceful river, tending always with unwearied motion to the sea; the waves of old ocean, forever since time began advancing and receding within its allotted boundaries with grand and measured tread, illustrates in another element the beautiful and the grand in the activities of nature.

It is only the stagnant, unnatural pools which are listless and idle; their placid sluggishness generating poison gases, scattering sickness and death broadcast, while in their lazy bosom the frog croaks and the slimy lizard creeps—typical this of the lazy sluggish man or woman, and the lazy, sluggish association of lazy men.

Consider, too, with what tenacious care nature guards all her treasures. The most cunning chemist—if he has the folly to attempt the task--may take a particle of earth and spend the labor of a life in the vain effort to annihilate it; whatever form the scattered particles may assume the indestructible substance remains.

Another noteworthy fact in this connection is this: that without labor nothing of permanent value is ever accomplished, no great result ever achieved; the experience of the world verifies this statement, and its aphorisms proclaim it. "The Gods sold us everything but gave us nothing," was the pagan maxim; "The devil tempts all other men, but idle men tempt the devil," the Moslem; and "Work whilst the day lasts," the Christian.

And just here, I digress a moment, to warn my young friends especially, that all abuses and exposures of the physical frame, however prompted, all excesses, all dissipations of every name and species, are—to borrow a commercial figure—just so many drafts drawn upon the future, with accruing interest, drafts which gold will not redeem; the fearful and only currency in which they can be redeemed is sickness or premature death, *and always the loser pays.*

The highest development of labor as applied to practical utility is the inventive. Arkwright, Whitney, Fulton, McCormick, Howe and his compeers in this department, rank among the foremost inventors of modern times. The spinning jenny, the cotton gin, the steam engine, the reaper, the sewing machine, have revolutionized the status of labor; whilst Morse and his associates in the intellectual department have so vitalized the inventive as to send thought in advance of time athwart the continent, and under the sea. The quickened and powerful intellect of the last half century seems to have centered with intense force upon practical utility, and to have busied itself in grand effort of producing new and useful results, drawn from new combinations of the powers of nature and the application of art; new combinations—for it is not pretended that in all these astonishing advances any new element or new mechanical power has been discovered. For example, the steam engine. A few hogsheads of water and a few cords of wood, by combination and application of powers, draws in three hours, upon the iron track, two hundred tons freight a distance of forty miles; a freight which would require the labor of two hundred and fifty horses, giving time for food and rest, thirty-six hours; or thirty hundred horses, *in the same three hours.* And this grand result is accomplished by the combination of a few simple and familiar elements of power drawn by the hand of art from the great laboratory of nature.

From the present standpoint, looking to the past, and assuming that the powers of the mind are unlimited, a safe assumption since no limit to their progress has yet been found, and that the powers of nature are inexhaustible, an equally safe assumption for the same reason, what may we not expect in the future? The story of the plain of Shinar, and the tower, seems dimly to foreshadow a limit to these powers somewhere, but the question when and where still returns unanswered.

It is not the condition but the unequal distribution of labor which works the individual hardships. A careful statistician states the proposition, and apparently sustains it, that one-third of the time of a whole community devoted to manual labor would produce sufficient for its wants. If this be the fact, it follows that two out of every three in whole or in part escape its burdens. This vast disproportion imposes grievous and unnatural burdens.

This imposition upon manual labor is the work of what is called society. The reasons of such an unjust discrimination are complex and difficult to define. Force, fraud, cunning, custom, habit, law, have each in turn contributed their effective aid in producing it. The evil can be felt and seen, and appreciated and deplored, but until society advances to a much higher plane than it now occupies, cannot be radically cured; none but the idealist dreams of a state of perfect equality of rights and burdens, and he even from hard experience is forced to transfer the happy state to the dim and distant future.

The true relation between capital and labor in its practical workings is a problem not yet solved, and is one at this time exciting unusual attention. The question seems to be, How far shall the law interfere directly or indirectly to adjust these forces? Without attempting to discuss this question here, I hazard the remark, that as each is indespensable to the success of the other, as society is constituted, they would naturally adjust themselves, on the exact basis of equality, if left free to their own intuitions.

As a general proposition, capital without labor is of no value, it is simply dead—while labor can live without capital; of course in its rudest and most primitive condition, but can make no advance. A policy which draws from labor all its surplus, bars it effectually from any further progress; and such a policy in the end must degrade labor into caste and draw broad lines of demarkation between the toiling masses on the one hand, and wealth, luxury and idleness on the other. In countries older than ours, where these conflicting forces have been longer at work, this status in society is an accomplished fact; and it may be worth the inquiry of the statesman, whether in this favored country of ours forces are not actively at work tending rapidly to the same end. The natural tendency of capital is to accumulate in the hands of the few, and there is but a given amount of course to dissipate and scatter in the hands of the many.

"To him that hath shall be given, and from him that hath not shall be taken away even that he seemeth to have," is a truth in finance as well as in ethics; and this tendency may be accelerated or retarded by that public policy which shapes itself into law.

Labor in its general characteristics is proverbially patient, submissive, and unselfish. Capital is active, aggressive and monopolizing; and it will hardly be denied by any observing mind that these distinctive characteristics of capital are more prominent at this time than ever before in the history of this country. We are constantly assailed by complaints of combinations, consolidations, class legislation, monopolies, burdensome taxation, and in its effect equally burdensome, non-taxation—and that these schemes to too great an extent occupy the time and engross the attention of legislators to their own personal gain, and the detriment of the public, and that around these centres circulate rings of speculators upon the public under the forms of law, gold gamblers and revenue cheats. This accumulated mass, in the strict sense of the word, *produces* nothing, and sways its oppressive burden back mainly upon the broad shoulders of productive industry.

Is it strange that under such circumstances labor should become restive, and here and there be upon the strike and everywhere upon inquiry? In our state generally, especially in its rural portion, we fortunately see little or nothing of these antagonisms, and probably never shall. But in the densely populated portions of the country, especially in the great cities, they appear every now and then in startling contrast. Take for example the metropolitan city of the nation—the city of New York. About a year ago a cunning gambler in gold, *made*, so they express it, the enormous sum of six millions of dollars in a few hours, by what was called a financial operation. This distinguished financier, flushed and excited with success, walked proudly out the gold room followed by an hundred broken and haggard victims, *hopelessly ruined* by this very operation; and the losses which caused their ruin did not pause with them, for by inevitable law they diffused themselves through all the various channels of society, until they found a common level upon the broad surface of productive industry.

I have been told that this gold room, the business centre of almost untold wealth, was within a stone's throw of the John Allen dance-house and the haunts of Reddy the blacksmith. In truth, St. James and St. Giles are near neighbors. Hived in the Five Points, rascality and hunger with glittering eye and sunken cheek and shivering limbs, from damp cellar and cold garret, peers out upon magnificent Wall street, where gorgeous equipages and liveried servants are tipped and burnished with gold!

The same public journals which published the wonderful financial success of this gold gambler, published another item of news of less pretentions but not of less significance to the thoughtful. This paragraph contained the startling intelligence, that an hundred thousand laborers in the city were out of work,—a number nearly equal to one-sixth of the whole population of Maine,—twice an hundred thousand hands hanging idle and listless in the depth of winter, and as many hungry mouths demanding food;—and this tangled mass of misery, filth and crime, incomprehensible as the fact might appear to the shoddy magnates of the great city, actually a part of God's universe, and really supposed to be made by his hand—and some confused idea of the right to live may have penetrated their dull brain. The thought struck me then, and still lingers, suppose the cry for labor becomes the *shriek* for bread, and the question of *rights* madly transforms itself into the question of mights,—after that, what? Would it be another rising of another St. Antoine upon another Versailles, and another example of history repeating herself?

The conflict between labor and capital was the one most dreaded by the framers of our admirable system of government; other conflicts, unlooked for by them, have come, and spent their bloody force and gone; this one has not yet appeared, and the hope of all lovers of order is that it may never appear. The fact that labor in this country carries a strong hand, a determined will—that it has the ballot, is vastly more intelligent and better paid than in any other country—presents one, and a strong guaranty against such a conflict. Another and stronger guaranty is found in the great, intelligent, and powerful middle interest class, who embody in their order the elements both of labor and capital; a class as such having no peers in any other country under the sun, composed mainly of agriculturists, independent, orderly, conservative, patriotic; placed between the extremes of labor and capital they hold a commanding influence over both.

The various professions draw heavily upon productive labor; stimulated, doubtless, by the impression that they are less laborious and more lucrative, and possibly more honorable than manual labor. These professions are all over-crowded; their average wealth in an agricultural community does not exceed that of the farmer or mechanic; they are not less laborious, for the labor of the mind is more exhaustive than that of the body. They are not more honorable, for the simple reason that they are not more useful. The leading professions are the legal, medical and clerical. I have time here only to deal briefly with the legal.

As society is constituted, this profession is indispensable to the rights of the individual; yet it has always been looked upon with distrust and judged without charity. Its status is peculiar in this, that while all the other professions in the popular judgment are characterized by their best representatives, this one has uniformly been characterized by its worst. No doubt great outrages upon society are committed by its unworthy members, and in its indignation and anger society sends forth its anathamas against the whole fraternity. Any man, professional or not, who stirs up strife and ill blood for personal gain, or who lies in wait to watch the poor, the thriftless, the weak, the contentious, to coin their frailties and vices into gold, is an unmitigated curse to the community in which he lives.

The power of this profession is one of the active forces in society, and if misused becomes oppressive just in proportion to its power, and its victims are as a general thing that class which most need the protecting hand of judicious advice instead of peculation and plunder. What the spider is to the fly, it entraps and devours; what the serpent is to the bird, it charms and swallows; what the Parthean arrow was to the mailed breast of the Roman soldier, penetrating the closest joints of his armor, and extracted only by tearing the vitals of the victim, the dishonest and unprincipled representative of the profession are to the class I have described. These practitioners have a philosophy, a religion, and a code of morals peculiarly their own. "Thou shall want ere I want" is their ethics, "I will chaffer for the ninth part of a hair" their poetry, and "pay me that thou owest" their religion. My advice to all farmers is to avoid this class of practitioners as they would avoid the rinderpest or cholera. If compelled to go to law employ honest lawyers. The tendency of a class of men, and quite a large class too, to plunge into lawsuits and fret away their lives and waste their estates in tedious and expensive litigation, has always been the puzzle of my life. Any lawyer of standing and experience will confirm the statement that the great vexation of the profession is to keep men out of useless and fruitless litigation.

I have only time to glance at another department of labor presenting a picture of the refinement of *oppression*, yet so silent and submissive in its suffering as to attract but little of public attention. I refer to the needle-woman, the seamstress. These uncomplaining laborers, ground to powder betwixt the upper and nether millstone of cupidity and frivolity, are reckoned in the cities by thousands and tens of thousands; ill-clad, ill-fed, living in wretched, cheap rents, toiling over dim lights, in broken health, too often embittered by memories of broken fortunes and the recollection of happier days, they toil on silent, despondent, hopeless, except it may be the hope of death, sixteen, twenty hours labor for twenty cents, for thirty cents—in rare instances for fifty cents—so the statistics show—with rent to pay, and a sick child it may be to nurse, and imperious masters, or more imperious mistresses to serve, under the constant dread of dismissal and consequent starvation.

Is it strange that the victim thus tethered should be straining her saddened eye to scan the social horizen, in order to discover in *some quarter* the hope of release? that she, too, should be inquiring for her rights, for long years a vain inquiry? or should we complain that at length the prying eye of the spirit of the age has fixed its steady gaze upon this social plague-spot, and the cause of the oppressed is championed by her own sex?

Something after the manner of the knights of old, "The strong minded" have entered the lists, thrown the gauntlet and defied all comers to the field of debate and argument. In the judgment of these enthusiastic reformers, the grand panacea for all the ills society is heir to is the bollot. True to the instinct of the propagandist, they assume the aggressive, and put their proposition in the affirmative; the whole theory of reform is concentrated in the one *short*, sharp interrogatory of Why should women not vote? The question demands a categorical answer. With the issue made up in this form, and the suffrage advocate seems inclined to hold it there, it must be confessed, I think, that a direct negative answer is somewhat embarrassing.

One fact in the controversy is quite obvious: a change of the immense power wielded by the sex upon society; from the passive, wherein its great strength is supposed to lie, to the active, must make a profound impression, and whether for good or evil is the debatable point. It is in vain to-day to argue that this thing should not be, because a like thing has not been. The practical intellect of the time has burst the barriers of precedents, refusing longer to be circumscribed by them. The pathway of inquiry, doubt and investigation is strewn thick with the lifeless skeletons of the dogmas of the past, never to be revivified; and the dogmas and theories of the present are alike submitted to the crucible of intelligence, and tried there to determine whether they are pure or base metal, or mere dross.

The answers thus far usually put in to this suffrage demand are, first, the inconvenience and trouble it would impose upon the sex. To this the advocate rejoins, that this objection concerns herself alone; and she will be happy to suffer the inconvenience for the benefit of the privilege; and, second, some rather ungracious remarks from the Apostle to the Gentiles, who evidently held an indifferent opinion of women as propagandists, a fact rather plainly indicated in his instructions generally upon this subject, and particularly so in verses 34 and 35 of chapter 14 of 1st Corinthians. To this objection one of the advocates proposed a simple and rather novel rejoinder, that of "passing by" both the authority and the author. With her the ballot is the one *intense idea,* and therein lies its stregth, its hope, and its prospect of success; for I am inclined to think that success is only a question of time, that the advocate has only to agitate, watch and wait. Such has been the history of kindred agitations striking at the base of settled custom.

This measure, in the judgment of its advocates, promises no less than the complete renovation of society; the ballot is to be purified, the wages of labor fairly adjusted, distinction of caste and condition in society abolished, and the public councils filled with honest and competent representatives; in short, a social and political millenium inaugurated. Most desirable reforms surely; and it is an invidious task to analyze these brilliant promises, so far even as to inquire into the means of performance; to ask, for example, what superior means of knowledge would the female voter possess over the male, of the fitness of any candidate to fill a place of public trust? Would the ballot endow her with virtue or intelligence superior to her father, brother or son? It is difficult to perceive that a bit of paper has any such occult power.

The adjustment of the question of compensation for labor betwixt the male and female involves the graver one of the adjustment of labor and capital. If the addition of the female ballot would bring a like addition of productive industry or of capital, then the scale could be easily balanced. Capital fairly worked can carry but a given amount of labor, and if the labor is performed it matters not to capital whether by one or many hands, by male or female. To illustrate, a farmer hires a man at twenty-six dollars per month and a woman for eight dollars a month; his capital, the farm, can carry this amount per month and no more. Now, if compelled to raise the wages of the woman to one-half the twenty-six dollars, he must reduce the wages of the man in the same proportion or abandon his business. So with all employments. The ballot has added nothing either to production or to capital. By law and custom the burden of providing for the female is upon the male; hence the higher wages and the more productive employments. Suppose the rule reversed and the burden shifted, nothing is added to the capital, the twain have but the same amount betwixt them.

Doubtless a more equitable division of the wages of labor betwixt the sexes is in many cases desirable; but the Chinese maxim is "that the law does not notice trifles." It strikes me that the evils so justly complained of are rather social than political, and the true corrective will be soonest found in educating public sentiment up to a healthier tone. This agitation has thrown off one good result at least by making it possible for women to fill many stations in the industrial pursuits, from which she was formerly barred out, without losing caste. Many more should be opened up in the pathway of life, and doubtless will be, and possibly justice attained without the inconvenience of the ballot or the violation of the precepts before referred to.

In conclusion, allow me to refer to two other drawbacks, alike paralyzing to all our industries and fatal to our prosperity as a State, drawbacks which appear in startling characters in view of the figures of the last census showing the state of our population, both children and adults. It will be borne in mind that population lies at the base of all prosperity. The one of these drawbacks is "*a deed without a name.*" Not a new crime, but an old one, one which strikes at the source of population, and one which in the history of the world has overturned states and empires by the forced necessity of a foreign population to fill up the gaps opened in society by the want of a native population. We are now importing Swedes, at a high bounty, to "replenish" our State. It strikes me that if the policy of settling our State by bounties and gratuities is to be adopted, it might be wiser to encourage by such agency home production rather than foreign immigration. This, however, is a question for the legislators.

The other drawback is *emigration.* With this spirit constantly combating all our energies, it is simply impossible to build a prosperous State. One of the stimulants to this is the eager desire to accumulate sudden wealth. We are not content with the old ways of accumulation by honest industry and by advancing steps. Gold gilds everything. If a man is rich, no matter by what means his accumulations come, he is a power in society. Talent, truth, integrity, genius, all combined, are but a secondary power. We are more devout worshippers to-day of golden calves, or rather of gilded calves, than were the Hebrews of old in the days of their idolatry. In this intense pursuit all ties are broken, and too often truth, honor and integrity left behind; under its heavy tread the foundations of society seem to be shaken. In the background of this picture are the crowded poor-houses and the crowded prisons; but these are simply the background, attracting little attention except from the connoisseur.

This greedy thirst for rapid gains act with intense force upon the young, the enterprising and the ardent, as in the nature of things few prizes can be drawn in such a lottery of life. The blanks represent a crowd of adventurers, disappointed, disgusted, and broken down in the very outset of business life. If our young men, the pride and hope of the future, would be content to live and labor by the cradle of their childhood and the graves of their fathers, then, indeed, our State would be rich and alluring in all that makes life useful and beautiful and grand.

Of all the people on the face of the earth, it has always seemed to me ours are most inclined to migratory habits. What are the inducements abroad impelling us to sever all the beautiful associations of youth and home and native clime and become alien to the fatherland? I am aware of the allurements that beckon us away, of the glittering prizes held out by fame to the hopeful, the credulous and the uususpecting, prizes always in the future and at a distance, and consequently the more dazzling. These things are not well considered. The success of the one comes back trumpet-tongued to excite, unsettle and disturb at home. Over the non-success or outright failure of the many the veil of oblivion is carefully drawn; they die and make no sign. The gifts of God are in nature, in my judgment, pretty equally distributed. "In all the wide world there is no Eden without its serpent and its sword."

We contrast our own rugged soil with the prairies of the West and the savannas of the South, and sigh for a change; forgetting that one generation of emigrants, at least, must pass away, must die out, before the comforts, pleasures and refinements of life enjoyed by us here can be approximated to there. The true philosophy of life is to make the most of what we have and be content; if the condition of agriculture in this State is not satisfactory, let us unite in a determined effort to make it so before abandoning the field. This pursuit has of late been quickened by the general current of active thought, and is rapidly taking rank as a science; hopeful men arguing that from the advance made in the past few years, are looking forward for greater advances and greater improvements in the future; they feel that they have only to hold well in hand a fair proportion of the intellect which belongs to their class, to place this pursuit in the front rank of honor and usefulness, and that it affords room and verge enough for the most active exercise of the highest intellectual powers. If it is a laborious occupation, so is every pursuit in life that leads to success. Very many beautiful things have been said and sung of the exclusive charms of rural life, the work, doubtless, of amateurs. The practical laborer can hardly appreciate these poetic effusions and imaginary charms, for in truth there is little of poetry in the use of the pick and the spade, the scythe and the hoe, in a hot July day. But there is substantial reward for these labors in that *indescribable, self-poised, independent manhood and true nobility* in the possession of houses and lands, woods and fields, flocks and herds, incident to no other pursuit or condition in life.

Capt. Stewart of Farmington, having been requested to give a statement of his method of curing hay, said: The method of curing which I have practised with uniform success for four years is as follows: The grass is cut *after* the dew is off. I deem it a matter of the utmost importance that none be cut while any dew remains upon it. I usually begin from eight to nine o'clock in the morning, using a mowing machine. Nothing farther is done until after dinner. At half-past twelve to one I begin to get it in, raking by hand, as two men will rake as fast in heavy grass as two can load it, and by five o'clock the hay is all in the barn. I put into each mow four, six or eight tons. Then I put what I call a sweat blanket upon it, that is to say, a foot in depth of straw. In from 24 to 36 hours it begins to ferment, and the heat concentrates towards the centre and rises to the top; the moisture and heat passing into the straw. That is the whole story. The harvesting of hay costs me but $1.25 per ton, notwithstanding the high prices of labor.

Question. What kind of a barn do you put it in?

ANSWER. A common farmer's barn, clapboarded, and having a double floor, ventilated at the top. After getting the hay in I shut tight, except always leaving the ventilator open. I never put more than six to eight tons in a mow—never tread it, but only spread evenly, as it mows itself to the proper condition. I have not lost a pound of hay thus made since I began in 1867. If the least dew remains on when it is cut it will blacken in the mow.

QUESTION. How large a surface does a mow cover?

ANSWER. Fourteen feet square.

QUESTION. Can you put one day's mowing upon that of a day before?

ANSWER. Yes, sir; two days' if you please, but not more.

QUESTION. What would be the result if you put no sweat blanket of straw upon it?

ANSWER. You would spoil as much again hay.

QUESTION. At what stage of maturity do you cut the grass?

ANSWER. In the second blossom.*

QUESTION. Do cattle relish hay cured in this method?

ANSWER. They prefer it to any other. If you put some of this before them covered with that cured in the common way they will pick all the first out and eat it before the other. As I said before, there is only one way to do it, it must be cut *after* the dew is off, must be exposed to the sun for three hours, and must be got in before any dew falls. You may spread it after cutting, if you please, but I never touch mine. I have samples here of four several years' growth, which you can examine and judge of their quality. I know it is said by many that this cannot be done; but I have done it four years in succession, with no approach to a failure. The first year I tried it a rain storm of a week came just after I got in my first lot. I watched that mow very carefully, and its behavior was so perfect that I concluced to treat the whole in the same manner, and did so, and have done so ever since.

MR. Z. A. GILBERT read the following paper on

FARMERS' CLUBS.

Without any statistics to show the magnitude of my subject, without referring to Washington or Webster to prove its popularity, without going back to mother Eve and the Garden of Eden to prove its antiquity, I proceed at once with what I have to say.

* NOTE, by Editor. An advanced stage of maturity is probably as essential a requisite for success by this method as freedom from dew, or any other.

Farmers' Clubs are of two kinds, the *ideal* and the *real*. The ideal farmers' club is made up of farmers and farmers' wives interested in progressive agriculture. They love their chosen calling, and follow it because they love it, ever carrying with them a living faith that it brings, or is capable of bringing with it, as much independence, as much health, as much happiness as any other calling on earth. Believing knowledge to be within the reach of all who earnestly desire it, they see no reason why the farmer should not possess himself of a liberal share as well as the mechanic or any other laborer. This knowledge is not content with the system, or rather lack of system, which characterized the agriculture of other days, but believes that the new order of things demands a different system. Progress in agriculture must keep even pace with progress in everything else. Consequently the mind must be kept active to meet the demands of the times. More light is needed, more knowledge desired. Associations for mutual benefit are the natural outgrowth of these necessities. Combined wisdom is more reliable than individual ideas. The farmers' club becomes a necessity. Here all meet for mutual benefit, and all not only expect but desire to participate in the discussions of the meetings. No time runs to waste, and when the hour for adjournment arrives the feeling is that it is all too soon.

That mental culture which the farmer so much needs is stimulated. Too often he labors too much with his hands without assistance from the mind. This meeting with his fellow farmers stirs up his mental powers. When mind comes in contact with mind the friction produces mutual activity. The mind is led out of its ordinary channels into new fields of thought. Inquiry is awakened, research is encouraged, a desire to know the reason of this result and the effect of that operation is awakened. Instead of the blind routine formerly followed, he knows the reason why such and such a course should be pursued; his operations are conducted in accordance with scientific principles, he knows what he is about.

The practice of talking before the club, makes him a fluent public speaker upon any subject on which he chooses to speak. The practice of arranging his thoughts upon paper in the preparation of essays to be read at the meetings, in the arrangement of topics, and in other business matters of the club, makes him a ready writer. His familiarity with the methods of transacting the business of the club renders him conversant with parliamentary rules and practice. In addition to all these advantages, practical knowledge also is gained. Every farmer has a fund of knowledge which he has gained from his experience and observation, and in the club it is made common stock, all can share it alike. Social intercourse, so much needed by the farmer in his isolated position, is thereby promoted. We need occasionally to lay aside our self-conceit and meet our neighbors in a common cause on common ground. The peace and quietude of the neighborhood, and the happiness of all living therein, is thereby increased. The social qualities are cultivated. A good library of agricultural and miscellaneous books furnish reading for the long winter evenings and such other leisure time as may be devoted to them. The knowledge gained from this reading is apparent at the evening discussions of the club. After being wrought over to suit the circumstances of the individual possessing them, the hints and suggestions found therein are put in practice. The association with the fellow members of the club creates a healthy rivalry in matters of rural taste and rural adornments, and neatness, thrift and enterprise are stamped on all the premises. A keener perception, a closer observation, a more accurate knowledge of the different farm operations is promoted, which inevitably tends to the correction of errors and to the practice of a more improved husbandry. The annual supper or social festival, in addition to the enjoyments of the hour, promotes the good will and the friendly feeling of all connected therewith. Deep-seated jealousies are uprooted, hatred is overcome, aristocracy is broken down, equality is encouraged. Mentally, morally, socially, practically and perceptiby does the ideal farmers' club operate upon its members.

Alas! how wide the difference between the *ideal* and the *real!* The history of the *real* is soon told. Some two or three individuals feeling an irrepressible desire to elevate the standard of agricultural intelligence in their vicinity, bestir themselves among their neighbors, and by a vast deal of talking and urging finally succeed in getting quite a number of farmers and two or three professional men to agree to meet together on an appointed evening for the purpose of organizing a club. If some outside assistance is procured—some speaker from abroad—a goodly number assemble, and the interest manifested appears encouraging. A club is organized. The result is reported for the local paper, with the list of officers, time and place of next meeting, and the topic for consideration. On paper the thing looks first rate. One of the professional members volunteers to give a short lecture on some industrial topic at the appointed meeting. All hands want to hear the lecture; so men, women and children turn out in goodly numbers, not to discuss the question, but to hear the lecture. Of course the lecture is the best part, and the principal part of the evening's work. Time goes on, and all the professional members (together, perhaps, with some member of the Board of Agriculture) having had a turn at the bellows, the exercises must now be sustained by the farmers themselves. The interest wanes; the meetings grow dull; the numbers in attendance grow "small by degrees and beautifully less." At last the originators of the movement find themselves, at the hour appointed for the meeting, almost or quite alone. They go out and drum in a few recruits, but the thing goes hard. Finally, after repeated attempts to die, it becomes, as Doesticks expresses it, "lifeless, defunct, dead without doubt."

Fortunately for the cause of agriculture, the picture does not correctly represent the result of all efforts for the establishment of these primary schools of agriculture. We have a few, too few, clubs in the State whose standard approximates closely to that of the ideal; and we have them also in all stages of success between the two extremes drawn, and some below the lowest.

Now, then, what are the causes of the success in the one case, and what are the hindrances to success in the other? How shall a deeper interest in practical agriculture be awakened among the masses? How shall we enlist to a greater extent the farmers' attention in these matters—his mind, his thought? We all know the sturdy, honest, hard-working farmer is hard to reach. The scales of indifference and conservatism so completely envelop him that he is almost impervious to new ideas, however forcibly they may be projected against him. How shall we approach him? Are we on the right track, or is there a better way? These are questions which I hope others well expand upon. What I have said is intended only to open the subject, expecting the representatives of the various clubs, and others interested in the matter, will continue the discussion. The active clubs which are at work in the State are doing a vast deal of work, work whose fruit will in due time appear; and what we wish to do is to speed them on in their work. We wish to know the best way to promote their interests, and the most efficient means of encouraging their multiplication. As for those clubs which have been unable to continue an active existence, let us throw around them the mantle of charity, and inscribe upon their head-stones "Requiescat in pace."

MR. ADAMS of Wilton. As delegates are present from various farmers' clubs, who are probably prepared to speak, I propose that we now listen to their reports.

MR. MOORE of Anson. As has been said by the lecturer, it has not been without labor that we have organized a farmers' club in our vicinity, but it has been followed with much satisfaction to those who have attended. But we have realized the difficulty which has been hinted at, that farmers who can sit down by their firesides and tell how to raise a calf, a lamb, a colt, or an acre of corn, with perfect ease, if you get them into a club and ask them to speak to twenty or thirty people, they do not feel at home, and decline to say anything. How do we overcome this? We resolve ourselves into a committee of the whole, and make it as social a thing as possible, and ask questions of one another. In this way we get out ideas that we should fail to reach in any way that seemed like public speaking.

But we have also many farmers who can stand up before twenty, a hundred, or a thousand people and make their statements as easily as they make them by their own firesides; and this is an advantage, but still we want to get items of information from the good farmers around us who have not the confidence to make these statements.

We endeavor to draw out facts. We do not go into the treatment of subjects so systematically, perhaps, as might be, but we get many valuable facts and hints touching soils and crops. We discuss the practical application of manures—what the effect is of a certain application, in a certain way, or upon a given soil. We likewise draw out the facts in relation to failures—for there will always be more or less of these,—and when a man is reaching forward, if we can point out a sunken rock, we consider it as good as to point out the highway. We draw out as many ideas as we can from practical men; and they tell us what they do with their potatoes; what with their grain; how they feed it out; how they keep their oxen on straw and potatoes; how they grow pork and sheep and fruit, and in regard to other branches of farming. And we have succeeded in making our meetings very interesting. The reports of our discussions are anxiously looked for, and many seek the paper in which they are published more for these reports than for almost any other matter that appears in it. Still, it has required labor on the part of a few to create an interest and to keep it up so as to have the meetings of the club well attended.

Col. Phelps of South Paris. The meetings of our club last year were very interesting. We adjourned over in spring to October. At that time a goodly number met, and we have succeeded in gathering a good number of professional men, mechanics, editors, lawyers and farmers; and we have only a few farmers in our town who fear to express their opinions before professional men whom they know can talk better than they. They mingle socially together, and take up the various topics which are presented for discussion; for instance, which is the more profitable to raise grain or stock? What is the relative value of the different fertilizers, &c. We have met regularly every fortnight since October, and sometimes weekly, and I find that it now attracts the attention of those who have never taken any interest in it before. I have known them to stay until after eleven o'clock, and they will say, "I will try this," and "I will try that." This is encouraging, and we have no doubt that our club will be productive of great good.

My friend, Col. Swett, went to Norway and gave an excellent lecture, and a good club has been organized in North Norway. The members of that club speak very highly of its usefulness, and I have read their discussions in the "Oxford Democrat." If every man in our section would take the interest friend Swett has, we should have a farmers' club established in every town in the county and much good would be done.

We have heard a good deal here about "theory" and "practice," about "science" and "experience." An old adage is, "a yard of experience is worth three of theory." In the farmers' clubs that I have attended I have gained as much information from the experience of practical farmers in raising stock and fruit and in fertilizing their fields, as I have from college professors, and I have got a great deal from them. I believe the time is not far distant when we shall derive great benefit from the Agricultural College. I think it will succeed.

I am told by the members of the North Norway club that they use the club for business purposes. One man says he has six or eight cows to sell, of such a breed; another has four; another has a horse; and another wants to buy. That is a new idea to me, but it is a good one.

Mr. Tarbox of Phillips. I am a young farmer, although forty-eight years old. I belong to the Central Club at Phillips. We have some farmers there who have taken great interest in the breeding of cattle. Major Dill, Mr. Hoyt, and others, have done much towards improving the stock of the county, and inducing farmers to go into more systematic and improved methods of farming, and they invited me to meet them in the club. I told them I never spoke, and had not been to the village six evenings during the six years I had been on the farm. I was loath, but finally I concluded to go. They appointed me as one of the speakers on the first question. I told them that I was not versed in farming, and could not do justice to the subject. I went home and told my wife that I should break down if I undertook to speak on that question. She said, "Write an essay, you can do that." I told her I could, but I could not read it. But finally I wrote an essay, and succeeded in reading it. After reading the essay I supposed I should be used up, but it only prepared me to say something more. I gained confidence, and followed it up four or five meetings, and the only objection to it is, that we get so interested we remain too late. My wife thinks we could say all we need to say without remaining until eleven o'clock.

Mr. Thing. I take my wife with me.

Mr. Tarbox. That is our intention, after we get under way; we are working for a revival. It is customary in all branches of business for men to come together and get up an interest. It is so in the temperance cause, it is so in all other causes, and one of the greatest benefits of these clubs is, that they awaken an interest in the farmers. They infuse such a spirit into the community that every lazy loafer will go into farming with a zeal and enthusiasm which cannot fail to be productive of beneficial results. We are doing that in Phillips. We have succeeded in keeping up the interest so far, and I think it will hold out. The statement of all those who have attended the meetings is, that they have profited greatly by listening to the discussions. That is my case. I learned more the first evening by looking over books, and posting myself in regard to the dairy business, than I ever knew before, and learned more in regard to the different breeds of stock. It is true that we get along slowly, but it takes a good while at best to investigate one subject thoroughly; we have not time to discuss so fully as we wish to.

I would encourage the organization of these clubs, and if it is hard to get the farmers to come in, call in the doctors, lawyers, and ministers, until you get up an enthusiasm that will set the farmers to talking. No money would have hired me a year ago to speak before this assembly, but a little practice has easily brought it about. As one remarked here, there is talent in farmers as well as in doctors, lawyers and ministers; and if we have neglected in former years to discipline ourselves to speak like professional men I trust we shall do so no longer.

MR. KEYES of North Jay. I am very sure that if I undertake to say anything I shall not be so fortunate as my friend Tarbox; I shall break down before I get through. But I will attempt to tell you how we get along in the Jay club.

Through the influence of the Board of Agriculture, some inducement was offered, a year ago last winter, for the organization of farmers' clubs, and a few of us, a year ago last March, talked the matter over, and thought we would organize. On the second of April we did so, and adopted a constitution, and adjourned over. The next November we called the club together, and we have been gaining ever since. We have no assistance from professional men, for we have none in our place, therefore it all devolves upon the farmers. We are not versed in parliamentary rules, and attempt little formality. We all meet on a level, take up a subject for discussion, and talk it over. We went on last winter and had profitable meetings, and when we got through in the spring were well satisfied with the result. We now number forty-two members, and we see evidence of good already accomplished, and are bound to keep on our way.

MR. PARKHURST of Aroostook. I suppose we are all familiar with the fact that the first impressions men receive upon entering on any new enterprise are generally lasting. I would like to inquire the best method of organizing a farmers's club, so that those farmers who attend at the first meeting may be so favorably impressed with the benefits to be derived from the club that they may continue to attend the meetings.

MR. BELCHER of Farmington. Let me say, that the Board has never expended any efforts more profitably than those devoted to the organization of farmers' clubs throughout the State. They have done immense good. They have had the effect, as has been said by Mr. Tarbox, to induce farmers to investigate and post themselves up, by the use of every means within their reach, upon the various subjects connected with this great business of agriculture, which is in reality the business of the State. I have seen the effects. I have read with interest in many papers the accounts of the meetings of clubs; and whenever you read these accounts you will find some new fact, or some interesting statement that has been made that is worthy of a good deal of attention.

Several clubs have been organized in this county, and on the whole they have been fully as successful as we could anticipate. They have brought out a great deal of talent. I have been pleased and deeply interested in listening to the remarks of farmers, and have frequently learned more in relation to farming from remarks made by some of our farmers, directly to the point, than in any other way. In a few words they will frequently suggest very important ideas, and give you practical results—the benefits and profits they have realized by adopting some different course from that which they had pursued before in raising crops, etc.

A year ago last October, we organized a club in this village. It was a hard matter to get up. We could get in, at first, only a few neighbors from the village; then some farmers out of the village came in and became interested. We had a series of lectures and essays last winter upon different subjects, and gained somewhat. In the spring we adjourned over, and this winter our meetings are gaining. We are getting up considerable interest. Of one thing I am satisfied, and that is, that every person who has attended the meetings of this club has found himself much benefitted.

It is not advisable to put too much upon any one member of the club. All should be called upon to contribute something, to give some experience. Neither is it advisable to be too formal, too parliamentary. We go on frequently, if we have a small meeting, in a conversational style. Sometimes subjects are selected beforehand, and after we have listened to the essay and discussion, if the subject flags, something new is started.

These clubs are great educators of the people; in fact, they are creating a greater interest in agriculture than any one course ever adopted in the State before. They are diffusing knowledge, and they make farmers more social. Men who quarrel about fences, and other things, and will hardly speak to each other, will get together in the club and become good friends. I have found many instances where the organization of a club created a better feeling in a neighborhood. I makes people better satisfied with the climate of Maine, for when men come together they enlighten and encourage one another. I wish also to say that the taking of agricultural newspapers is of very great benefit. Every science is now brought to the aid of agriculture. We have had very able lectures from our professional men in relation to the nature of plants, modes of culture, the diseases of plants, on labor, and on other subjects. Some of our mechanics have also delivered very interesting lectures. As far as possible induce mechanics to come in and speak on subjects connected with their business. They can give you a good deal of information in regard to new inventions.

Mr. Thing. There are two points on which I wish to speak. We decided, soon after we commenced our club, to have no questions debated, but merely topics discussed. There was no affirmative or negative decision. We thought it was not well for farmers to talk against one another, perhaps doing violence to their own better judgments. A topic is presented, for instance, "Winter care and feeding of farm stock," or "Sheep husbandry," and each member is at liberty to talk upon it and say what he pleases. The other is, that we have continued our regular meetings, once in two weeks, at the regular place of meeting in the village. On the alternate weeks we go to a school-house, or private house if invited. We have found that a great help, for, as the ministers say, there are some men who must have the gospel carried to them; we cannot get them out to hear it.

Mr. Dill. A club was formed at Strong a year ago last fall, called the North Franklin, the meetings being held alternately at Strong and Phillips. That was continued through the winter. The meetings at Strong were better attended than those at Phillips, and exhibited more energy and excited more interest. At Phillips we had rather small gatherings during the winter, and in the spring we adjourned over until fall. We got together last fall at Phillips and voted to have a society there, and not go to Strong every other week. We called it the Central Franklin Club. We have done much better than we anticipated, and are still gaining. We found many from whom we expected no assistance could talk so much better than those of us who started the club that we were thrown quite in the shade. We choose new officers once in four weeks, so giving all a chance to serve. The Strong club is having full meetings. The discussions excite general interest; all hands turn out, and they are doing even better than at Phillips, and have more members.

The Chairman. Do you admit female members?

Mr. Dill. We have not as yet, but the suggestion has been made that the meetings be held one week in the village and the next outside, going to the neighbors' houses, and having the ladies come in.

MR. THING. In organizing our club, the wives of members were constituted members *ex officio*, and we have made it a point, whenever practicable, and subjects were discussed in which the ladies were interested, to take our wives with us. We can't get the men out so well unless the women go. There is more disposition to go where the ladies are. And another thing, the meetings are always more quiet and orderly where the ladies are.

MR. FLETCHER of East Wilton. The club which I represent was organized in 1858. It then consisted of about fifteen members. We met in school-houses, and also at the village, and held meetings once in two weeks. The interest increased, and the number of members also. We continued in that way for about three years; we then thought a better way would be to go round to the members' houses and take our wives with us. These meetings have been quite interesting. The ladies frequently have an apartment by themselves, and discuss dairy and household matters. We have a committee to present topics for discussion, and sometimes we have an address. At the annual meeting we generally have an address and discussion, which makes the occasion a very interesting one. We also have a library. At present there are about seventy-five members.

MR. WALKER of Topsham. Last year a club was organized in Topsham, one in Brunswick, and one in Bowdoinham. They have all been successful, awakening so much interest among farmers that at the recent annual meeting of our agricultural society, the subject came up and was thoroughly discussed, and a rallying committee appointed to organize at least one club in each town, and see that they were provided with addresses, with books, and with everything necessary to carry them on to a successful issue.

MR. PARKHURST. A farmers' club was organized at Houlton, the shire town of Aroostook county. I have never visited it, Houlton being about fifty miles from where I live, but I learn that it has been very successful. They meet regularly once a week. Mr. Putnam's testimony was like that of many others, that farmers generally supposed they could not talk, but when they came together and became interested, the trouble proved to be that they talked too long.

At Presque Isle we organized a club last winter, but it was not a success. It was mainly composed of men from the village—not farmers, but lawyers and traders, &c. We had at no time over half a dozen farmers. We attempted to obtain lectures, and got one on raising fruit, from M. R. Keep, which was very interesting and instructive, but being a bad night there were only two farmers present. We ran along for a time, but finally gave it up.

This winter we have organized a new club, and we have not had a lawyer, doctor, minister or merchant attend so far. Our meetings have been very interesting. The farmers take hold of it with determination to make it a success, and I have been astonished to see how well they could talk on agricultural subjects. We find, too, a growing interest in the improvement of farms, the cultivation of crops, and the improvement of neat stock. Five years ago not one farmer in ten in that county knew what a thoroughbred animal was. Now, a large proportion do know. We have a few in our county, and the demand is increasing. Our people desire to keep up with the times. As you are aware, many of them emigrated from what we call "outside," that is, the western part of this State, or from other States. They are generally intelligent; they now have their agricultural and other journals, and I think, upon the whole, the prospect of progress is very encouraging.

I have been requested to state somewhat about the Swedish colony which has lately been established in our county. As most are aware, the State appropriated a small sum last winter to employ an agent to go to Sweden and endeavor to induce immigration to Maine. W. W. Thomas, Jr., of Portland, was appointed that agent, and he went out and was successful—so much so that he had many applicants to choose from. He selected men of intelligence and of good moral character, but not having much means.

In June, the State Land Agent went to Aroostook and commenced felling trees. They first lotted a township into lots of one hundred acres; then made four clearings of twenty acres each, five acres to a lot, where four lots cornered together. Then they made separate clearings of five acres in a lot. They did not clear the land; they merely felled the trees and limbed them.

In July, Mr. Thomas came with his first colony. They landed at Halifax, and went from there to St. Johns, and as the water was very low, they came up river on tow boats to Tobique, and from there across to Fort Fairfield. On their arrival there they were received very cordially. A dinner was provided at the Town Hall. They were very much surprised and pleased at meeting with such a reception. Their first impressions were favorable. That afternoon they went to Lyndon, or Caribou village, which is about ten miles from Fort Fairfield. There they were provided with entertainment and lodgings for the night in a large hall. The next day the citizens turned out *en masse* and went with them to their new homes. The State Land Agent and his assistant had built each family a log house, sixteen feet by twenty-four, and furnished a cooking-stove for each house. Provisions were provided by the citizens.

They immediately went to work clearing their land, and as it was too late in the season to raise any grain crops, they sowed turnips, and after they got through with that, some went to work for the neighboring farmers and some at their trades. They have various trades, such as basket making, &c., and the women manufacture cloth of excellent quality.

Their customs and habits are somewhat different from ours, but they are fast learning to live as we do. Their custom at home was to cook bread only four times a year. They cook it in small, thin sheets, which, after they are dried, are about an eighth of an inch thick, perhaps a little more. This they pile up in stacks until they get enough to last three months. At the end of that time they go at it again, and have a general baking of bread. But they are gradually giving that up and adopting our modes of living. They are very much pleased with their situation, and like our country much better than they did their own.

Most of the men are at work out this winter. Some have gone into the woods and some are at work at their trades. They are a very prudent, industrious, trusty and civil people. The men are willing to work early in the morning and late at night. They never find any fault, whatever work is required. They never resent an insult, and are very peaceable.

We at first were a little fearful that the enterprise was not going to succeed. A good many thought if the same inducement had been held out to the people of our own State it would have been better for us; I thought so myself; but since we have had them among us, and have learned what they are, we are satisfied that it is a success, and that it is to be one of the best means the State ever adopted for settling our public lands. I know there is still considerable feeling on the subject in different parts of the

State, many thinking it wrong; but that feeling is gradually dying out, and eventually all, I think, will be satisfied.

They are a religious people, and all Protestants; but their manner of worship is somewhat different from other Protestant churches. In respect to keeping the Sabbath, they are like the Catholics. They go to meeting in the forenoon and worship in their way; in the afternoon they meet together and have a good time, and sometimes they dance. They are, nevertheless, a strictly religious people, young and old. They never use profane language, and they are a praying people. In illustration, I will mention that one little girl, about twelve years old, who went to work in a family for the winter, told some of her friends, after she had been there a week or two, that she did not want to stay there any longer for the people never prayed. That shows that they train their children up religiously, and with good principles. This is gratifying to us, and we are really glad to have this colony of Swedes among us.

Hon. Mr. Belcher. I take very great interest in this matter of inducing the Swedes to come into our State. Undoubtedly they are a good population, honest, thrifty and industrious. They perfectly understand the modes of cultivation in their own climate, and they will soon learn ours and perhaps improve upon them. The climate of Maine is well adapted to them. I learned a few days ago that about the same time that the Swedish colony came into our State another colony went to Mississippi, who are very much dissatisfied, and have written to Mr. Thomas, our agent, a most pressing letter, asking aid to come to this State. They numbered one hundred and twenty-five when they went there. Twenty-five have already died, and there has not been a day since they have been there when there have not been from twenty to thirty in the hospital. They say the climate does not agree with them, and they are very desirous of coming to Maine. On the other hand, I understand there has been scarcely a case of sickness among those who have gone into Aroostook county. If we can settle our State from the northern countries of Europe, if we can induce the best European population to come here, it will be of immense benefit.

To return for a moment to the clubs. When in the discussions any important fact comes out, or anything that will be useful, let the secretary sit down and write a few lines to the "Maine Farmer," or to the nearest paper, and that information will spread, and by-and-by it will get into the "Country Gentleman" and the "New York Tribune," and be circulated over the whole country. So great has been the increase of interest in agricultural matters, that our leading papers have found that in order to keep up their immense circulation they must employ the ablest men they can find to write upon agricultural matters. The effect will be to have the people of this country, in a few years, more generally and thoroughly educated in everything that appertains to agriculture than the people of Europe. It is important also that agriculture should be taught in our schools, and I hope that the members of our farmers' clubs will labor to get up an interest which will secure its being taught in our schools.

Mr. Bodge of Lincoln. The people in the section where I reside are more interested in navigation than in farming. If we talk to them about ships and ship-building they are wide awake, but farming excites little interest. Yet we have a farmers' club in the town where I reside, Jefferson, and a fair attendance. We have had several lectures, and the meetings have been interesting. There is also a club in Bristol, which I am told is in successful operation. They held a town show there last year, which was reported to be better than the county shows had been in years previous.

Mr. Adams of East Wilton. We found that the holding of a town show added much to the success of our club and helped to bring many into it who had held aloof before. We found, too, that taking our wives and daughters with us was a great help. The young men would come where the young women were when they would not come where only old men met together to talk over farming matters. Two years ago we hit upon another plan which worked well: to assign special subjects to different individuals to be investigated and reported on by a written or spoken report. In this way we got out many who did much better than we supposed them capable of doing. The money and labor expended for establishing and sustaining farmers' clubs has done more good than in any other way, and I hope more will be given, for it could be spent for no better purpose.

Mr. Keyes of North Jay. Our place is a small one—about forty families. We are not strong enough to hold a show, but we contribute to the one at Jay and Wilton and to the county show. About a year ago some of us got together and started a club, and after a few evenings we increased to about twenty-five in number.

We have some discouragements, but we keep along, and have taken up a good many subjects for discussion, and have obtained much benefit from the information contributed by one another. We find that when only a few meet the interest is not lessened in proportion to the numbers. Mind acts upon mind, brightening and invigorating one another, and even when only a few come together we do not always adjourn at an early hour. Let none who think of starting a club fear lest they may not succeed. There is no danger if they only take hold in earnest and hold on. There ought to be a club in every school district.

HON. MR. MORRILL of Farmington. If farmers will look at this one fact, which is true in regard to every form of associated effort, that when two persons combine their efforts for the accomplishment of any purpose they increase their strength in tenfold proportion, they will see the importance of these organizations. The Bible says that "one can chase a thousand, and two put ten thousand to flight." Why can two put ten thousand to flight so readily? Because of concentrated power. If farmers will only look around they will see that almost every great enterprise is carried on by associated effort. Every man who stands alone is weak and feeble; but when a number of men unite their efforts they form a power that can carry forward almost any cause, and carry it forward as they please. Our physicians have their associations; the lawyers have theirs; the clergy have theirs. Every profession, and almost every branch of business, has its organizations, and in their associated capacity they are a power in the community. Break up these associations, and where is the power? It has been a matter of surprise to me that there has been needed any word of counsel or of exhortation to the farmers in any community to come together and form a club. It is your life, it is your safety, it is your power, and by it you can not only make your power felt in your business, but you can make politicians feel it just as you will.

There is another thing in regard to associated action and that is, let any body of people unite themselves for the purpose of carrying forward a good cause, and it increases the attachment and the love and good will among those persons, and these are as essential and as valuable among farmers as among any other class of citizens. I hope that the farmers of this county will form clubs in every town and in every school district, and exercise a power in the county and in the world which they have hitherto failed to exercise, but which they are abundantly able to do.

Col. Swett. The gentleman has hit the nail on the head. There is one further idea in this connection to which I will allude, and that is, the expediency of having a convention of all the farmers' clubs in the county. We propose to have one in Oxford county, and anticipate much good from it, in strengthening and encouraging them to go forward in their work.

Mr. Keyes. I was about to offer the same suggestion, and earnestly hope that it way be brought about.

Resolutions of thanks to the citizens of Farmington for their courteous attentions and labors, to the fruit growers of the vicinity for the beautiful and excellent display of fruit shown and generously bestowed upon those present, with several others, having been passed, the Board finally adjourned.

The needs of European and American agriculturists in some respects differ materially, yet in other respects they are identical. Practice, to be judicious, must vary according to conditions and circumstances, such as the nature of the soil, the climate, the abundance or scarcity of labor, markets, etc., but the principles which should underlie practice are always and everywhere the same; and if these be understood it is comparatively easy to adapt the practice to the conditions and circumstances in which we are placed and thus secure the most profitable results.

The principles of fertilization, and of amelioration of the soil by other means than by the application of manures, are the same in America as in Europe, consequently so much as farmers abroad have learned by practical experience and by scientific investigations in relation to these subjects is of equal value here as there; and they are ahead of us, at least in the matter of time. Some of the needs most felt among us now were equally felt there in years past. Our lands have been and are yet being impoverished by reason of inadequate returns made to the soil during the period while we were taking away crops grown upon the strength of their virgin fertility—which fertility was far from being so nearly inexhaustible as was commonly supposed. Cows have drawn upon pastures for phosphates conveyed away in their milk and bones until too little remains in the soil to supply actual pressing needs; and now not only are these pasture lands deficient in herbage, but the little which is yielded is deficient in bone-making material. This is true to so great a degree that in some cases the cows are actually suffering disease arising from the want of phosphatic material to form healthy bones, and their systems crave it so earnestly that nature prompts to the gnawing of bones whenever one can be found, a sure indication that this want is urgent. Crops, too, have been taken which have robbed the soils yielding them not only of phosphates but also of nitrogenous matter and of potash until they are comparatively barren. Experiences similar to these took place in older countries long ago. Necessity, the mother of invention, led them to adopt means which have proved effectual not only to restore the natural degree of fertility but to exceed it. By their experience in this regard we may profit, and with a view to assist in making it available to the farmers of Maine, I have thought it well to prosent here several papers given by those who have contributed most largely to the increase of agricultural knowledge. Occasionally, portions of these are omitted, when pertaining to points regarding which Maine farmers are not much concerned, and in some instances slight alterations have been made, such as the substitution of equivalants in currency where sterling values are mentioned, and also of words where used among us in a different sense, as for instance, the word "grain" has been substituted for "corn," the latter term being used by foreign farmers to designate wheat, barley or oats, while we use it only to designate maize or Indian corn; but no change of meaning in any case has been wittingly made.

CHEMICAL INVESTIGATIONS.

[A Lecture delivered by Dr. A. VOELCKER before the Royal Agricultural Society of England, at their rooms Hanover Square, London.]

The course that we pursue on the present occasion differs somewhat from the usual practice when I have had the pleasure of addressing you on subjects under examination. On this occasion I have to give you a *resumé* of what has to a great extent already appeared in print. I do not know which is the better of the two plans—to give a lecture or two on matters under consideration, and not yet completed, or to complete a subject under investigation; to issue the result to the members for them to criticise, and then to invite them to come here and pull me to pieces; this plan at any rate gives me an opportunity of replying to any objections which may be made to opinions or statements which I may have made in public. I am not at all sure whether the experiment which is to be tried this morning be or be not a good one. My chief object, however, to-day, will be to give you an abstract of some results of investigations which have already been published in a great measure in the *Journal* of the Society. I am afraid that my papers share the fate of many others which appear in that publication; that is, that they are not read by the great majority of the agricultural community. I cannot, however, blame farmers for not reading chemical papers; for how can a man understand chemical language if he do not—as is the case with many of the older farmers, those who have passed the meridian of life—

understand the chemical alphabet? I trust that as time advances we shall succeed in our efforts to extend scientific education. For my own part I am exceedingly anxious to lend every possible assistance in the extension of scientific knowledge, not only on my own subject, but in all branches of such knowledge. I am sure that no man will ever take up geology without being led to study chemistry also. A man cannot be a successful cultivator of botanical or of geological science without acquainting himself to some extent with chemistry; and if farmers are acquainted, in some degree, with chemical science, I shall have the gratification of having my chemical papers, which appear in the *Journal,* more extensively read than they are at present. I do not, indeed, take the neglect to read them much to heart; for I do not think that in the prsent condition of educational matters that is any great discredit to a man who writes in a tolerably decent style, as I trust I do, being tolerably intelligible and not too long-winded, which is sometimes an excuse, and it is a very reasonable one, with agriculturists for not reading scientific statements. I have no doubt that by-and-by papers like mine will be read. In the meantime I must do the best I can under the circumstances; and I will now endeavor to give you, as briefly as possible, an account of the chief points which have occupied my attention during the last two seasons, and more particularly the season which has just ended.

The chemical work with which I am entrusted by the society divides itself chiefly into three branches. In the first place I am engaged in making numerous analyses for the private use of members. Many of the reports of chemical analyses which I send out are interesting in various respects; but it is not possible always to communicate them to the public at large, as they refer to matters in which discretion is required on the part of the chemical professor who is consulted; while some analyses are interesting only to the individual who sends a substance for investigation. I shall not, therefore, say much under this head, especially as you will find some of the more generally interesting details in the chemical report which appeared in the last part of the *Journal.* Before I pass on, however, to speak more strictly of the scientific investigations with which I am occupied, I would just observe that at the present time the work which I have in hand for members of the society is very extensive; and this I believe is in a great measure owing to a lecture delivered by me a short time ago at the Central Farmers' Club, in which I pointed out the enormous extent to which adulteration in manures and food is now being carried on. I may here state that during the last fortnight I have had before me no less than six different samples of nitrate of soda shamefully mixed with common salt. A hope which I expressed at the Central Farmers' Club, that the eyes of farmers generally would be opened to the extent to which this evil prevails, seems to have been fulfilled. At any rate I have received during the last fortnight no less than six samples of nitrate of soda adulterated with common salt, some to the extent of seventy-five per cent. others of thirty, and others in a smaller degree. At the present time I have in the laboratory four samples of adulterated guano, the analyses of which are not yet completed, and I have other cases of adulterated manures in hand. I mention this point, not because I am over anxious to get analyses to perform for members of the society in my laboratory; indeed, I may say that I here speak from a truly unselfish motive, because, so far as I am concerned personally, the smaller the number of analyses I have for members of the society, the better I am off in pocket; and I am afraid that if the number increases as it has done lately, I shall be obliged to apply to the Chemical Committee for additional assistance. However, in such a matter one ought not to take a narrow view; and, indeed, I believe that the more useful a man tries to be, the more successful he will be ultimately. I am therefore quite prepared occasionally to make analyses at a non-paying rate.

But, leaving this first branch of the duties with which I am entrusted by the society, I would observe that the second portion of my chemical duties consist in instituting experiments throughout the country. We have excellent machinery in operation for conducting experiments in various parts of the kingdom. I am happy to say that I have been connected for the period of fourteen years with the Royal Agricultural College, where in the midst of a purely agricultural district I have enjoyed much of country life, and received much encouragement in my professional labors; and I can truly say that my sojourn in the country prepared me for greater and more extended usefulness now that I am resident in London. Although thoroughly inured to town life, I have not given up my old love, but whenever I have an opportunity of doing so, I fly to the country, where I do everything I can to encourage field experiments; and, I may add, that if I can at any time be instrumental in aiding gentlemen who are members of this society, or who may become members of it, I shall be most happy to lend them a helping hand in instituting field experiments.

The third branch of my duty is connected with purely scientific laboratory experiments. But let me in the first place give you a brief account of some of the field experiments which have been carried on for a number of years, chiefly by former pupils of mine, who are now members of a club which may be called the field club of the Royal Agricultural College, at Cirencester. That is a club in the proceedings of which I take great interest, because, as I have intimated, it includes many of my former pupils, men who are rising in the agricultural world, and who are willing and qualified to make trustworthy and useful practical field experiments. Now, I would refer especially to a series of experiments of clover seeds and on clover, some of the results of which were published in the last part of the *Journal*. Without wearying you with many details, I would allude to a series of experiments carried out in the year 1867–68, at Escrick Park Home Farm, near York, by my friend and former colleague, Mr. Coleman. In all my field experiments, I may remark, the same manuring substances, or their mixtures, were employed in the several localities in which the experiments were tried. They were the following: Nitrate of soda, sulphate of ammonia, mineral superphosphate, common salt, muriate of potash, sulphate of potash, and sulphate of lime. I am always careful to have two plots upon which no manure is used. In preceding years I tried these various substances upon heavy soils; one of the objects which I had especially in view being to ascertain under what circumstances the artificial supply of potash was attended with practical benefit to the farmer.

Speaking generally, I may say the result was not favorable to the artificial supply of potash on most of the heavy soils. In the majority of cases the increase of produce was not sufficiently striking to repay the greater portion of the outlay attending the purchase of potash manure; while in many instances I could see no beneficial effect whatever resulting from the application of potash manures to heavy land. Now, if we look at the chemical composition of clays of a better description, we shall find that most of them abound in silicate of potash, and under the decomposing influence of atmospheric action they readily yield soluble potash. Indeed, in some of the experiments, the results of which I published some time back in the *Journal*, on the effect of water passing through the soil, it appeared that some kinds of liquid manure—very dilute, liquid manure, containing but little potash—in passing through clay soils, actually became charged with potash, the drainage waters possessing more potash than the liquid manure contained in its natural condition. This shows clearly that on certain clay soils the application of potash manure is not desirable. I here allude more especially to such soils as the excellent one—I use the word "excellent" in a purely chemical point of view—of Mr. Mechi's farm at Tiptree. Mr. Mechi had to deal with a very unproductive clay soil; but as it is full of mineral matters, he found the more he worked his land the better became his crops. In his case there was actually more potash removed from the land by passing the tank liquid through the soil than was contained in that liquid itself.

Here we have a ready explanation of the fact, that in good clay soils an artificial supply of potash is not attended with any benefit to the person using it. I have, therefore, been anxious during the last year or two to try experiments, mainly in light soils, and a capital opportunity was afforded for this purpose in the case of the extremely poor soil of the Home Farm, belonging to Lord Wenlock. I gave the analysis of this soil in the *Journal*. It there appears that the soil contained as much as 91.8 (that is, nearly 92) per cent. of quartz sand, an exceedingly small quantity of potash, a mere trace of phosphoric acid, and very little lime. That soil was ascertained to be poor in every description of mineral matter which is necessary to bring agricultural produce to perfection; but I had the gratification of finding that on such a soil the supply of the mineral food required for the clover crop is attended with the most beneficial results. Incidentally I had occasion to make some observations with respect to the utility of nitrogenous manures; and I believe that such manures will prove very useful to the practical farmer who has frequently to deal with a variety of soils, and ought, therefore, to be in a position to judge what description of manure is best suited to particular classes of soils.

Now, reverting to the experiments which were made at Escrick, I find that whilst common salt—that is, chloride of sodium—had no effect on the produce, muriate of potash—that is, the compound of chlorine with potassium—materially increased it. Soda is frequently a mere accidental constituent, which, in the form of chloride of sodium, indirectly tends to introduce food into the vegetable organism, but which in its turn is eliminated from the ripe produce. I find that chloride of sodium circulates in many plants, but that it does not enter into the chemical composition of the perfected seed of the plant. In perfectly ripe wheat you will find no chloride of sodium; in perfectly ripe beans and seeds, and many other plants, you find hardly any chloride of sodium; while this substance circulates very freely in the green plant, and is productive of very great advantage to the general condition of the vegetation. The case is, however, different as regards potash. Potash enters into actual union with many parts of plants, and it is absolutely necessary to bring the plant to perfection. To show you the difference between the physiological effects of potash and soda in this respect, I would just mention that, whereas you can wash out chloride of sodium with water from a substance like the root of the mangold, or the leaf of the beet root, or the stalk of wheat, or from grasses, you cannot remove potash so as to show its presence simply by the mechanical process of washing; you cannot prove its existence before you have incinerated the plant, destroyed its organic structure, and thus re-obtained the potash in the ash. It has, in fact, entered into an organic combination, from which it cannot be removed by the mere mechanical process of washing. On one of the experimental plots of the Escrick Park I used mineral superphosphate alone, and, to my astonishment, no effect whatever was produced by its application. This is an interesting result, seeming as it does to indicate that the great deficiency of potash, which is characteristic of the soil in that experimental field, entirely prevented the display of the usual functions which we know perfectly well superphosphate of lime discharges on land of a better character than that at Escrick. The superphosphate, (or, rather, the phosphoric acid) in that manure did not act, simply because potash was not present to form part of the substance of the clover plant. You can, I think, readily understand that. Place before a man all the dry food which tends to entice the appetite, and at the same time withhold from him drink, and you will find that he cannot assimilate the dry food. You may give him every description of dry food that can tempt him to eat, but if you keep from him for any long time that unimportant substance, as we are too apt to consider it—though it is, in fact, a most essential thing—water, he will ultimately perish. Potash is non-essential as regards many clay soils, because many clay soils contain abundance of potash; but it is most essential on poor sandy soils, because, generally speaking, these soils are very deficient in the necessary amount of potash which is required to bring clover crops, and I may also say root crops, to perfection. The mixture of potash, salts, and superphosphate, yielded the larger weight of clover and rye grass, per acre, which was obtained on any of the experimental plots. Further, it was astonishing to notice that not only was the weight of the first cutting larger in the case of this particular plot than on any of the others, but the second cutting also yielded a much larger quantity. Let me give you the actual figures as respects the produce on these particular plots. With no manure whatever the soil yielded per acre of fresh clover 8 tons, 5 cwt., 40 lbs.; mineral phosphates alone gave 8 tons, 4 cwts., 12 lbs. Thus there was actually a rather smaller result; but then you must make allowance for variations of soil in the field, and avoid thinking too much of small differences of results. Practically speaking, the produce was the same in the case of the plot manured with superphosphate as in that of the plot which had no manure.

Mr. C. S. Read, M. P. What was the extent of the plots?

Dr. Voelcker. The extent was one-twentieth of an acre in each case, but the yield is calculated at so much per acre. Muriate of potash gave 9 tons, 16 cwt., 28 lbs., while the mixture of superphosphate and muriate of potash gave 13 tons, 15 cwt., 40 lbs., showing a great increase of produce above that of the unmanured portion of the field—that is, in the total amount of produce. This was distributed over two cuttings. The first cutting from mineral superphosphate and muriate of potash gave 9 tons; the second cutting nearly 5 tons; whereas the first cutting on the unmanured portion of the field gave 5 tons, 9 cwt., 72 lbs., and the second one only 2 tons, 15 cwt., 80 lbs. Thus, you will observe that, although through the application of manure, a larger amount of produce was obtained, yet the agricultural condition of the land after the application of superphosphate and potash was better than it was when no manure whatever was applied. On the other hand, I find that nitrate of soda had an unmistakable tendency to exhaust the soil of both the plots in which it was used, the second cutting weighing less than that of the unmanured plot. It is true that the first cutting weighed rather more than that of the unmanured plot; but the second actually weighed less, showing clearly that nitrate of soda has an exhausting effect, which tells badly on poor land, and that this effect is produced rapidly.

From these experiments we may learn that nitrate of soda alone, or even in combination with superphosphate, should not be used as a top-dressing for artificial grasses on very poor sandy soils, not even with superphosphate, because it does not supply the needful alkali potash. Indeed, nitrate of soda, and, to a considerable extent at least, ammoniacal salts are the worst manures that can be used on poor soils. They tend rapidly to the complete exhaustion of such soils, and do serious injury to the land, while they do not even benefit the tenant-farmer who may apply them for a season with the view of obtaining a very large produce.

On very poor sandy soils not only do purely nitrogenous manures rapidly exhaust the land, but the produce also becomes very inferior. My friend, Mr. Coleman, was so much struck with the appearance of a particular field that he asked me to go down and inspect it. I did go, and I must say that never in my life was I more struck with the aspect of a field which had been manured with these different fertilizing agents. On the land manured for clover with sulphate of ammonia and nitrate of soda there was not a plant of clover to be seen, and, quite contrary to my expectations, the true grasses, the Italian rye grass, etc., which should have been very luxuriant after the first cutting, were quite wanting. The land was, in fact, completely burnt up. I should have thought that the soil would stimulate the growth of Italian rye grass, and that a second crop would grow luxuriantly; but, contrary to my previous expectations, not even rye grass would grow—clearly showing that, although ammoniacal manures may be very useful for the production of grass and corn crops under many circumstances, yet they are not useful when there is an insufficient supply of mineral food in the land, and that the poorer the land is the more rapidly it becomes unproductive when salts of ammonia alone are applied, even as regards those plants which in the ordinary course of farming are decidedly benefited by the use of ammoniacal salts or nitrate of soda. In fact, the application of nitrogenous manures in this case evidently tended to the complete exhaustion of the land. On the other hand, I was struck with the remarkable effects which potash, applied in conjunction with phosphatic manures, produced upon the clover plant. You could see to a line where the potash and superphosphate had been used. There the clover plant was growing luxuriantly and healthy, and keeping in check the Italian rye grass with which it had been sown. So much, then, with regard to these experiments.

I will not detain you by referring to similar experiments which were made last season. I will only observe that they fully confirm the results of the experiments of the preceding season, and at the same time show that in very dry seasons it is most desirable to apply saline manures sparingly, and also to apply them early in the spring. Allow me to impress upon you, that when you apply top-dressings to pasture, or to artificial grasses, or to cereal crops—wheat, oats, or even barley—you should apply them early in the spring, in order that the manure may have a chance of getting thoroughly distributed through the soil by being washed into it. I tried similar experiments on clover—a mixture of clover seeds of different kinds being sown without rye grass or any other grass seeds. The experiments in that case were undertaken by Mr. Kimber (a former pupil of mine,) on land which was naturally rather poor, but which had been done extremely well. The clover was sown in the preceding year with a barley crop coming after a good crop of swedes, being well manured with dung and drilled in with three hundred weight per acre of superphosphate of lime, and fed off by sheep. In consequence of the applications of good dressings of farmyard manure, of the artificials used for the turnip crop, and of the feeding off the swedes by sheep, with corn being given to them at the same time, the soil seems to have been in excellent agricultural condition. Neither nitrate of soda nor sulphate of ammonia produced any effect on the clover; and that appears to indicate either that the land must have been in an excellent agricultural condition, as I believe it was, or that the clover plant is not benefited by nitrogenous manures. On this latter point we have no conclusive evidence. I have been extremely anxious to ascertain under what circumstances, if any, ammoniacal salts, or nitrogenous organic substances, or nitrates, benefit the leguminous tribes of plants. Some years ago I made some experiments which seemed to indicate that nitrogenous manures have no beneficial effect on the clover tribes, and probably none either on other leguminous plants. At any rate, I could never see where sulphate of ammonia had been applied to clover, nor could I notice any beneficial result from the application of ammoniacal salts to peas and beans;

whereas I could perceive minutely the effects of nitrogenous manures when they had been applied to wheat or barley, or any of the graminaceous family of plants, I was anxious, therefore, to ascertain whether nitrogenous manures have any effect on clover. In the experiments which were conducted by Mr. Kimber, at Tabney Warren, near Abingdon, the nitrate of soda and the sulphate of ammonia had no beneficial effect whatever on the clover.

At the present time the Scientific Committee of the Horticultural Society is engaged in making experiments on special plants. Amongst these are several varieties of clover on which we intend to try the effect of ammoniacal salts alone, and of various mixtures, and I hope the result will be to bring out some useful information on the subject. It is sometimes difficult to conduct experiments on a large scale with sufficient scientific precision; I therefore strongly recommended the Committee of the Horticultural Society to institute some experiments in boxes. A number of boxes are now set out at Chiswick, and I hope that on a future occasion I shall be able to give you the results of the observations which we are making there with respect to the peculiar action of some special fertilizing agents, such as potash and nitrate of soda. So much, then, with regard to the field investigations which occupied so much of my attention during the last season.

In close connection with these field experiments I have undertaken to investigate the causes of the benefits which result from growing clover as a preparatory crop for wheat. It is well known to most practical farmers that if they can succeed in growing a good crop of clover they are almost certain to get a good paying crop of wheat. You see how all agricultural matters depend upon each other. If we can by chemical means enable the farmer, on land which otherwise would not grow clover, to produce a good crop of clover, we shall thus place him in the very best position for afterwards obtaining paying crops of grain. I have come to the conclusion that the very best preparation, the very best manure, if you will allow me thus to express myself, is a good crop of clover. Now, at first sight nothing seems more contradictory than to say that you can remove a very large quantity of both mineral and organic food from the soil and yet make it more productive, as in the case of clover. Nevertheless it is a fact, that the larger the amount of mineral matter you remove in a crop of clover, and the larger the amount of nitrogen which is carried off in clover hay, the richer the land becomes. Now here is really a strange chemical anomaly which cannot be discarded, and invites our investigation; and it is an investigation which has occupied my attention, I may say, for more than ten years. I first took it up in my leisure hours when I lived at Cirencester. In the paper which I published in the *Journal* last year, you will find analyses of clover roots and clover soils on the College Farm at Cirencester. Chemists are much in the same position as painters; we cannot finish a work off-hand at once; we take up a thing and then leave it for a time. We then take it up again; just as the opportunity occurs to add to our experience we take up new matter and make it the subject of investigation.

This clover investigation has very much interested me for a great number of years; but only during the last season have I been able to bring it to anything like completion, so as thoroughly to explain the strange anomaly that is presented to us in the growth of clover as a preparatory crop for wheat. The explanation is very simple, though puzzling when you know not the chemical points that are involved in the investigation. I cannot deny myself the gratification of showing to you, in a few figures that, in a thorough chemical point of view, clover is the most exhausting crop that you can possibly grow, whilst in a thorough practical point of view it is the most restorative crop, and the best preparation for wheat that you can possibly grow. Now if we examine what is taken from the land in the shape of clover, we shall find that, assuming an acre of land to yield four tons of clover hay, these four tons of clover hay will remove 672 lbs. of mineral constituents, and not less than 224 lbs. of nitrogen, which is equal to 272 lbs. of ammonia. Four tons of clover hay, the produce of one acre, must contain a large amount of nitrogen, and remove from the soil an enormous quantity of mineral matters abounding in lime, potash, and also much phosphoric acid. Now, comparing what is removed by a crop of wheat, we find that, in a clover crop, we remove fully three times as much of mineral matter, and a great deal more, six times as much I believe, of nitrogen, as we do in a crop of wheat. The total amount, to give the exact figures, of mineral matters removed in an average crop of wheat amounts to 175 lbs. an acre; that is, taking in both the grain and the straw, the total amount of nitrogen removed in the grain of wheat amounts to only 26.7 lbs. per acre (not quite 27 lbs.), and in the straw of wheat 19.2 lbs.; or in both together

46 lbs. of nitrogen, which is only about one-fifth of the nitrogen contained in the produce of an acre of clover. We should, therefore, naturally expect that clover, which removes so much more nitrogen from the soil, would be greatly benefited by the application of nitrogenous manures; but the reverse is the case. Wheat, it is well known, is benefited by the application of nitrogenous matters, but not clover.

On the other hand, clover is benefited by mineral manures; and at the same time it leaves the land even in a better condition in this respect for the succeeding grain crop than it is without the intervention of clover. I believe a vast amount of mineral manure is brought within reach of the grain crop by growing clover. It is rendered available to the roots of the grain crop, while otherwise it would remain in a locked-up condition in the soil, if no recourse were had to the introduction of the clover crop. Clover, by means of its long roots, penetrates a large mass of soil. It gathers up, so to speak, the phosphoric acid and the potash which are disseminated throughout a large portion of the soil; and when the land is ploughed the roots are left in the surface, and in decaying they leave in an available condition the mineral substances which the wheat plant requires to enable it to grow.

Although in clover hay these mineral matters are removed in great quantity, yet the store of mineral food that we have in six or twelve inches of soil is so great that it is utterly insignificant in comparison with what remains; in other words, the quantity of mineral matter which is rendered available and fit for the use of the succeeding grain crop is very much larger than the quantity which is removed in the clover hay. But the accumulation of nitrogen after the growth of clover in the soil is extremely large. Even when the clover crop is insignificant a large quantity of nitrogen, amounting to tons, is accumulated in the surface soil, and the better the clover crop the greater is the accumulation of nitrogen.

In one of my experiments I tried to determine the amount of nitrogen which is left in the portion of a field where the clover was, comparatively speaking, poor, and I found that on the brow of the hill in that field, for it had a considerable declivity, the clover was weak, the produce to an acre being 1 ton, 11 cwt., 99 lbs.; whilst at the bottom of the hill, where the clover was stronger, there being more soil, it was 2 tons, 2 cwt., 61 lbs. Observe, too, that at the bottom of the field the wheat was always better. Now, it is in virtue, I believe, of this accumulation of nitrogen that the wheat grew so much more luxuriantly. I had another experiment tried two seasons ago upon land on which clover grew tolerably well. The experiments to which I refer were tried at Leighton Buzzard upon the farm of Mr. Robert Valentine.* We had a capital field of clover, and I thought I should have a good opportunity of ascertaining whether there was more nitrogen accumulated in the soil after the clover crop was cut twice, or whether more was accumulated when the clover was mown once, and then allowed to run to seed.

At first sight you would think that the land was in a worse condition when the crop is grown for seed. We know, indeed, that this is generally the case; but in the case of clover we have a remarkable exception to this rule; and I find, on looking into this matter, that after growing clover for seed, a very much larger quantity of nitrogen remains in the surface soil, in the first six inches of soil as well as in the second six inches, than when the clover is mown twice. I have ascertained that when you feed off clover by sheep, when it is still young, and everything is returned to it as it is removed from it, the land is in a worse condition than when you take off the clover hay. This is an anomaly. You say it is against all principle and against all reason. But when you see positive evidence in our fields, I think no scientific man has a right to say that it is against all reason and against all principle. It is certainly not against fact. All who are practically acquainted with the subject must have seen that wheat invariably grows less luxuriantly when you feed it off quite young, and that the best crop of wheat is produced when you grow clover for seed. I have repeatedly and repeatedly seen it. Now, if I had been always shut up in my laboratory, I should never have seen it or investigated it. I should have followed in the track of those scientific men who so frequently turn up their noses at anything they cannot understand, or that they think unscientific. Therefore, the men who make the practical experiments must be wrong; and they must be right. Now, I think this is a proceeding which cannot be commended. When we see a plain matter of fact, our simple business is to investigate it carefully and conscientiously. Then we shall find frequently, as I have found in other departments of chemical investigations—I allude to my investigations in farmyard manure—that a practice which is at first sight con-

* For details of these experiments see Report for 1869, page 466.

trary to theory, or rather with what we call theory, but not against true science, on being investigated is found to agree perfectly with the established observations of good agriculturists, and that there are really good causes which fully explain apparent anomalies which sometimes are very puzzling. Referring to those clover investigations, I would just give you the total amount of nitrogen which I found in different layers of soil in the same field, and upon one-half of which the clover was mown twice, and upon the second half of which the clover was mown only once, and then left for seed. The percentage of nitrogen in the clover soil twice mowed for the first six inches amounted to .168; in the second six inches to .092; and in the third six inches to .064. Thus you see that it becomes very much less the deeper you go down. The accumulation takes place chiefly in the surface soil, and I believe it is principally due to the dropping of the leaves. When we grow clover for seed those leaves continually drop and enrich the surface soil; and if it be the case, which I think is likely, that the clover tribe of plants is satisfied with the ammonia which exists in the atmosphere, we can at once account for the accumulation of nitrogen in the soil. The clover plants take the nitrogen from the atmosphere and manufacture it into their own substance, which, on decomposition of the clover roots and leaves, produces abundance of ammonia.

In reality, the growing of clover is equivalent, to a great extent, to manuring with Peruvian guano or other nitrogenous manure; and in this paper I show that you obtain a larger quantity of manure than in the largest dose of Peruvian guano which a farmer would ever think of applying; that there is a larger amount of nitrogen accumulated in the first six or twelve inches of soil than there is in the heaviest dose of Peruvian guano that any person would think of using. On clover soil once mown and left for seed, I found in the three layers of soil a larger percentage of nitrogen than where the clover was mown twice. In the first six inches it was .189, in the next six inches, .134, and in the lowest six inches, .089. Now the total quantity of nitrogen calculated per acre for twelve inches of soil amounted on that portion of the field mown twice for clover, to 5,249½ lbs.; whereas the total amount of nitrogen in twelve inches of soil on that portion of the field which was mown only once and then left to stand for seed, was 8,126½ lbs., thus producing an excess of nitrogen on an acre of soil twelve inches deep, calculated as ammonia on the part of the field mown once and then seeded, amounting to 3,592 lbs. A very large quantity of nitrogen was accumulated when the clover was left for seed; and the total amount of large clover roots was much greater in the part where the clover was grown for seed; for the longer it is left in the soil the more the roots extend. In the different layers of the soil also, in every instance, more nitrogen was found where the clover was left for seed than where it was twice mown. There was, as just mentioned, upon one acre 3,592 lbs. more ammonia in the land where the clover seed was grown than on the other portion where the clover was made entirely into hay. The chemical points brought forward in the course of this inquiry show plainly that mere speculations as to what can take place in the soil, and what cannot, do not much advance the true theory of certain agricultural practices. I would just mention that it is only by carefully investigating subjects like the one under consideration that positive proofs are given showing the correctness of intelligent observers in the field. I have frequently been struck with the remarkably luxuriant appearance of wheat after a heavy crop of clover has been removed from the land. I at first doubted it; but at last I was obliged to confess that it invariably follows when you get a good crop of clover that you also get a good crop of wheat. An enormous amount of nitrogenous organic matter is left in the land after the removal of the clover crop, and this gradually decays and furnishes ammonia, which, at first, during the colder months of the year, is retained by the well-known absorbing properties which all good wheat soils possess. An investigation which I have now in hand, however, shows me that the ammoniacal salts in the soil are rapidly transformed into nitrates. Gradually, the oxidation of the ammoniacal salts which are produced from the decomposition of the clover roots takes place, and nitrates are eliminated; but the benefit that we derive from the growth of clover is very much greater than the benefit that we can derive from the direct application of nitrate of soda, because if we use nitrate of soda, we must just hit upon the right point when it will be beneficial to the growing crop. If there is not sufficient rain or water to wash the nitrate of soda into the soil, it does no good, but rather may do harm by burning up the land. If there is too much rain, it may pass into the drains. Nitrate of soda is not retained by the land—not even by clay soils. It passes through them as through a sieve; therefore it is the most precarious kind of manure that you can use.

It is well if you can hit upon the right time; and this you must find out for yourselves. By observation you will find out the right time in the particular locality where you are placed. You may go wrong once, but for a number of years you will generally hit upon the right time. Speaking generally, I would say that about the middle of February, in most localities, is the right time for the application of nitrate of soda; but, useful as nitrate of soda may be in some special cases, I think the less you use it on poor soils the better. I should like more indirectly to accumulate nitrogen on my land, and not go to any great expense in buying nitrate of soda when my land is in poor condition. It is well if you have very good land, but under ordinary circumstances it is perhaps better not to rely upon this source of supply. Nitrate of soda may readily be washed out; but you will notice that the benefit that you obtain from clover roots is, that you have a continuous source from which nitrates can be produced. It does not matter if some of the nitrates pass away in the drain; you have an enormous accumulation of decaying organic matter. The clover roots and leaves are not all at once changed into ammonia; but there is a gradual transformation of the organic matter, first, into ammoniacal salts, and a gradual change from ammoniacal salts into nitrates, and you have a complete series of chemical transformations which is highly conducive to the gradual development of the plant. Whereas, by using nitrate of soda, you run the risk of getting it washed away into your drains. Thus, there is more certainty of growing a good crop of wheat through the instrumentality of clover than through the direct supply of the nitrate of soda. These, then, are the chief points which have been established, I believe, by my chemical experiments in the laboratory with respect to the chemical history of the clover crop.

During the last season I have also been actively engaged in investigating the variations in the amount of sugar in sugar beet. There is a great desire at the present time to grow sugar beet in this country, with the view of supplying the sugar manufacturer with the raw material from which he is to make his sugar. In the course of the last season I examined nearly two hundred specimens of beet root, some grown in Scotland, others grown in the south of England, some grown in the west of England, and others grown in the eastern counties; and without wearying you by entering at length into the details of the results, I should like to say a few words on the growth of sugar beet in this country. I think that the cultivation of sugar beet is at any rate a hopeful one. In the eastern counties, where we have so much less rainfall, I believe there is a very good chance of growing beet root successfully as a raw material for the manufacture of sugar. Not so in Ireland, or in the western part of England.

The cultivation of beet root, I need hardly say, is very much better understood on the continent than in this country. Perhaps I should rather say, the conditions favorable to the production of a large quantity of sugar in beet root are better known on the continent than they are here. With respect to the practical cultivation of beet root, there is very little mystery about it. You may grow beet root just as you do mangold. Get your land in a good state of preparation; let your seed be the true seed, white Silesian is the best; get it early into the land, and keep it well stirred whilst growing. Plant rather more thickly than you do with mangold. Perhaps from twelve to eighteen inches will be a sufficient width between the rows, and avoid any excess of nitrogenous manure. If possible, you should have got your land into good agricultural condition for the previous crop. In other words, do not manure directly for the beet root crop if you can possibly avoid it. Now, in these few words are really summed up the chief matters for the consideration of the agriculturist.

But there are some other points which deserve to be considered when you propose to introduce beet root culture with the view of supplying the manufacturer of beet root sugar with the raw material. For it is not every climate nor every description of soil which is calculated to produce a large amount of sugar in beet. In some climates you would never get a large percentage of sugar in beet root, do what you like. In some soils also, unless they are in a first rate state of preparation, you do not get a high percentage of sugar. Let us, then, inquire what is the climate most conducive to the development of sugar in beet root, and what are the soils which are best calculated to produce much sugar in that crop. Now, the climate best suited for beet root is that in which you have a good deal of rain falling in the early period of the year, in the spring months and in the early summer months, when the beet is in an active state of growth and of leaf development; for you must lay the foundation of the apparatus by which the plant is to manufacture sugar. You must rapidly develop, first, the leaf organs of the beet root, and it is essential for this that you should have sufficient rain. The experience in the north of Germany is, that the amount of sugar produced from an acre of land in beet can be calculated, within some limits of course, from the rainfall during the early summer months, and from the absence of rain during the succeeding summer months. We want a good deal of rain in the early summer months, and a dry autumn. Some people have an idea that we have not sufficient heat in England. It is not the want of heat that beats us; it is the excess of moisture in the autumn. That is my only fear. If you could only secure a dry autumn, the climate of England would suit you beautifully for the culture of beet root, for last year I analyzed beet roots which yielded as high a percentage of sugar as any grown in France or Germany. Experiments upon roots sent from Holland and upon roots grown in the neighborhood of Lavenham, in Suffolk, showed that the English roots contained more sugar than the Dutch. They were grown for the use of sugar manufacturers; and, speaking generally, we grew in England last year beet roots which contained on an average ten to twelve per cent. of sugar, which is as high a percentage as you get in the beet root districts of France. In the north of Germany we grow rather more sugar, and there is a good reason for it, because we pay taxes not according to the percentage of sugar which an acre produces, but according to the weight of the roots. It is, therefore, to the advantage of the sugar manufacturer to get as high a percentage of sugar in his roots as he possibly can; for he pays no more tax for a root that contains fifteen per cent. of sugar than he does for a root that contains only five or six per cent. of sugar. This has induced the manufacturer of sugar to go very minutely into the circumstances which tend to raise the percentage of sugar, and during the last three years a vast amount of useful information has been accumulating, through the works of agricultural chemists who have specially worked in this direction. In the north of Germany we can to a very great extent regulate the production of sugar in our root crops by withholding certain kinds of manures. I may mention them. For example, by withholding in a great measure ammoniacal manures, fresh farmyard manure, guano and such like nitrogenous manures, and by putting upon the land superphosphate of lime, or similar phosphatic manures, which promote early maturity, we produce a much larger percentage of sugar in the roots than otherwise we should obtain. I look forward, then, with great hope to the cultivation of beet root in this country being successful.

SCIENTIFIC AGRICULTURE WITH A VIEW TO PROFIT.

By John Bennet Lawes, Esq., F. R. S., F. C. S.

"Practice with Science," the motto of the Royal Agricultural Society of England, and "Scientific Agriculture with a view to Profit," the title of the subject we are to discuss this evening, represent very similar ideas. It is true, the founders of the Society gave more prominence to "Practice," by placing that word before "Science;" while the committee of the Maidstone Farmers' Club have given to Science the place of honor; but they have indicated in plain and unmistakable language upon what terms they yield the position of distinction to Science—it is only provided it can be followed "with a view to profit." They say in fact to Science—"fill our stack-yards and our pockets and you are welcome; but do not trouble us with abstract truths or speculative opinions, which we cannot turn to profitable account."

I think I may assume that your desire to discuss this subject, and my presence here to introduce it, are due in great measure to what some of the members of this club saw and heard on the occasion of a visit which I had the honor to receive from them, at Rothamsted, during the past summer. They then saw, as many others have seen, that a great deal of active investigation has been, and still is, going on there in connection with agriculture; and I have little doubt they felt some disappointment, as I know others have done, at not being able to see very clearly the direct practical lessons to be learnt from the results of so much labor. If their thoughts were put into words they would probably say—"You have made very interesting experiments on various crops, both with ordinary and with artificial manures; you have conducted numerous experiments on the feeding of stock; and you have a laboratory containing nearly twenty thousand bottles; but we wish you to understand that we take no special interest in these things, excepting so far as they relate to our business. We are farmers; our capital is invested in the cultivation of the soil; and the welfare of ourselves and of our families depends upon the profits we can realize. We want to know how, if you were a farmer, with no other source of income, you would use your knowledge to increase your profits? or rather, how, if in addition to our practical knowledge we possessed all the information which you have acquired from your scientific experiments, should we alter our practice to increase our profits?" I take it that, in arranging for this evening's discussion, the Maidstone Farmers' Club hoped, by its means, to arrive at some solution of the above questions.

When we consider that the system of agriculture practised by the most intelligent farmers of any district, has been the result of long observation and experience, it must be admitted that any important changes suggested by science should, as far as possible, be based on a knowledge of the principles involved in the existing practices. For example, those who would propose to interfere with the ordinary course of rotation, by substituting a grain crop for a pulse or a root crop, may reasonably be asked, not only what description and amount of manure will be required to grow the grain crop, but also what will be the relative state of fertility in which the land will be left when the one crop has been substituted for the other? Again, if it be proposed to use artificial manures, instead of producing ordinary manure by the feeding of stock on cake or other purchased food, it is obviously desirable to possess accurate knowledge not only as to the description and amount of artificial manure required to produce a given crop, but also as to the amount of meat, and the amount and composition of the manure, that will be yielded by the different descriptions of purchased food.

Now, I propose to show you, by one or two examples, how much labor and how much money the investigation of subjects having a direct bearing on the practice and profits of agriculture may require before absolute certainty can be arrived at respecting them; and I could, without difficulty, occupy the whole of the time of this meeting in pointing out the various subjects which have been and still require to be investigated by men of science before long established existing practices can be thoroughly explained.

I dare say most of you know that the atmosphere which we breathe is composed almost entirely of a mixture of nitrogen and oxygen. The nitrogen constitutes more than three-fourths of the whole by weight, and the quantity of it resting upon every acre of our fields amounts to more than 32,300 tons. All the crops we grow contain nitrogen, some in larger and some in smaller quantity. Nitrogen is also, as you well know, a very active and a very expensive element in manures, costing when purchased in artificial manure rarely less than a quarter of a dollar per pound. Accurate knowledge in connection with this substance is, therefore, of the greatest possible interest to the farmer.

As all our crops are so dependent upon nitrogen in their food, and as they are surrounded by so large a store of it in the atmosphere throughout their growth, what could be more natural than to suppose that they obtain it from that source? What investigation could be more important than to determine whether they are able to do so or not? and if they are, to settle to what extent they do so, or by which of them, or under what circumstances the largest quantity of it can be assimilated? In fact, one of the explanations which has been put forward of the benefits to be derived from a rotation of crops is, that whilst some plants can absorb the nitrogen of the atmosphere others cannot do so. Here, then, is a question for scientific investigation "with a view to profit;" and what do we find has been done to arrive at a solution of it?

Nearly a century ago, Priestley and Ingenhousz came to one conclusion on the subject from their experiments, and Sennebier and Woodhouse to an opposite one from theirs. About the end of the last century and the beginning of the present one De Saussure took up the question; and, a little more than thirty years ago, Boussingault, one of the most laborious and accurate of living chemists who have devoted themselves to agricultural subjects, commenced the inquiry, and renewed it from time to time for a period of about twenty years, he arriving at one conclusion, and M. G. Ville, another French chemist, who worked at the subject for many years, coming to an opposite conclusion. Besides these, minor investigations have been undertaken by Méne, Roy, Cloez and Gratiolet, De Luca, Harting, and Chledodarow and Petzholdt, with considerably varying results. Lastly, the field and other experiments at Rothamsted having shown how important was a definite settlement of this question, and, considering how conflicting was the existing evidence bearing upon it, the investigation was undertaken there, and a very intelligent young American chemist, the late Dr. Pugh, was engaged upon the subject, at the Rothamsted Laboratory, for nearly three years. Well, the result of all this expenditure of time and money, extending over a period of more than three-quarters of a century, is a balance of evidence in favor of the view that the free nitrogen of the atmosphere cannot be assimilated by our crops.

One more illustration and I have done with this part of my subject. It may be taken as an established fact, that if the price of the hay, cake or grain, and roots, which the farmer gives to his oxen and sheep, or of the meal which he gives to his pigs, be charged against the animal, the cost of the food will be more than the increased value in the shape of meat. To show a profit upon the feeding transaction, it is necessary to charge a portion of the cost of the food against the manure obtained. It is, however, quite possible to keep land in high condition for growing grain without the manure produced by feeding stock. Whether it will be the more advantageous to attain the end by the production of meat and of animal manure, or by the use of artificial manures, is entirely a question of cost, depending on the character of the land, the prices of meat and grain, and the relative cost of certain constituents in cattle manure and in artificial manures. But obviously essential elements in the inquiry are, what proportion of the various constituents of the purchased cattle food will be obtained in the form of meat? what proportion will be expended or lost by the respiration and perspiration of the animal? and how much will remain as manure?

Let we put a case to illustrate the point in question. One hundred weight of rape-cake will cost a dollar and a half, and one hundred weight of linseed cake about twice as much. If applied at once to the soil, these two substances would be of very nearly the same value as manure. Both would supply about eight pounds of mineral matter and about ninety pounds of organic matter, containing nitrogen equal to about six and one-half pounds of ammonia. But the linseed cake is first employed for the feeding of stock, and the questions arise, how much of the above constituents will go to form increase? how much will be expended or lost by the vital processes of the animal? and, how much will remain for manure? Now, these points can only be settled by very laborious scientific investigation. I could give you a long list of the names of those who have experimented upon one or other branch of the inquiry; and the subject, in one or other of its aspects, has been under experiment at Rothamsted, from time to time, for more than twenty years. Well, it may perhaps safely be assumed that, of the total dry or solid matter of the linseed cake, not more than ten per cent., and of its total nitrogen not more than five per cent., will be retained by the animal as increase. Of the total solid matter, however, a large proportion will be expended by the respiration of the animal; leaving, in fact, only about twenty-five or thirty per cent. of the whole as manure. But the essential point whether, besides the small proportion of the nitrogen of the food which is stored up in the increase of the animal, another portion is expended and lost by respiration and perspiration, or whether the whole of that which is not retained by the animal remains for manure, can hardly be said to be absolutely settled. The balance of the evidence is, however, in favor of the view that there is no loss of the nitrogen of the food excepting that which contributes to the increase of the animal, and that which may be due to the decomposition of the manure after the animal has produced it.

I have brought forward these illustrations to show you how much time, labor, and money, must be expended in scientific inquiry before some of the most fundamental practices of agriculture can be thoroughly understood, and before, therefore, the £ s. d. standard of calculation can be rigidly applied to them. Whilst, however, much remains to be done before we can discuss some important branches of the science of agriculture "with a view to profit," we can, I think, in the meantime learn much from the results of field experiments, if conducted on a sufficiently large scale, for a sufficient length of time, and with due regard to accuracy. I believe the experiments at Rothamsted meet these requirements; and I now propose to consider how far the results of some of them are applicable to agriculture "with a view to profit."

Among the results of the Rothamsted field experiments there is one fact which stands out with the greatest possible prominence; viz., that certain substances, which constitute a very small proportion of the crops, exert a very striking influence on their growth when employed as manures. Thus nitrogen, in the form of ammonia salts, or nitrate of soda, used in admixture with superphosphate of lime, and applied to the Rothamsted soil when in an agricultural sense in a state of exhaustion—that is when it is unfit to grow another grain crop without manure—will yield a full crop of grain, and, with a repetition of the manure each year, will continue to do so for many years in succession.

For example, a mixture of 300 pounds of superphosphate of lime, and 200 pounds of ammonia salts, applied every year for nineteen years, has yielded almost exactly the same amount of barley as 300 pounds of superphosphate of lime and 1,000 pounds of rape cake, or as fourteen tons of dung, applied annually for the same period. Each of the three has given an average of about forty-eight bushels, or six quarters of barley, and about 28 cwt. of straw. Nitrate of soda has not been used in similar combination for so long a period; but it may be assumed, that if, instead of the 200 pounds of ammonia salts, 275 pounds of nitrate of soda had been employed every year with the superphosphate of lime, almost identically the same result would have been obtained.

Now, let us compare the quantity of certain constituents in forty-eight bushels of barley, and its straw, with that of the same constituents contained in the above named different kinds of manure which will produce it. The following table illustrates the point:

	Dry organic matter.	Mineral matter.	Nitrogen.
48 bushels barley and 28 cwt. straw	4,566 lbs.	196 lbs.	56 lbs.
14 tons farmyard manure	8,540 "	868 "	200 "
1000 lbs. rape cake	810 "	80 "	50 "
200 lbs. ammonia salts	–	–	41 "
275 lbs nitrate of soda	–	–	41 "

Thus, of dry organic matter the crop would contain about 4,566 pounds, or rather more than two tons. Of such substance the annual dressing of dung would supply nearly twice as much, and the rape cake not one-fifth as much as the crop contained; whilst the ammonia salts, or nitrate of soda, would supply none at all. Of mineral matter, again, the dung would annually supply very much more, and the rape cake very much less than the crop contained. Of nitrogen, too, the dung would contain from three to four times as much as the crop; whilst neither the rape cake, the ammonia salts, nor the nitrate, would contain as much as the crop. Practically, then, we obtain the same quantity of grain and straw whether we supply much more or much less organic matter than the crop contains, or even none at all. In fact, more than ninety per cent. of the really dry substance of the crop may be derived, either directly or indirectly, from the air and water, and not from the substance of the soil itself, or of the manure.

A similar result is brought out even more strikingly in the experiments on the continuous growth of wheat. To one plot in the experimental wheat field, fourteen tons of farmyard dung per acre have been applied annually for twenty-seven years in succession; but the amount of produce yielded by it is exceeded by that from mixtures of mineral and nitrogenous manure, supplying no organic matter whatever. It may be considered established, then, that, at any rate in the case of moderately heavy soil such as that at Rothamsted, the only manures required for the production of good grain crops for a number of years in succession, are such as will supply certain mineral constituents, and nitrogen, the latter either in the form of ammonia salts, or nitrate of soda.

Referring again to the results with the barley, I wish to recall your attention prominently to the fact, that the fourteen tons of farmyard manure, which gave only the same amount of produce as the mixture of superphosphate of lime and ammonia salts, or superphosphate of lime and nitrate of soda, not only supplied large quantities of organic and mineral constituents of which the artificial mixtures contained none, but it also supplied probably between four and five times as much nitrogen as either of the artificial mixtures, and yet only gave the same amount of crop. The salts of ammonia supplied forty-one pounds of nitrogen in the form of ammonia; the nitrate of soda also forty-one pounds in the form of nitric acid; and for some years, an amount of ammonia salts containing eighty-two pounds of nitrogen was applied to one series of plots, but this was found to be too much, the crop generally being too heavy, and laid. Yet, probably about two hundred pounds of nitrogen was annually supplied in the dung, but with it there was no over-luxuriance and no more crop than where forty-one pounds of nitrogen was supplied in the form of ammonia or nitric acid. How is this to be accounted for?

The answer to this question must be, that the activity of vegetation does not depend alone upon the mere amount of the required constituents provided within the soil, but very materially also on the state of their combination, and distribution, being such that they can be taken up by the growing plants. Only a comparatively small proportion of the nitrogen of the dung exists as ready-formed ammonia, and the remainder only very gradually passes into that state of combination. Hence it is that dung is found to be what is considered by some so desirable—namely, a lasting manure; that is to say, a manure which only yields up its fertilizing constituents very slowly. Salts of ammonia and nitrate of soda are, on the other hand, both very soluble in water; but, when applied as manure, the ammonia of the ammonia salts is much more readily absorbed and retained by the soil than is the nitric acid of the nitrate. The latter, consequently, distributes more rapidly, and is more liable to be dissolved by heavy rains, and washed into the drains or the subsoil; though a portion of the ammonia of the ammonia salts itself becomes converted into nitric acid, and then is subject, in like manner, to loss by drainage.

The farmer has, therefore, to deal with that very important constituent of manure, *nitrogen*, in very different conditions of combination, in which it acts very differently when applied to the soil. It is probable that when the reactions of these various descriptions of nitrogenous manure on different descriptions of soil have been more carefully investigated, and are better understood, some considerable saving may be effected in their use. At Rothamsted, in the experiments on wheat less, and in those on barley not much more, than half of the nitrogen supplied as ammonia salts or nitrate of soda is recovered as *increase* of produce in the first crop; and only from *one-sixth* to *one-fifth* of that which is supplied in the form of dung is so recovered. Our attention is now directed to this subject, and experiments are in progress to determine whether a reduced amount of these valuable manures will not yield an equal result, if applied more carefully in close proximity to the growing plant.

Taking, however, the Rothamsted experiments as they stand, let us now examine what results they give when brought to the standard of profit and loss. In the barley field the average annual produce obtained by the annual application of three hundred pounds of superphosphate of lime, and two hundred pounds of salts of ammonia, or instead two hundred and seventy-five pounds of nitrate of soda, has been, as already stated, about six quarters, or forty-eight bushels, of dressed grain, and twenty-eight hundred weight of straw. As the supply of nitrate of soda in the market is much greater than that of the ammonia salts, I will adopt the nitrate as the basis of calculation. We have then the cost of the crop per acre, approximately as follows:

$2\frac{1}{2}$ cwt. nitrate of soda, at $4	$10 00
$2\frac{3}{4}$ cwt. superphosphate of lime, at $1.25*	3 44
Sowing manure	38
Rent, tithe and rates	8 75
Ploughing	2 50
Scarifying	75
Harrowing	1 00
Rolling	50
Drilling	50
3 bushels seed, at $1.06	3 18
Hoeing and weeding	1 75
Harvesting	2 50
Threshing and dressing, at 50 cts. per quarter	3 00
	$38 25

The above may be considered as a close approximation to what would be the annual cost of growing a crop of barley for a number of years in succession, at Rothamsted.

On the other side of the account we have—

48 bushels of dressed barley, at 1.12\frac{1}{2}$	$54 00
3 bushels of offal barley, 62$\frac{1}{2}$ cts	1 87
28 cwt. of straw, at 25 cts	7 00
	$62 87
Cost of the crop	38 25
Profit per acre	$24 62

I will next call your attention to a few of the experiments on the continuous growth of wheat. The first crop of the series was harvested in 1844, and the twenty-eighth in succession is now growing. Omitting the results of the first eight years—1844 to 1851 inclusive—when the manures were not exactly the same as they have been since, we have, as in the case of the barley, a period of nineteen years—1852 to 1870 inclusive—during which the same manures have been applied to the same plots year after year. Plot 5 has received each year a mixture of salts of potass, soda, and magnesia, and superphosphate of lime; Plot 6 the same mineral manures as Plot 5, with 200 pounds of ammonia salts per acre; Plot 7 the same mineral manures, and 400 pounds of am-

* A mineral superphosphate, and containing no ammonia. The best brands usually sold in this country usually contain ammonia, and sometimes potash also, in addition to soluble phosphate.—Ed.

monia salts per acre; and Plot 9 the same mineral manures, and 550 pounds of nitrate of soda per acre. The following are the average results over the nineteen years:

Plots.	Per acre, per annum, nineteen years, 1852-1870.		
	Manures.	Average Produce.	
		Dressed Corn.	Straw.
5	Mixed mineral manure, alone	17 bushels.	15 cwt.
6	" " " and 200 lbs. am. salts	27 "	25 "
7	" " " and 400 lbs. am. salts	36 "	36 "
9	" " " and 550 lbs. nit. soda	37 "	41 "
2	14 tons farmyard dung	36 "	34 "

Thus, the mixed mineral manures alone give, over nineteen years, an average annual produce of wheat of 17 bushels of grain and 15 cwt. of straw per acre. The addition of 200 pounds of ammonia salts per acre to the mineral manures gives an increase of 10 bushels of grain and 10 cwt. of straw. The addition of 400 pounds of ammonia salts to the mineral manures gives an increase of 19 bushels of grain and 21 cwt. of straw; and the addition of 550 pounds of nitrate of soda to the mineral manures gives an increase of 20 bushels of grain and 26 cwt. of straw. The farmyard dung, on the other hand, gives the same amount of grain, but 2 cwt. less straw than the mineral manures and 400 pounds of ammonia salts; and 1 bushel less grain and 7 cwt. less straw than the mineral manures and 550 pounds of nitrate of soda.

It is evident from these results that, in the case of moderately heavy land like that of the experimental field at Rothamsted, full crops of wheat may be grown for many years in succession, by means of the annual application of certain mineral constituents, with ammonia salts, or nitrate of soda, in addition.

Taking, again, the cost and result with nitrate of soda as the basis of calculation, the following will be the money account per acre of the experiment on the continuous growth of wheat:

5 cwt. nitrate of soda, at $4	$20 00
Salts of potass, soda and magnesia	12 50
2¾ cwt. superphosphate of lime, at $1.25	3 44
Sowing manure	37
Rent, tithe, and rates	8 75
Ploughing	2 50
Scarifying	75
Harrowing	1 00

Rolling	50
Drilling	50
2 bushels seed at $1.50	$3 00
Hoeing and weeding	5 00
Harvesting	5 00
Threshing and dressing, at 50 cts. per quarter	2 31
	$65 62

On the other side of the account we have—

37 bushels of dressed wheat, at $1.50	$55 50
2½ bushels of offal wheat, at 50 cts	1 25
41 cwt. of straw	17 70
	$74 45
Cost of the crop	65 62
Profit per acre	$8 83

There are several reasons why the results with the wheat are not so satisfactory as those with the barley in point of profit. The crop is much more costly to keep clean; and, as you will see, I have charged $1.75 for hoeing an acre of barley, but $5.00 for hoeing and cleaning an acre of wheat. Again, for a given weight of grain, there is nearly one and a half times as much wheat straw as barley straw; and with the winter-sown and stronger straw crop we are enabled, in the average of seasons, to ripen a greater weight of total produce. The result is that, to obtain a full crop of wheat, we have to employ about twice as much ammonia salts, or nitrate of soda, as is required to yield what may be called a corresponding crop of barley. Thus, 48 bushels of barley, and 36 or 37 bushels of wheat, may be taken as of nearly equal money value; but to grow 48 bushels of barley we have used only 200 pounds of ammonia salts, or 275 pounds of nitrate of soda, producing at the same time only 28 cwt. of straw; whereas, to get 36 or 37 bushels of wheat we used 400 pounds of ammonia salts, or 550 pounds nitrate of soda, and produced about two tons of straw, withdrawing, of course, at the same time, much more mineral matter from the soil.

It is obvious that, in growing wheat or barley year after year by the manures above described, and removing both grain and straw from the land, the exhaustion of mineral constituents will show itself sooner in the case of wheat than in that of barley. Hence it is that, in the wheat account given above, there is the heavy charge of $12.50 for salts of potass, soda and magnesia, whilst there is no such charge against the barley crop. The amount of those salts annually used in the particular experiments quoted was, it is true, considerably more than would be required to compensate for the exhaustion by the increase of crop obtained. It must be distinctly borne in mind, however, that the Rothamsted experiments are not arranged with a view to providing direct examples of profit. At the same time, the fact is clearly brought out that more money must be expended on nitrogenous manures to yield a given money value in wheat grain than an equal value in barley grain. Calculations show, indeed, that of a given amount of the expensive constituent nitrogen supplied in manure, a larger proportion is taken up from the soil by the barley than by the wheat crop.

To conclude, in regard to the wheat experiments, I am sure you will agree with me that the fact of having removed twenty-seven full crops in succession from the same land, is one of the greatest possible interest and importance, as showing what constituents must, and what need not, be applied to the soil for the successful growth of the crop. But, although the growth of wheat under such circumstances may require the employment, as manure, of expensive constituents, such as potass, it is by no means to be concluded that such manures would be requisite under the very much modified application of the system of more frequent grain growing, which could alone be followed in farming "with a view to profit."

As the experiments on the continuous growth of oats, at Rothamsted, have as yet only extended over two seasons, I will not occupy your time by following up the illustration as to profit in regard to that crop. The land devoted to the experiments was dunged for beans in 1864; it then grew wheat in 1865, beans in 1866, and wheat in 1867 and 1868, all without manure; and the first experimental oat crop was taken in 1869. In regard to the results, it will suffice to say, that the same mixture of superphosphate of lime, salts of the alkalies, and ammonia salts, or nitrate of soda, as was employed for the wheat (on plots 7 and 9 respectively) gave, in the favorable season of 1869, about 70 bushels of oats and about 50 cwt. of straw, and, in the unfavorable one of 1870, about 50 bushels of oats and 28½ cwt. of straw.

I will now direct your attention to some experiments on rotation. In one field at Rothamsted an experiment on rotation of crops has now been carried on for nearly twenty-four years. The course followed is—turnips, barley, clover, beans or fallow, and wheat. On one portion the swedes are very highly manured with a mixture of rape cake, salts of ammonia, superphosphate of lime and salts of potass, soda and magnesia. From one-half of this piece the whole of the swedes, both roots and tops, are carted off; and on the other half the crop is consumed on the land by sheep. The twenty-fourth crop, that is, the last of the sixth course, is now growing. Omitting the first course, in which Norfolk whites and clover were grown, and the sixth, which is not yet completed, the following are the quantities of roots and of dressed grain per acre, obtained in the second, third, fourth and fifth courses:

SECOND COURSE.

Year.	Crop.	Swedes carted off the Land.	Swedes consumed on Land.
1852	Swedes	$19\frac{3}{4}$ tons.	$19\frac{1}{3}$ tons.
1853	Barley	$38\frac{1}{4}$ bushels.	$35\frac{1}{4}$ bushels.
1854	Beans	10 "	$13\frac{1}{4}$ "
1855	Wheat	$37\frac{1}{2}$ "	$40\frac{3}{4}$ "
	THIRD COURSE.		
1856	Swedes	$16\frac{3}{4}$ tons.	17 tons.
1857	Barley	48 bushels.	$63\frac{1}{4}$ bushels.
1858	Beans	$12\frac{1}{2}$ "	$14\frac{3}{4}$ "
1859	Wheat	$39\frac{3}{4}$ "	$38\frac{3}{4}$ "
	FOURTH COURSE.		
1860	Swedes	$4\frac{1}{3}$ tons.	$3\frac{1}{2}$ tons.
1861	Barley	$60\frac{3}{4}$ bushels.	$54\frac{1}{2}$ bushels.
1862	Beans	$43\frac{1}{2}$ "	$41\frac{1}{4}$ "
1863	Wheat	$46\frac{1}{4}$ "	$44\frac{1}{2}$ "
	FIFTH COURSE.		
1864	Swedes	$8\frac{3}{4}$ tons.	$8\frac{1}{2}$ tons.
1865	Barley	$47\frac{1}{2}$ bushels.	$43\frac{1}{2}$ bushels.
1866	Beans	$20\frac{1}{2}$ "	$24\frac{3}{4}$ "
1867	Wheat	$23\frac{3}{4}$ "	$21\frac{1}{4}$ "
	SUMMARY—AVERAGE OF THE FOUR COURSES.		
1852, '56, '60, '64	Swedes	$12\frac{1}{4}$ tons.	12 tons.
1853, '57, '61, '65	Barley	$48\frac{3}{4}$ bushels.	49 bushels.
1854, '58, '62, '66	Beans	$21\frac{3}{4}$ "	$23\frac{1}{2}$ "
1855, '59, '63, '67	Wheat	$36\frac{3}{4}$ "	$36\frac{1}{4}$ "

Thus, the average produce of swedes was about twelve tons of roots, and there were besides about three-quarters of a ton of tops. The manures applied to each crop of turnips, if they had been employed directly for barley, would have been sufficient to grow three crops of about 48 bushels each; that is, in all, 144 bushels of barley. Yet we find that the average yield of the rotation where the whole of the roots were consumed on the land, was almost exactly the same as where they had been carted off. The condition of these two plots must, however, have been very different. The amount of nitrogen alone, returned to the land by the stock consuming the turnip crop, would probably be equal to that contained in between 400 and 500 pounds of nitrate of soda.

From the results of these experiments we may learn—

1. That the growth of the root crop did not of itself contribute anything to the fertility of the land.

2. That the treading of the land by the stock was injurious to the succeeding barley crop.

3. That it is not alone the quantity of manurial constituents applied which determines the amount of the crop, but that the effect depends very much upon the condition in which the constituents exist within the soil.

A careful consideration of these results, and also of those of experiments in which swedes have been grown year after year for many years in succession on the same land, leads me to the conclusion that on the heavier class of soils, where the treading of sheep is injurious, the turnip crop, if not out of place, might at all events with advantage occupy a much less proportion of the area of the farm than it usually does. There are many and obvious reasons why it would be impracticable to devote the whole of the arable land of a farm to the growth of grain; and if I were farming with a view to profit alone, I should not attempt to do so. But, taking as a basis the facts that on moderately heavy and heavy land full crops of wheat, barley or oats may be grown with certainty for some years in succession, by means of artificial manures containing soluble phosphate, and nitrogen in the form of ammonia or nitric acid, and that the increased produce obtained by these manures is remunerative, I should certainly devote a much larger proportion of my land to grain than is usual in the district. To give an example of what I have done in this direction, I may mention that a field adjoining the experimental barley field, received a heavy dressing of dung and artificial manure for mangolds in 1866, and since then it has grown wheat, oats, barley, and barley in succession. The last two crops of barley have each been fully fifty-six bushels per acre; and another grain crop is to be taken from the land in the coming season.

I am also disposed to give up the growth of turnips altogether, growing no other roots but mangolds, and these probably to the extent of not more than one-fifteenth or one-twentieth of the arable land of the farm. Under this system the land for the mangolds should be manured very heavily with dung, applied partly in the autumn and partly in the spring, and also with artificial manure at the time of sowing. It would be advisable, too, to prepare the land for the spring grain as much as possible in the autumn, by means of steam; and, of course, altogether to avoid injury by treading with sheep in wet weather. To what extent such a system would be applicable and profitable in other districts must be left in great measure to the judgment of the individual farmer to decide.

In the "Report on the Farm-Prize Competition, 1870," published in the last number of the *Journal of the Royal Agricultural Society of England*, Mr. Keary condemns the system of growing more frequent grain crops by the use of artificial manures. On the other hand, in the *Agricultural Gazette* for November 5 and November 19, we have an account of the successful cultivation of a farm on which 330 to 350 acres of grain are grown out of a total area of 450. The whole produce, grain and straw, is sold off the farm; no stock is kept, and no meat is produced. There can be no difficulty whatever in agreeing with Mr. Keary in doubting whether, upon light soils, where the treading of sheep is beneficial, "the alternation of green and white crops can properly be departed from;" and, for my part, I do not recommend that it should be on such soils, unless under very special circumstances. I equally agree with Mr. Prout, that on soils of quite another description, both roots and stock may be more plague than profit; and, in fact, that, by means of steam or other deep cultivation, and the judicious employment of those special fertilizers which experience shows to be advantageous, remunerative grain crops can be grown over a larger area of the farm than is consistent with our recognized systems of rotation. Cleanliness is, however, an essential element in the profitable growth of grain; and when the land becomes foul, the grain growing should be suspended and a fallow or cleaning crop taken.

The time is past for maintaining a servile adherence to fixed systems of rotation as essential to profitable agriculture, whatever the description of the land, the intelligence of the farmer, or the local conditions of his farm. Whether we look to the greatly extended knowledge of the present cultivators of the soil, to the greatly increased command of the elements of fertility in the form of purchased cattle foods and manures, to the marvellous development of mechanical appliances, or to the increased facilities for transit and for the carriage of produce, it must be admitted that the farmer of the present day, as compared with his predecessors, has very marked advantages. And it is only reasonable to suppose that these great changes should have a commensurate influence in modifying systems and practices which owe their origin and their reason to other times and to other circumstances.

In conclusion: if those who farm "with a view to profit" can gather nothing else from the results of the Rothamsted experiments, they may at least learn with what certainty of result certain manurial substances may be employed for the increased production of some of the most important crops which they cultivate; and I am sure I may safely leave it to the intelligence and the judgment of those I am addressing to decide, each for himself, how far his own particular soil, and other circumstances, will justify him in modifying his present practice in the direction I have indicated.

THE AGRICULTURAL AND COMMERCIAL VALUE OF ARTIFICIAL MANURES.

[A Lecture delivered by Dr. A. Voelcker, before the Derbyshire Agricultural Society.]

Dr. Voelcker, in commencing his address, said: He must be allowed, before commencing the actual subject of his lecture, to make a slight digression to congratulate all the members of that influential society who had taken so deep an interest in the establishment of the Cheese Factory in the town, that the undertaking had been placed in a position which gave every assurance of success. He was extremely gratified that the men of Derbyshire, who were not always proverbial for being in the front rank of agricultural improvement, had taken the wind out of the sails of other counties, and were certainly the leaders in what he could not but call a great national improvement, which must very materially influence the social, and, from the high price he hoped they would secure, the economic position of the farmers of the country. He had been delighted that day to find in Derby, in actual and successful operation, what he recommended so long ago as ten years —the Cheddar system of making cheese. It was about ten years since he investigated the subject of cheese-making, and the result was, that he came to the conclusion that the only method which admitted of being carried out successfully, on an extensive scale, was the Cheddar. The adoption of the factory system would relieve farmers' wives from much of the drudgery, not to call it the slavery under which the wives of dairy farmers at present suffered. It was a plan which, when strictly carried out in all its details, not by guess work, but according to definite rules, must give as definite results as the observance of those rules would naturally imply. He had scattered those notions abroad ten years ago, and, strange to say, they were first taken up in America, and long before his papers were, he believed, much read in this country, the suggestions they contained were practically applied in America, and were sent back to us in the shape of a system which contained in it all the elements of success. There could not be a shadow of doubt that if they proved successful in their endeavors to carry out the

American system, they would see small factories springing up through the length and breadth of the land in all the diary districts of England, and he most heartily wished them success in a project in which he had always felt the deepest interest.

Coming now to the subject of Artificial Manures, he need hardly say that it was a subject of annually increasing importance, for where five or ten years ago men spent their tens of pounds in the purchase of artificial manures they now spend their hundreds, and those who spent their hundreds now spend their thousands. To see how important the question was becoming they need only look at the many manufactories of artificial manures which were springing up everywhere, and at the keen competition which existed between rival dealers; indeed, the dealer in artificial manure had become one of the greatest bores in the market. They could not go into a market without being pestered by some agent for an artificial manure manufacturer, who praised his wares, often to the detriment of those of his rivals.

There were now makers who produced from thirty to forty thousand tons per annum; others twenty and ten thousand, and some a thousand or five hundred. Very large sums were invested in the manufacture, and it was unnecessary to say that large sums were paid annually for these manures by agriculturists who must, in the present day, if they would successfully cultivate their land, spend a good deal of money for the purchase of these manures; for the present state of agriculture necessitated the application to the soil of more fertilizing agents than could be conveniently obtained from farm-yard manure. Seeing that so large an amount was spent on these manures, it was of the greatest importance to the farmer that he should lay out his money to the greatest advantage, and how could he do this unless he possessed some knowledge of the fertilizing constituents which enter into the composition of the manures offered for sale? The time was long past when the fertilizing powers of certain materials were ascribed to a certain unknown force, and they now knew pretty well on what substances the value—both economical or money value, and the fertilizing or practical value—of the manures depended. It was not by any process of cooking or of turning over that they could obtain good manures; they could only secure them by incorporating the right materials. There was a time when a mistaken notion prevailed that farm-yard manure should be turned three times, and that it got better every time. Now there was, as was generally the case, a little truth mixed up with the error involved in that idea. To turn manure helped to make it rotten, and rotten manure was better than fresh, bulk for bulk; but by its standing exposed it was apt to lose a great deal of its fertilizing properties, and the more economical plan was to cart the dung to the field as soon as possible, and then they avoided the risk of losing a portion of its valuable properties by evaporation or by drainage. They knew well that the value of animal manure depended very much upon what they put into the animal's belly, and that it would be very different if they used plenty of oil cake, or other rich food, than if they gave their stock an insufficient amount of poor food.

So with artificial manures. Their value depended on the materials put into them. They might concoct a manure of the sewage matter of London, or Birmingham, or Derby, by sifting out its solid parts, but its fertilizing value would be very little, and it would largely consist of soil, clay, or sand, with some organic matter of no great value. They must not expect to get much fertilizing matter from town sewage, unless they incorporated with it a good deal of Peruvian guano, or good bone dust, or nitrate of soda. The fertilizing value of manures depended mainly on the nitrogenous matters, phosphates, and salts of potash they contained. Nitrogenous matter was derived from animals, and existed largely in blood, flesh, skin, hair, and other refuse animal matters. Dried flesh contained almost as much nitrogen as Peruvian guano. As a rule ammoniacal salts produced bulk, and phosphates produced quality, and his aim would be to get both.

He would now direct their attention to a few of the more commonly used artificial manures. The fertilizing value of guano depended essentially on the amount of nitrogenous matter, which was measured by the amount of ammonia it yielded. The fertilizing value of guano was declining. Formerly it would often contain 19 per cent. of ammonia, but that was a great rarity at present. A few years ago they might fairly have expected 16 per cent., and often 17 or 18 per cent., with very little insoluble silicious matter, which was only a long name for their old friend sand. Dr. Voelcker then directed attention to a diagram showing the composition of four samples of guano, and of which the following is a copy:

	I.	II.	III.	IV.
Phosphate of lime..................	25.07	19.31	30.98	42.93
Organic matter—Ammoniacal salts.....	52.98	59.11	33.94	19.79
Insoluble silicious matter.............	1.50	1.45	14.50	9.36
Yield of ammonia....................	17.21	19.30	11.80	4.35

This showed that whilst two specimens of Peruvian guano contained about one and a half per cent. of sand, another which was evidently adulterated contained $14\frac{1}{2}$ per cent., and another nearly nine and a half. The last had once been Peruvian guano, but it had suffered from the action of the weather and the sea water, and its valuable constituents had been washed out. Whilst the first yielded upwards of 17, and the second upwards of 19 per cent. of ammonia, this yielded only $4\frac{1}{2}$ per cent. The ammonia was easily removed by the exposure and washing of the sea, but this specimen contained a good deal of the phosphatic materials, which were not so valuable, and were not so easily affected by the water. It was really guano no longer. Peruvian guano was getting less and less valuable, and an inferior guano was perhaps the dearest thing the farmer could buy. Genuine guano was light in color; it had not a pungent but an aromatic smell, and a cheesy flavor when tasted, which was derived from the undigested fish on which the birds fed, and which disappeared when it had been washed by the sea. The inferior guano was discolored, and was generally of a darkish brown, somewhat like the color of varnished oak when neither very new nor very old, and invariably lost the peculiar taste to which he had referred. Inferior guano always weighed more in proportion to the bulk than the best. It should not exceed sixty-eight or seventy pounds per bushel. By applying those tests every farmer could tell whether the article was genuine or not, or whether it was of inferior quality or not. He had had many samples of guano direct from the importers, and from respectable dealers, which contained 12 or 14 per cent. of sand. It had not been mixed with it purposely, but the guano had been scraped too near the rock, and some of the rock had found its way into it. The sand should not exceed two or three, or at most four per cent.

Nitrate of soda was often used with great advantage, especially for cereals, and it was useful as a spring dressing for wheat, but like many other manures of high value it was often adulterated, and often a large quantity of common salt was mixed with it. Not long ago a Worcestershire dealer in manure went to him, and asked, "What are we to do this season? The price of nitrate is going up so frightfully that we cannot sell it unless it is mixed with salt. If I don't do that my customers won't buy at all." He mentioned that as an example, and all the cases to which he referred had come under his own experience, or were vouched by correspondence. They were not the creations of fancy. Now as the price of nitrate of soda was $85 per ton, and that of common salt four to five dollars, it was plain that a mixture of ten per cent. of common salt would pay very well. Whilst all manures were very much adulterated, none were so much adulterated as bone dust. It was extremely difficult to get genuine bone dust, as bones were getting scarcer and scarcer. People had learnt to appreciate their value as manures, and they had also learnt to appreciate the comparative value of bone phosphate, in comparison with mineral phosphate, which was used extensively in the shape of coprolite.

The superior value of bone phosphate arose from its containing a large proportion of nitrogen, and genuine bone dust yielded from four and a half to five per cent. of ammonia. For pasture land he preferred steamed bones to boiled bones, because in steamed bones the fat which was naturally contained in a large proportion in bones was removed. Fat, as an element in bones, had no fertilizing qualities whatever. It consisted of carbon and hydrogen, and they need not trouble themselves to supply those elements to the plants. Fat was decidedly injurious in its effects, for it prevented the decomposition of the bone dust, and fresh bone would be in the land for many years before it came into active play, the fat preventing the rain from affecting it. Bone dust put into a heap, especially when it was a little wet, heated; and the effect was to cause the ammonia to combine with the fat and to make what was called ammonia soap, which would not prevent the rain obtaining access to the bone phosphate which was then rapidly brought into operation. Superphosphate was another kind of manure on which he would offer a few remarks.

He was often asked to give the composition of a good superphosphate, and also what was a fair price for it. The general answer to the second question was, "As much as it is worth." The determination of the value of a superphosphate was not easy. It could not be ascertained by merely looking at it, or handling it, or smelling it. It might be necessary to handle it to see its condition, whether it was dry, and so on; but they could not test its value by smelling at it. Pointing to a table showing analyses of eight specimens of superphosphates, Dr. Voelcker said the value of a superphosphate of lime depended on the amount of soluble phosphate of lime it contained, and the amount in comparison, of

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insoluble phosphate. The latter would be greatest in the case of bone dust, the former in the case of mineral phosphate, and that made all the difference. Coprolite, which was a mineral phosphate, unless dissolved had hardly any practical value. In the next place, the value of a superphosphate depended upon the amount of organic matter it contained, and a very good test of that was the amount of ammonia it yielded. Speaking generally, the value was regulated by the amount of soluble phosphoric acid. The quantity varied from three per cent. to as much as ten per cent. It was entirely a question of what they would pay. They might say, "I pay, say fifty dollars per ton; what sort of manure should I get for it?" or they might say, "Here is a manure, what ought I to pay for it?" His advice was that it should be bought at a rate fixed according to the quantity of soluble phosphoric acid it contained—so much for each percentage.

There was a class of manures termed phospho-guanos, some of which were very good. They were a mixture of phosphates with ammoniacal salts, and combined the good qualities of superphosphates and of guano. They were sold under various names. Their value depended on the amount of soluble or insoluble phosphates, and the amount of ammoniacal salts which were present. Another class was that of nitro-phosphates, which was only another name for a description of superphosphates. These often did not contain nearly so much nitrogenous matter as ordinary bone superphosphates. Fraudulent mixtures, he was sorry to say, were very frequently sold in England. There was one which had almost gone the round of every county, for after being exposed in one place it was sold with vigor in another district. One sample he had analyzed yielded six-tenths per cent. of ammonia, a later one a third per cent., and the last not a trace. It consisted of gypsum, salt and vitriol, and was of no value whatever. It was true that the proprietor got many testimonials, and no doubt most of them were genuine, but it was not difficult to see how they were obtained. Small specimen bags were sent gratis to a number of persons with a request for a statement of the results, and the maker wisely advised that only a small quantity should be used, not exceeding 1 cwt. or 1½ cwt. per acre, and for the simple reason that if used in any quantity it would seriously injure the land. Every one knew that the result of the best manures was peculiarly affected by the season, and that a crop which had been treated with the best manure would sometimes look worse than one badly manured.

Hence a certain number of crops to which this stuff was applied would turn out pretty well, and as all the worst results went into the waste-paper basket, in the course of a few years (with a liberal distribution of samples) a good many testimonials were obtained.

It was impossible to form a decided opinion of the value of manures without repeated trials under different circumstances, there was so much variety in the seasons; and he would advise them not now to spend any money in top-dressing, the season was far too much advanced for it, and it would do more harm than good. Nitrogen existed in organic matters, in the shape of ammoniacal salts, in the shape of nitrates, which consisted of nitric acid with some base, and as nitric acid, which consisted of nitrogen in combination with oxygen. The next in value to nitrogenous compounds as fertilizing elements were phosphates, which were compounds of phosphoric acid with another substance, often with lime, and were very important elements in many artificial manures.

The third class of fertilizing substances was salts of potash, and the value of an artificial manure, speaking generally, depended on the quantities it contained of nitrogenous matters, phosphate of lime, or potash salts. Of course there were other matters essential to the growth of plants, but they were of minor importance because they either existed naturally in abundance in the soil, or if not they could be readily supplied in a cheap form. Gypsum, for instance, was a useful fertilizer on many soils; but it would be better to apply it directly to the land requiring it than to buy it in the shape of artificial manure. Lime was very valuable on some land, and especially pasture land, and also on some arable land; but he need not say that it answered infinitely better to lime the land than to buy lime in the shape of artificial manure. So common salt was another useful fertilizer, and mixed with lime was the means of renovating many poor pastures; but they could use those materials in their ordinary form. He would name a few constituents that should not be present at all, or only in the smallest possible quantites, in artificial manures. They did not want vegetable matter in the shape of peat, or sawdust, or rotten straw, or such cheap substances, which he was sorry to say sometime entered very largely into the composition of artificial manures. Peat had been called one of the best friends which artificial manufacturers had; and he knew that sawdust, impregnated with sulphuric acid often did duty for superphosphate. Superphosphate was an acid substance, and was often cleverly simulated by acid sawdust.

There was a manure called bone phosphate, which did not contain bone or phosphate in any shape or form. Sand was a substance which should exist in artificial manures in as small a proportion as it was possible to obtain it. It was impossible for any commercial product to be chemically pure, and substances could not be dealt with for the purpose of manufacture without a little sand being introduced into them, and it was found in small quantities in the best artificial manures, but the quantity should be as small as possible.

So far as the value of manures depended on the matters employed in compounding them, it could be ascertained by analysis, but their value depended also on the form in which the elements of fertility existed in them. In certain combinations nitrogen acted much more rapidly on vegetation than in others. Nitrate of soda, when properly washed into the soil, showed its effects in the course of three or four days, by imparting a darker color and a healthier appearance to the grass. But this would not be witnessed in dry weather, and it was only fit to be applied in showery weather, or it would be lost. It was the most powerful form in which they could apply nitrogen to the soil, was most easily taken up by the plant, and the quickest in its effects; but it readily disappeared from the soil, and those substances which were quickest in their operation most readily passed away in drainage and otherwise. Ammonia in the shape of ammoniacal salts was not quite so active as nitrate of soda, so that it could be applied with less risk of being lost. They might top-dress the land with manure containing ammoniacal salts in the autumn, but it would be a bad plan to top-dress with nitrate of soda. It was a remarkable fact that the soil possessed a special power of laying hold of ammonia in the form of ammoniacal salts. That constituted, he considered the second stage in which nitrogenous matters were presented to the plant, an intermediate stage between the crude fertilizing material, such as they found in fresh manure, or in dried blood or flesh, which entered into fermentation readily, and was changed into ammoniacal salts. The soil readily laid hold of these ammoniacal salts, and during the winter months converted them into nitric acid, which was, he believed, the form in which nitrogen was taken up by the crops. That was a lesson from Nature that time should not be lost, but that the farmer should make good use of his spare time, and cart his manure to the land as soon as his leisure would admit of it. It would never do to apply fresh manure as they well knew, in the spring. It would have very little effect comparatively on the root crops. Rotten dung answered a great deal better, for the simple reason that it had undergone the necessary change, that the nitrogenous matter existed in it in the appropriate form.

In considering the value of artificial manures, they must consider not only the value of the materials which entered into them, but also the form in which they existed in the manure. They might have nitrogenous matter, for instance, in the shape of nitrate of soda, Peruvian guano, or dried blood, in which case it readily became effective; or again in the shape of shoddy or wool refuse, which required a long time before it came into action, unless specially prepared. Ammonia existed in shoddy or wool refuse, but it was impregnated with greasy or fatty matter, which prevented its decomposition; and this greatly detracted from its value. Again, nitrogen occurred in leather; but do what they would with leather, let them reduce it to the finest powder, the nitrogen would remain inactive. Some manufacturers knew well how to compound a manure, which on analysis would show a large percentage of nitrogen; but it made all the difference whether it was in such a form as leather powder, or as Peruvian guano, in which latter shape it was readily taken up by the soil. He would rather have one per cent. of nitrogen in the shape of sulphate of ammonia, than six per cent. in the shape of powdered leather. They must not, therefore, too implicitly trust to analyses, which were sometimes made for sale as much as the manures themselves. A mere number of figures of percentages would not put them into a proper position to judge of the true value of manures, but they would show in what force the various constituents figured in the analysis were present in the manure. Another point was the mechanical condition of the manure, whether dry or wet, whether finely powdered or lumpy, which had a material influence on its value. Dryness and fineness of division could not be obtained without expense, but the farmer was well repaid for paying several dollars per ton extra for a manure in a dry and finely powdered condition.

Again, the fertilizing value of manure depended very much on the use the farmer made of it. Certain manures answered best for cereal crops, and others for root crops; some were adapted for one kind of soil and some for another; and their value also depended on their being applied at the right time of the year, and in the right manner. Some years ago he made a series of experiments with a variety of artificial manures as applied to grass land, and the result of those experiments, carried out on a tolerably large scale in several counties in England, was to lead him to the conclusion that the most economical and most efficient manure which could be applied to grass lands was good farmyard manure. No manure produced so good a result, if they could get plenty of it, as good stable dung on grass land; but as they could not always get enough they must get the next best, or the land, instead of becoming richer, would become poorer and poorer. In determining what was the best substitute, they had to consider what was the character of the land. If, as was the case with most of the Derby pastures, the land required lime, they should lime it well, and having done so leave it for a couple of years without putting any manure at all upon it. His experience showed that in most counties of England it was desirable to apply bones to grass land, but bones never did well on newly limed land, and in many cases where it had been so applied he had not been able to see even where the bones went to.

It was very important to settle the point whether the land needed lime. If the herbage looked unhealthy, they might take a little of the soil, and pour upon it weak spirits of salt, and if there was an effervescence that would be an indication that there was enough lime. If they tested the land in that locality, they would find that by far the larger part of the pasture land required lime. The effects of liming might be regarded as permanent, and after its application they should adopt other means. Supposing the lime to be thoroughly incorporated with the land, the next thing to decide was whether bones would answer as a manure. There were no general rules which would hold good under all circumstances. On some descriptions of land bones had little effect; on others the effect was perfectly marvellous. Speaking generally, on heavy soils fresh bone dust, at any rate, did not show so well as on light and more porous soils; and as bone manure was rather expensive at the present time it was well to make an experiment on a small scale before applying it extensively. The result of his inquiries went to show that all good artificial manures for grass lands should contain a certain proportion of phosphatic materials, if possible in the shape of bone dust; and light land should also be supplied with salts of potash.

Pasture lands, to yield a good crop, must be also supplied with a considerable proportion of nitrogenous matter, and he would recommend for light pasture lands mixtures of manures, which should include potash—a good deal of which was now got from Germany, where it had been discovered in a state called kainit. He would recommend for light marly grass land 1 cwt. of superphosphate, 2 cwt. of bone dust, 2 cwt. of potash salt, and 1½ cwt. of Peruvian guano. He would not advise them to put on less than that, if they wished to apply artificial manure to grass lands at all, as he thought it would be like wasting away powder by dribbling it into the breech lock of a gun, where it would produce no effect. Two cwt. of bone dust, and the same quantity of Peruvian guano, and three-fourths cwt. of nitrate of soda made a very good dressing for light grass land. On heavy soils they might leave out the potash salts, more especially if they contained a fair proportion of the better description of the more unctuous kinds of red clay. In buying artificial manures they should first ascertain what would suit the land, and they could ascertain that for themselves, if they were not ashamed of being called experimenting farmers; and every farmer should be that, for observation and experiment were essential to progress.

He would advise them to deal with respectable men, who had a reputation to lose, for in buying cheap manure from some one who went on for a short time and then failed, they would in the long run not gain any advantage. He would advise them not to be led astray by statements of analytical results, for, as he had stated, nitrogen might be present in the form of leather, or phosphate in an insoluble mineral, like coprolite, which would have very little effect. He would not, on the whole, advise them to deal with their brother farmers who made a little manure, and chopped a few horses, and so on, as, generally speaking, they would get an inferior article. He would not recommend them to buy cheap manures, and he showed by reference to analyses that many of the cheap manures were by far the dearest. Some of these manures consisted mainly of dried night soil, which was perhaps worth about $1.25 for a good cartload, and which were sold at $20 to $30 per ton. If they bought superphosphate they should buy by analysis, and when they were certain that they had got what they wanted, they must give the price for it. In buying nitrate of soda they should have a guarantee stating the amount of impurities it contained—5, 6, 7, or 8 per cent.—and deducting it would show the amount of nitrate it contained. He should have liked to have spoken on the question of Supply Associations, for the purpose of ensuring genuine manures, but could only recommend the question to them for discussion.

AUTUMN SESSION OF THE BOARD.

A public meeting of the Board of Agriculture was held at Lincoln village, Penobscot county, commencing on Tuesday, September 19th, and continuing through the two following days. Most of the members were present, as well as the Faculty of the State College of Agriculture and the Mechanic Arts, and a greater number of students than at any previous session, the last class which entered being much larger than any previous one.

The Board was welcomed by Hon. William R. Hersey of Lincoln Centre, as follows:

Mr. President and Gentlemen of the Maine Board of Agriculture—We are happy to meet you here, and both as citizens and members of the North Penobscot Agricultural Society we extend to you a cordial and hearty welcome. We will endeavor to make your tarrying here pleasant to yourselves, as we doubt not it will be profitable to us.

Feeling my inability to discuss scientific agriculture, I have thought it might not be amiss at this time to speak regarding the settlement and agricultural resources of this comparatively new portion of the State.

Lincoln Village, where we now are, is situated at the outlet of Mattanawcook lakes, only a short distance from the Penobscot river, opposite the group of Mattanawcook islands, where Penobscot Indians till the rich soil, and the school-house has been built to educate their children. We hope to see some of them here during this session.

The settlement of the Upper Penobscot was commenced somewhat less than half a century ago, and for awhile the times were hard for the new settlers. But before long the State constructed a road to this place. It was here, too, that the United States commenced building the military road to Houlton, which was a great help to this town and to all the upper settlements. The town of Lincoln embraces townships number two and three and Foxcroft half township. It was incorporated in 1829. Number three belonged to Massachusetts, and was bid off at public sale by Simeon Cumming in 1823. He took as partners in the purchase Enoch Lincoln, Cyrus Hamlin, John Daniels, Jr., Caleb Cushman, Jr., Moses Hammond, Jacob Jackson, all of Paris in Oxford county.

The town was afterwards named for Governor Enoch Lincoln. Number two was owned by this State, and the settlers obtained their lots at twenty cents per acre. The proprietors' land was then held at one dollar per acre. The first settler here was Aaron Woodbury, from Orrington, in 1822. John Carpenter with his family came in 1823. Alfred Gates, Esq., moved with his family from Paris in 1824, to what is now Lincoln Centre village, and was appointed the first Post Master at what was then called Mattanawcook settlement. The mail was then carried once a month from Bangor to Houlton, part of the way by water and part by a spotted line. The first grain raised was carried forty miles to Oldtown to mill, on the ice in winter and in boats in summer.

Where this village now is a lot of land with water privilege was reserved by the State for any one who would build mills. Israel Heald, now living here, took possession and sold to Ira Fish, Esq., from Wakefield, N. H. He built a dam in September, 1825, and soon after a grist-mill and a single and double saw-mill, where he carried on the manufacture of lumber. Many of the first settlers came from New Hampshire, and engaged in cutting and manufacturing lumber, which was run to the river in sluices, there made into rafts and run to market.

Mr. Fish afterwards became one of the proprietors of what is now the town of Patten, in the northern part of Penobscot county, where he still lives at an advanced age, eighty-four years. I came here in 1832, and in company with Gen. S. F. Hersey built a store, and for some years sold goods to the settlers. There was then only one painted building in town, and that a law office, and it never got a second coat of paint. The lawyer took a farm and became a tiller of the soil.

Deacon Stephen Chase moved to township number three from Woodstock, Oxford county, in February, 1825, and preached there a number of years. He took up lots on the river above the Cumberlasse stream (now Lincoln Centre,) which he afterwards divided with his seven sons as they became of age, settling them all around him. Benjamin Chesley, Esq., from Paris, lotted out the town, and settled on the river near Benjamin Hammond and a number of Oxford men, who made for themselves some of the most desirable farms in town. Other settlements were made about the same time on the west side of the river, and also in number four (now Winn). A little later a covered bridge was built across the Mattawamkeag river, now in the town of Mattawamkeag, where Hon. Asa Smith was one of the first settlers. I am happy to see him with us to-day, for he has done as much as any one to encourage the growth and settlement of this section of the State.

Not long after the settlement of Lincoln, the emigrants' trail moved eastward. Choppings were made rapidly in Lee and Springfield, and soon after in Carroll, where flourishing towns have grown up. To the south, Enfield, Lowell and Burlington are in close proximity to us and do considerable business here. On the west side of Penobscot river, opposite the south line of Lincoln, where the Mattamiscontis stream comes into the river, a large block of mills was built and lumbering was carried on, vigorously for awhile, but like most up river mills, for want of cheap transportation the business died out and the buildings went to decay.

For the last twenty years our villages and settlements have languished, many of our most enterprizing men leaving for the West; and much of our capital has been carried away. Our young men, too, have gone to California, and are scattered all through the West. But since the completion of the European and North American Railway, through trains passing twice a day, bringing cheap transportation and shortening the distance to our markets, indications of new life are to be seen, and men of means have come among us. Just across the way you see the tall chimney which denotes active business, the grinding of bark and the tanning of leather. On the stream below new mills have been built, with gang saws, the boards being put directly into cars from the mill.

Northern Penobscot is not solely an agricultural section. The manufacture of lumber and of leather are carried on to an extent more than sufficient to supply our own needs. The Penobscot, although a noble river, and the largest in the State, has not upon its borders so much rich interval as is found on the St. John, or on many of the smaller rivers of Maine. But our uplands are good; although not so universally good as in Aroostook county. We have fine hardwood ridges, back from the river and streams, which bear good corn, being fertile and not being subject to early frost. t was upon these ridges that the early settlers in Lincoln got their first start, raising fifty bushels good corn to the acre, and selling it to the lumbermen for a good price for cash.

Our valleys are generally covered with a mixed growth of pine, spruce and hemlock. Hemlock growth has advanced much in value within a few years, very large tanneries having been built at Winn, Kingman, Medway, Lowell and Lincoln. These consume about thirty-five thousand cords of hemlock bark annually, making a great slaughter of timber; after this is cut and hauled the land can easily be cleared, new farms will be made, and farming in the upper Penobscot will take a new start. Our home markets are good, and the demand for labor and farm produce is constantly increasing.

R. S. Kingman, Esq., who has built up, within less than two years, a tanners' village at Jimskitticook falls on the Mattawamkeag river, on the line of the railroad, harvested this year 160 acres of oats, which will probably yield 5,000 bushels or more; and this season he will clear 150 acres more, ready for seed next spring. Now, if he can make it pay to clear land with hired labor, cannot our young men, with strong hands and hearts, make for themselves productive farms and comfortable homes near some of these villages which are growing up in the wilderness with magic rapidity? As the timber is cut off proprietors will sell the lands, and large towns must grow up, with good educational privileges, too; for almost the first building you see on entering one of these new places is a large and commodious school-house.

Our lands are well adapted for grazing, and the pastures are excellent, so that the raising of sheep, neat cattle and horses can be made as profitable here as anywhere else. Thousands of sheep go past here every fall. I have seen twenty-two hundred on one train, going to market. We claim a part of those sheep as being raised in North Penobscot. All stock coming from the north is said to come from Aroostook. It is true to a great extent; but a glance at the map will show that Penobscot county stretches up far north of Houlton, the shire town of Aroostook, and far north of Mt. Katahdin, where we have large and flourishing settlements. Centrally situated among these is the handsome village of Patten, where all the lumbermen fit out and start for the east branch of the Penobscot. The Aroostook county line runs near by, north and south for a long distance, and the quality of the lands on either side are much the same. The farmers on both sides are alike prosperous and happy.

Dairying has not received much attention. Butter and cheese are made for home consumption, and some excellent butter is sold from the newer settlements, the new pastures furnishing very sweet feed; but cheese factories will not be established in this section until farmers quit lumbering and keep more and better cows. There is great inquiry for the best breeds of cows, and I hope we may be enlightened upon this subject at this session. As an early train runs to Bangor every morning, we might easily send milk there should the demand warrant.

Regarding the crops chiefly grown among us, I may say that oats grow best, and on all kinds of land, and are extensively raised, and they are always in demand at a good price; but wo to the farmer that sows them too often, they will sap his land. Oats and peas succeed well, and can be sown together with less detriment to the farm than oats alone. Wheat, barley and corn are raised and generally produce a fair crop. Potatoes always yield well, and since transportation has become so easy large quantities are grown for market. Hay is a staple article and the yield is abundant on new land.

Without occupying your time farther, gentlemen, I again welcome you to our village; I tender to you its freedom—and I promise you an attentive audience, comprising all classes among us, for we are all seekers for knowledge.

Mr. Hersey then called upon John F. Robinson, Esq., of Lincoln, who spoke as follows:

Mr. Chairman:—I feel embarrassed in following Mr. Hersey, since he is President of the North Penobscot Agricultural Society, a practical lumberman and a successful farmer, devoting a large proportion of his time to agriculture. As he has spoken of the northern part of the county, and as it will be impossible for you to see much of our town and its farms, allow me, in the few moments I propose to occupy your attention, to introduce you to the town of Lincoln.

In the first place, it is the largest in this part of the county, and if you look at the map to find the centre of the European and North American Railway from the point where it starts at tide water to where it leaves the State, you would find it to be just here. We have a flourishing community. The men about us devote their energy and enterprise mainly to lumbering. Last winter, in this town, there were twenty-five men engaged in lumbering, who paid out no less than $125,000. Large numbers go into the woods, and our farmers, instead of paying exclusive attention to their farms, have given much to lumbering. But already they see the distance from the camp to their homes increasing. Where the timber grew so thick and large a few years ago, it has been cut off, and now these men see that they must turn their energy and enterprise to some other vocation than that of lumbering, and you could not have chosen a place in the whole State where a meeting of this kind would be of so much value as in this town. Our men want to know the best methods of farming, and they will be here and listen with great attention.

Lincoln has an excellent water-power, fed by four beautiful lakes. Three of these are reservoirs, connecting with each other, from which the water is drawn at the will of those who wish to use it. These lakes are surrounded by forests of spruce and fir and pine. This railroad is giving us new life, energy and enterprise. Since it came here we have had a large tannery built, two steam mills, and within a few weeks another has started near by. A few years ago it took a long time to get lumber to market. Mr. Ayer informed me that not long since he had a dispatch from Bangor at nine o'clock in the morning, stating that a quantity of boards were wanted. The logs were drawn out of the lake, sawed, and at six o'clock that lumber, which was in the lake in the morning, was in Bangor. That is an illustration of what the European and North American Railroad is doing for us.

This town, as well as other portions of the State, has suffered much in consequence of our young men emigrating. The war took many, but many others, both of our young men and of our active business men, have gone West. This morning a gentleman told me of his son, a mechanic, who lived here until last spring. He had accumulated three thousand dollars, working with his own hands; last spring he took the Western fever, and went, with his wife and child, to the West. What was the result? He went to Nebraska first, then moved to Kansas, left his wife and child, went thirty miles further, took the fever and died.

Ours is a healthful region. With a population of 1,500, the snow was not shovelled in our grave-yard last winter, nor the winter before; the snow that fell in autumn was undisturbed till spring. If men love life and health, they can find them here. I believe there is no place in the whole country where a man can, for the same amount of money and labor, get as much of all that makes life happy as here in the State of Maine; and I trust that this gathering will result in a better apprehension of the facts in the case, and a fuller appreciation of the blessings of a home in the "Dirigo" State.

Mr. A. L. Sampson of Bangor being called upon spoke as follows: I congratulate the Board on the warm reception we have met, and I trust that our labors may do something to stimulate the people upon the Penobscot to direct their energies more towards the pursuit of agriculture, for our lumber regions are receding further every year, and our energies must be turned into other channels of industry than that of lumbering, or the Upper Penobscot will be depopulated. No necessity exists for that; the opening of the railroad has brought us within easy reach of a good market. I was much interested in a remark made by one who knew whereof he affirmed, that the increased value of the potato crop in the county of Piscataquis last year, from the opening of the railroad there, would pay the interest on the entire cost of the road. He said, also, that this year there were double the number of acres planted with potatoes that there were last year. Now, if the agricultural interest of that county can be so developed and increased by the opening of the railroad, we shall see it developed in this whole region; and it is well that we have these meetings where they are most needed, where the soil although rich has not been under a high state of cultivation, that its ample resources may develop into the means of wealth and comfort to a large and increasing population.

The Chairman having responded in appropriate terms to the welcome extended to the Board, Mr. Calvin Chamberlain presented the following upon

OUR FARM EXPERIENCE AND THE LESSONS OF THE YEAR.

Before we came together here, I suggested to Secretary Goodale, that our meeting could hardly expect to accomplish more than to compare notes of misfortunes, and listen to the recital of wasted crops and blighted hopes. Judging from my field of observation, I might suspect that our time here could best be employed in planning to colonize the people now remaining in the State, upon some favored spot where vegetable and animal life give promise of better regulation, so as to leave something for our sustenance, than they seem to be under here. Till some proposition for a general migration is presented, we may spend some time in looking at our real situation, and inquiring whether our present home may not be made to answer our purposes reasonably well a little longer; and while we remain, to give our State yet a season of probation, let us try and learn to treat the domain better.

Grasshopper plague and sharp droughts have consumed and desolated some of the fairest portions of the State, leaving little or nothing to feed ourselves, our flocks and our herds. How it has come about that Nature is so badly out of balance, is as much a proper subject of inquiry as is the best way to extricate ourselves from the predicament. These new circumstances call into action all the wisdom we now have, and demand new expedients—experiments seeking for more light, and leading to further discoveries. We are a people who will not starve by reason of local plagues.

A very good farmer recently made the remark, that "Our climate is better than our farming." Climate may and does change; our farming is always in a condition to be changed for a better way. You know I profess to believe that climate is essentially modified by the acts of man; and I hope we all believe that our farming may be improved upon. I propose to present some of the lessons of the year only, in such manner as to open the subject to the meeting, and shall try to leave unsaid all the theories and wise conclusions that many of you have ready digested for our instruction.

Grass, the leading crop, is nearly exterminated from a considerable portion of the State. The question has been asked thousands of times in the last month, How shall we proceed to get a hay crop on our lands where grass-seed has failed the present season and the last? The question applies with nearly equal force to our other fields, where we have cut a heavy mixed crop of clover and timothy, most of which has disappeared under the combined power of drought and grasshoppers. To plow the grounds where the seeding has failed, either this fall or next spring, demands 1st, the purchase of clover and grass seeds; 2d, the purchase of some fertilizer; and in most cases, 3d, the purchase of seed grain, or the land will carry no crop next season. If two or three of these demands were not present to the vision of the farmer, he would not be asking *what to do.*

Can we restore the hay crop to fields where clover and the valuable grasses have been killed, otherwise than by the plow and a rotation of crops? There is demanded of us an employment of more capital than we have been willing to invest in our business, or a substitute in some cunning device to cheat the land into the belief that it has been honestly dealt with in seed, manure and manipulation. I am not aware that much has been done with us to renovate old fields by turning them over after haying and immediately applying grass seed and manure. It has been extensively practised in other States, I believe with good results, no other crop intervening between the crops of hay. I hope some one will tell us whether this can be done in this latitude so late in the season as this; and whether the commercial phosphates alone could be applied in this case with advantage in the absence of other manures. A serious leak from the farmer's purse is for this item of clover and grass seed. The demand is so great and so constant that prices rule altogether too high. Now I happen to know how very much of this expense may be saved, and I do not know how I can better pay the State for my expenses in coming here than by making the knowledge common property.

There is no other forage plant that I prize so highly as the Alsike clover. It may be allowed to stand till the first heads are ripe, without loss of value for hay, and then cut and made in the cock as other good hay should be treated; and when sufficiently dry taken directly from the cock to the threshing-floor and whipped lightly with the flail. Treated in this manner the straw is not broken, and you have good hay and a clean lot of chaff, a barrel full of which will seed an acre abundantly. I treated a half acre in this way the present season, and have chaff enough to seed fifteen acres, and it cost me only a day's work. Should you buy seed in the first instance, it will cost, at present prices, about one dollar and sixty cents per acre.

As a substitute for hay, we all know something of corn fodder. When an acre of it is worth—as this year—about two hundred dollars, we may hope to see more of it planted. Should we adopt fall seeding for grass, would it not be advisable to give winter wheat another trial? Arnold's Hybrid is a hardy variety that promises well. I sowed a pint last September and harvested three pecks.

Now that railroads are extending in the State, reaching new lands, potatoes will continue to be an important crop without any advice from us. Farmers will do well to heed the admonition that they are an exhausting crop, and the land will call for fresh supplies of potash and other inorganic elements. These railroads are great revolutionists. They traverse the valleys and swamps where the farmer has his reserve of wood and timber—lands where is found a large deposit of decayed vegetation, which, in our dry seasons, becomes a sure prey to the scattered fire from the engine, thus wasting our remaining forests to an alarming degree. I hope this wholesale destruction, before it proceeds much farther, will teach land-owners to plant their ledgy hills with valuable forest trees, and to clear up these rich, low lands along the railways. It is a change of front that will cost time and vast labor, but in the long run will be a great improvement.

I shall not now inflict upon you another discourse upon forests; but this is a good place to say that our country is in prospective need of all the wood we have, and that each and every one of us should have a constant care to see that the future acres of wood and timber are well located. Insect destroyers are most formidable in districts scantily wooded. Insects are doing more damage to crops and fruits than all other agents and elements combined. A country thrown out of balance by a rapid waste of its forests is from this cause further thrown out of balance by reducing the numbers of the birds and increasing the insects. An observing farmer in one of the most afflicted towns in the State, says, "We have very few birds in our town this year. The boys for two or three years past have been striving to excel in collecting a cabinet of birds' eggs." It is an instance where a slight knowledge of ornithology is gained at a great public loss. Better take an outfit of pins and nets and strike out for some knowledge of entomology. To sum up the peculiar experience and draw the lessons of this or any other year, requires other data and more reflection than we can bestow upon it in an hour after all has passed.

In connection with a subject of inquiry like this, it would be well to sum the average of individual and collective prosperity. My aim only teaches the agricultural interest. This meeting, as a farmers' convention, may be supposed to confine its attention to its speciality; but a Board of Agriculture should take broad ground, and should know of the success attending the various manufacturing pursuits, and especially the vast seaboard interests of building and sailing ships, and the fisheries.

Manufacturing and commercial centres show an increase in population and wealth. How is it in the ship-building towns? Have the sturdy carpenters taken to other pursuits at home, or have they left the State? The agricultural population of Maine is decreasing. This is true of many of the States, and the rule holds in the leading countries of Europe. Where this tendency is to culminate, and what it portends, we will not venture to predict. But I must stop abruptly or overstep my limits.

The Chairman. The subject of farm experience and the lessons of the year are before you. It is hoped that the very suggestive thoughts given to us may be enlarged upon, and the lessons well learned by us all. It may be well, at the outset, to ascertain to what extent the disasters of the past season have prevailed, for I understand that they are not uniform throughout the State. For this purpose I will call upon members in the alphabetical order of their counties. As the member from Aroostook is not in, I will ask Hon. Asa Smith who lives near.

Hon. Asa Smith. So far as I am advised, Aroostook county has not suffered either from grasshoppers or drought to any extent worth mention. All their crops have been good.

Mr. Gilbert of Androscoggin. The ravages of the grasshopper have been the principal cause of the great reduction in the hay crop in Androscoggin county, and not only of that but in many sections they have almost destroyed the grain also. They have done more damage in the northern part of the county than the open winter and the drought combined. They appeared very early. On warm days in March, on crossing the fields you would see them hopping round before you, and as we were not blessed with heavy rains after that time they continued to multiply until the first of August, when they began to disappear. Their ravages were confined to particular sections, and did not extend over large districts. There would be sections in some towns where the vegetation was almost destroyed; in others, not remote, but little damage was done. The northern portion of the county suffered most severely. In my immediate neighborhood (East Turner) they did no serious injury. The amount of damage cannot be well estimated. The pastures, after the first of July, furnished no more grass than the grasshoppers were able to dispose of, and from their ravages on trees and other plant growth I should say that the grass furnished a very short supply for them; consequently the stock in the northern part of the county have had but little to eat in the pastures, and they have resorted to the low grounds, to the forests and the bushes, and have literally browsed for a living. The consequence is, that the animals are in poor condition, and many farmers are actually compelled to dispose of their stock at whatever price is offered. Their barns are empty, their pastures are bald and brown, and in some sections they have felled trees and bushes to keep the cattle alive.

SEC. GOODALE. Were any means of saving the crops adopted with success?

MR. GILBERT. Some efforts were made, and in some cases with partial success. The method chiefly used was for a man on each side of the field to hold a rope and slide it over the stalks of grain, when the grasshoppers would fall to the ground and remain there during the night.

MR. SCAMMAN of Cumberland. The grasshopper plague has not been so noticeable in Cumberland county as in many other portions of the State. The northern part of the county suffered more than the southern, but in no part so far as I am advised, have their depredations been so severe as in Oxford, Kennebec, and some other portions of the State. A few miles from where I reside some of the farmers had to mow their grain to save what was left of the straw. On my own farm I saw few grasshoppers until late in the season. It would be interesting to learn the time when the grasshoppers made their appearance, and when they have been most destructive. None were seen in my neighborhood until a month later than reported from Androscoggin. The only way that I can account for their being so much later with us is, that we only got the "last run of shad." I suppose it is generally known that when we have many grasshoppers we have also fat mackerel, and we have had very fat mackerel this year. Grasshoppers migrate. There were times this fall when if you looked up, with the sun in a certain position, you would see the air full of grasshoppers, all bending their course to the sea, and we got the grasshoppers in the southern part of Cumberland county when this migration took place. We have had abundance of mackerel on our coast this season, from the latter part of July up to September; only a week ago, a very large school came into Casco bay.

MR. LORIN ADAMS of Franklin. The grasshoppers began with us this year earlier than we have ever known before. Early in May the ground was covered with them. They commenced in the pastures, and the feed began to fail; our cattle soon showed it. The first crop attacked was oats; they trimmed the leaves off and then went to the wheat and grass fields. The grass was trimmed up, the leaves eaten off, leaving only the stalks. Many fields were left, hoping they would gain, and some were not mowed at all where we might have got half a ton to the acre at one time. They went from the grain to the corn, and trimmed off the tassels and leaves. On many fields not an ear was harvested. One man attempted to keep them from his wheat by a line, but he said they were hungrier the next day, and ate worse than if they had not been disturbed. In one town a man planted twelve acres of sweet corn, and he kept his men at work until they succeeded in raising eight acres of the corn; four acres were lost. There were nurseries of young fruit trees from which every leaf was stripped. From these they went to larger trees, and trimmed them. I have seen hundreds and thousands of apple trees with not a leaf on them. That was about the middle of August. When they left those locations they appeared to be aiming, as Mr. Scamman said, for low land, and the farms on low land suffered severely. I am on a hill farm, and after the middle of August I had no great trouble from them. In Farmington they suffered more than in Wilton. Large fields of grass, grain and corn were completely destroyed. The grain was cut four or five weeks before it should have been if it could have been left to mature. I have seen my barn covered with them in the middle of the day; it seemed as though they were rolled up. They also took the leaves from grape vines, and cut the stems so that the clusters fell to the ground. The period of their greatest depredations was about three weeks. I have had no trouble from them since. A few remain, but not many.

Mr. Buck of Hancock. In the early part of the season we had not grasshoppers enough for our turkies, and now we hav'nt enough to feed a chicken. We have good feed in our pastures, and our stock is looking finely. We have not suffered from grasshoppers, or anything else, until the frost of last Thursday. Some people are getting a good second crop of hay; the first crop was light.

Mr. Hawes of Knox. The grasshoppers made their appearance in June, in such numbers that we feared the loss of our crops, but we suffered chiefly in our pastures. The hay crop was not much lessened. I do not know that they injured grain except by eating the leaves. We were fearful of losing our corn, but it escaped. Some farmers suffered a great deal, chiefly those occupying low farms; others but little.

Mr. Gilbert. As there is no one from Kennebec present, I will say that the ravages of the grasshoppers have been as severe in the northern, and particularly in the northwestern part of Kennebec county, as in any other section of the State. Their devastations in the region about Vienna, Mt. Vernon, Fayette, and in other towns, have been very great. The adjoining town of Readfield suffered less. Vienna and Mt. Vernon were almost literally devastated by them.

Mr. Bodge of Lincoln. In the northern part of Lincoln the experience has been similar to parts of Androscoggin. Grasshoppers did considerable harm on some farms; more on the higher lands than on low. In the northeastern parts of Kennebec they were plenty, but their ravages were not serious. I may also say that years ago when I went to sea, I frequently saw great numbers; the currents swept them into winrows of different widths; generally these were not far from land.

Mr. Gilbert. I regret that the member for Oxford (Col. Swett) is not present, for the northern portion of that county has been sadly devastated by grasshoppers. I have knowledge of this from various sources, as well as from personal observation. In some cases they ate all the crops of the farm. The grass was not cut early enough to secure the whole, and from that they went to the grain, which was cut and housed as soon as possible to save even the straw for fodder. Then they attacked the corn, and in many instances whole fields were immediately cut up, dried and housed. The potatoes also suffered badly, only bare stems being left. In one case a man had a fine young orchard of five acres that was completely stripped last year of every green leaf. This spring it was found that the vitality of the trees was entirely destroyed. He removed them, and re-set the orchard with new trees. The same fate followed the new planting. In many instances trees of large growth have been greatly injured. With young trees, after the leaves were eaten, they attacked the young and tender twigs, eating the bark. This was in the northern part of Oxford. Canton, Dixfield, Mexico and Andover, suffered most; thence toward Sumner and Paris, and still further west. Further south their ravages were less.

Calvin Chamberlain. Grasshoppers have been very thick in the southern portion of Piscataquis, and in the first tier of towns in Penobscot next adjoining our county, both last year and the present season. This year many of our best farmers have not cut more than a tenth part of their usual hay crop. Some have cut no hay at all, and have lost their grain crop. In some instances where forty, fifty or sixty acres have been sown, no grain has been harvested. What the grasshoppers did not eat up was cut for fodder, and they got very little of that. They have entirely destroyed the bean crop, where beans were planted with corn, as many practice with us, and they would eat out the silk from the corn, so as to injure the crop. Some fields have been very seriously damaged, others only slightly injured. The hay crop is very light throughout our county. Young fruit trees have been killed, as reported in other sections. The evil is a great one; our loss has been immense, and we shall be slow in recovering from it. The grass has been destroyed in our fields, and the question is how to restore it. I hope that more light will be thrown upon the question during this session. If we could learn the habits of the insects and how to rid ourselves of them there would be more hope for us; but we do not know how to do it. In regard to their migrating. When they get their growth they rise in the air and drift with the wind. The prevailing winds in fair weather are northerly and westerly; of course they drift to the ocean and are destroyed. If the prevailing winds were the other way, they would drift into the forests and into Canada, instead of going to the ocean.

MR. BRACKETT. Has the bad condition of the mowing fields been caused by grasshoppers alone?

MR. CHAMBERLAIN. Grasshoppers and drought together destroyed the herdsgrass and clover in many places last season, and the plants were found dead this spring. In other places, where they lived through last winter, they are found dead this fall. On farms where they did not cut the hay, we find the roots dead and weeds have taken the place of the grass.

MR. SIMPSON of Penobscot. About Bangor grasshoppers have not been very numerous, and their depredations were slight. In the western and northwestern part of the county they were numerous and destructive. The great question is, how to prevent their ravages in the future. It matters not so much what they have done, the important thing is to prevent, if possible, a repetition of their visit.

MR. BRACKETT of Waldo. A portion of Waldo was ravaged; another portion escaped, and the middle line was partially ravaged. In the shore towns the grasshoppers have been scarce, or no more than usual. But in the northwestern portion, in the towns of Unity and Troy, our best farming towns, they have been very thick and have caused much loss. The drought of last year and the grasshoppers this year, together, almost spoiled our hay crop; we got only from a half to two-thirds a crop last year; in the northern part of the county less than one-half. A fortnight after haying I went through a field of six acres, in Unity, which was seeded with herds-grass, and a fair crop taken from it. It appeared to be entirely dead. What the drought had left the grasshoppers had eaten, so that you could see no green thing on it. The consequence is, that stock in northern Waldo is suffering badly, and the farmers are selling off at very low prices. In the southern part it is not so bad.

The opinion prevails with many that grasshoppers originate from the little insect found in the spittle, so called, which is found on grass; but the two are entirely distinct, as different as a horse from a cow. The one formed in the spittle never grows larger, or not perceptibly larger. It belongs to what are called the frog-hoppers; they live by sucking. If you examine you will find that instead of jaws they have a piercer, with which they penetrate the stalk and suck out the juice; and such an amount of juice that it passes through the body and covers them, in the form of spittle. It seems to be a provision of nature that they shall be covered with those bubbles to protect them. However that may be, they constitute a distinct species of insect from the grasshopper. The grasshopper has jaws, and gnaws instead of sucking; which of itself is proof that it is a very different insect. I am not able to state the exact history of the grasshopper, or, rather, of the locust, for the insect we have been talking about to-day is, strictly speaking, no grasshopper at all, it is really a locust, and closely resembles the insect spoken of as the locust in the Bible. The true grasshopper is quite different, and has rarely been found in this country, never to cause perceptible damage. You will notice that the locust lays its eggs; that its abdomen is not furnished with anything growing out of it. The true grasshoppers are furnished with a sharp piercer, growing out of the abdomen, with which they pierce where they deposit their eggs. The locust never has that appendage.

MR. GILBERT. Do they resemble the seventeen-year locusts?

MR. BRACKETT. They are very distinct. The seventeen-year locusts, *(cicadæ,)* belong to a different order entirely, one which is furnished with a sucker, and they do not eat with jaws.

MR. SIMPSON. Are they not more numerous in dry seasons than in wet?

MR. BRACKETT. Yes, sir; and probably because a wet season kills the eggs, or kills the insects in the earlier stages of their life before they reach the perfect or winged form.

MR. SIMPSON. When and where do they deposit their eggs?

Mr. Brackett. I am not able to state from observation. It is understood that they deposit in the ground, in the fall, just before they attain their maturity and die. The female drills a hole in the ground and deposits its eggs, which remain there during winter, and hatch in the spring. It is a fact that full-grown specimens sometimes live through the winter, and that is a fact with regard to some few other insects. The general rule is, that after insects have deposited their eggs for the future brood, they die; there are very few exceptions to this rule.

Mr. Chamberlain. Are there two broods a year?

Mr. Brackett. That is not conclusively settled.

Mr. Wasson. Can you inform us of any remedy?

Mr. Brackett. No, sir. To some extent they are destroyed by a natural enemy, a parasite, with which you are probably familiar. But I know of no easy and effective remedy which can be successfully employed.

Mr. Lucas of Somerset. I think the grasshopper plague has been worse in Somerset than has been represented in Piscataquis, with this exception, that so far as I know, they have been confined to the dry farms. I do not mean the highest farms, but the driest land. Wet farms, even if they were high, have not been so much troubled. Then, again, there are many farms which were greatly damaged by them last year that have been troubled much less this season. Both sides of the river, the western part of Kennebec county and the eastern part of Somerset county, have suffered more from the grasshopper than other sections. In one district near where I live, the crops have been almost destroyed. Farms that cut from twenty-five to forty tons of hay two years ago, and two-thirds as much last year, were reduced to from three to five tons. They were obliged to cut all their grain for fodder, to save it from being entirely destroyed. In several instances where they cut oats one day, intending to get them in the next day, when they went to the field they found the straw so badly eaten that they did not rake it up. Once in awhile you could find a piece of potatoes where some rows were eaten and then abandoned. And so with the wheat. I should think one-half of the wheat crop of the county was lost by their ravages. They began about the middle of July, and ate up half the grass, destroyed two-thirds of the grain, and all the beans, and ate the foliage off of the apple trees.

Sec. Goodale of York. In the northern and northwestern parts of York county, I am told that grasshoppers have been somewhat destructive; and there, as in other places, certain limited localities have suffered most. They seem to go in veins. For myself, I suffered in no crop except Swedish turnips, half an acre of which were damaged to the extent of half or two-thirds of the crop. I was looking at a good farm in Biddeford the other day, and the owner told me he had suffered severely. He tried drawing a rope over his grain towards night, but it did little good. By another field, which was in the vein where the grasshoppers were moving, he built a brush fence four or five feet high, which arrested them; what became of them he could'nt tell. This suggests the inquiry, what becomes of the grasshoppers that we hear of in the interior, when we hear of very few in the coast towns, and then hear of fat mackerel at sea, and fattened upon grasshoppers? Where I have travelled in shore towns this summer, I have not found any town that has suffered, or very little. I heard all along the coast of an abundant catch of fish, not that the mackerel were particularly fat, but more abundant than had been known for years. So it was with other kinds of fish. The idea prevailed generally that this abundance was connected in some way with the grasshoppers of the interior; but I got no evidence showing that the grasshoppers and the abundance of fish stood in the relation of cause and effect; nor was there anything to the contrary.

THE CHAIRMAN. Having heard from the various sections of the State of the disasters suffered, the chair would suggest that we now discuss *The present condition of Agriculture among us, and the lessons of the past season*—a broad subject, and one admitting considerable latitude as to the points that may be taken up. The opening words of the interesting paper to which we listened not long ago, suggest the expression of the hope that we may not occupy the time with a continued wail over losses and gloomy prospects, but instead of this consider what methods should be adopted to retrieve the losses which have been experienced, and bring about a more hopeful state of things. We may not be able to do this in an hour, perhaps not in a year, but if we can only learn the best way to accomplish it, the farmers of Maine I am sure have the will and the energy and the determined perseverance to do it as soon as it can be done.

MR. SCAMMAN of Cumberland county. It is doubtless true that there are some very important lessons to be learned from the misfortunes which have befallen farmers in our State for a year or two past. We have heard much of the drought and of the grasshopper plague, and it might seem to superficial view that the elements have been leagued against us. But shall we throw blame upon Him who holdeth the winds and the rains in His hand? I believe most fully that all things are under His control, and that all His providence is guided by infinite wisdom and infinite love. But that love and wisdom allows us to eat the fruit of our own doings, that we may be made wiser and better thereby; and I fully believe also that our doings as farmers have thrown serious obstacles in the way of our prosperity, and that we ourselves are responsible for a portion at least of the adversity which has come to us.

One point in which blame attaches to us I will speak of, for it is one which palpably manifests its fruit in the meagreness of all our crops. Look at grass, that has been so much spoken of here. Is the loss of our hay and pasturage to be attributed mainly to the drought of the past season? I think not, but rather that the system of agriculture that has been pursued in this State has been such that we are brought to learn, by sad experience, our folly in the course we have pursued. What has been our system of agriculture? The best which can be said of it is, that it is a starving process. We have been cropping our lands year after year, without making sufficient returns. Our whole system of farming, (speaking in general terms,) has been a cropping process. Our lands, once new and rich as those we see about us in this vicinity, yielded year after year abundant harvests until the elements which are necessary as food for plants have become more or less exhausted, and when we consider what we have been doing we find that our common every day practice has impoverished the soil, so that when we have a dry season, or a season when insects abound, we get very scanty returns. I believe that if when we commenced farming we had practised returning to the soil those elements which our crops draw out of it, we should have heard very little of this cry about the destruction of the grass roots and grasses. The fact is, we have been taking out of the soil, year after year, until we have robbed it beyond the point of endurance of those elements on which plants live. If we treat our pig in this way, he will not grow. If we treat our young stock so they will be dwarfed. Take away their feed and they come to nothing. My mind has been turned to this question with absorbing interest for three months. I have heard the cry about the drought, and the devastations of the grasshopper, and it has led me, as I doubt not it has every person present, to inquire the reason, and I have come deliberately to the conclusion, that no blame is to be attached to Providence, that no blame is to be attached to the elements, but the blame comes back upon ourselves.

What would be the result with a better method of practice? I have one piece of ground on my farm that has been cultivated much in the way that I should like to cultivate the whole of it. It has been plowed deep and well manured. It was a garden when I bought it, and it had been used so for a long time. It is naturally good soil, but no better than thousands of acres all about us; and no more moist than my other land near it. Six years ago that piece was seeded to grass. It has uniformly yielded luxuriant and abundant crops of hay, such as you would see on these fields in the best seasons. And after the hay crop of this season was removed, notwithstanding the drought, the fresh grass sprang up vigorously, and it is as green to-day as any spot you can find here or elsewhere. Why is it? Simply because that piece of ground has been thoroughly cultivated, thoroughly manured. Now, supposing we had cultivated all our land in this way, should we have come up here and rehearsed the evils that have come upon us? No, sir. But some one says, "That is very well for a garden spot; but some of us have larger plots than that." That is the trouble. Not that it is wrong to have so much land, but it is bad policy to cultivate more land than we are able to do justice to.

One very important lesson we should learn from experience the present year is, not to run superficially over too much land; not to cultivate more than we can properly feed and properly cultivate. I admit that it is a hard lesson to learn. It is the most difficult thing in the world to convince ourselves and to convince farmers generally, that we are cultivating too much land, that we spread ourselves out over too much territory. But this has been one of the great faults of our system, and we find ourselves where we are this year, in consequence of pursuing such a system.

Mr. Wasson of Hancock. It has been aptly remarked, that the farmers of Maine are at present under a cloud. Most of the crops that we usually grow with success, have this year wholly or partially failed; and, worst of all, the hay crop, for without hay we are without means of feeding stock, and without stock we are without manure, and without manure we are without crops. This is the condition in which we find ourselves. Are we helpless and hopeless under it? If so it is of no use to spend time in discussing the matter; we may as well reconcile ourselves as best we may to the condition in which we are, or make up our minds to emigrate. But I believe nothing of the kind.

The thought occurred to me while remarks were made of our agency in reducing the fertility of our soil, that if we will look back two hundred years, we shall find that the soil of the mother country produced but six and a half bushels of wheat to the acre; yet that very soil, although it has been cultivated continuously, now yields near thirty per acre on the average. Here is a fact which presents itself in English husbandry, and we may ask, in connection with this fact, two questions: With a climate and soil as favorable as theirs, how is it that our fields have become exhausted? and what are the agencies which have brought about this change in the fertility of the soils of Great Britain? The answer to the first has been well given by Mr. Scamman. Let us see if we can find an answer to the other; and first let us notice another fact, namely, that English farmers pay a large rental, together with tithes and other taxes, which constitute a heavy burden on the land, and which we know nothing of; and yet those farmers make their business profitable in spite of all. The answer I conceive to be, first, that they have faith in their business, and secondly, that faith leads to works; they give themselves to their business. They do not, as some farmers in my county do, farm a little and fish or coast the rest of the year; they do not mix farming with lumbering as some do here; nor do they if they have a little spare cash loan it or invest it outside of their business, but they put it into their business; they give to their business their undivided attention and thought and labor and study; they put far more active capital into their business than we do. If guano or superphosphate, or fish, or plaster, or ashes pay them a good profit to use, they use them freely; if once certain that they are profitable they get the most profit which can be got from their use. This requires the use of active capital, and they do not hesitate to employ it for the purpose.

Our farmers are asking what of the future? What, especially of the hay crop in years to come? If this can be restored we can go on; if not we may as well give up. The suggestion was well made in the paper read, that we take hold of this subject, that we not only think and talk, but act; that we devise ways and means to replace living grass roots where dead ones are now.

How shall this best be done? Must we plow and manure and cultivate and reseed? or can we succeed by surface manuring and reseeding without cultivation or plowing? I believe that what has been done in England can be done on the banks of the Penobscot and of the Kennebec and all over the fields of Maine? I have a practical suggestion to offer in this connection. It has been my experience that seeding in the fall with top-dressing has proved a most successful method of securing grass roots where they are scanty or feeble from any cause or combination of causes in years past, and I know of no reason why the same method may not be successful in this emergency in which we now find ourselves.

MR. LUCAS of Somerset. The cause of the drought and of the grasshopper I really know nothing about. I do not feel myself responsible for them, nor do I charge blame upon the farmers of Maine for these difficulties which have come upon us. I cannot see why they should be held responsible for such plagues as the drought and grasshopper. If the trouble had come from bad cultivation and too heavy cropping, would not the effects have come gradually?—would not the crops have grown less and less year by year, just in proportion as the fertilizing elements had been abstracted? My experience is that the grass crop generally diminishes on any given field year after year, until manure is again put on; but this does not account sufficiently for the experience of the last two years. But the main question is, what is the remedy? How shall we put our fields and pastures into grass in the easiest and cheapest and quickest way?

MR. BODGE of Lincoln. One way to help get over our difficulties is to keep up good heart. Seed time and harvest are promised as long as the world stands, and God will not forsake us. If we use what skill we have and a fair proportion of labor, we shall soon get over these discouragements. Plentiful years follow scanty ones—according to my experience and according to all history.

MR. BUCK of Orland. In the town where I reside, there are several farmers who are never troubled with drought. Some of them are very small farms and keep a pretty large stock of cattle. Their farms are thoroughly drained, thoroughly cultivated, and they know next to nothing about drought. They have cut upon those lands this year two good crops of hay. There are other farmers, who have larger farms, and further removed from the village, who get their entire living from their farms, and who are holding on to all their stock, which is in capital condition. They do this mainly by a judicious rotation of crops. They know in the fall just what to do in the spring, and they study and plan for it, as other business men plan and work in their business.

It seems to me that Mother Earth has rather got her back up. She says we have been robbing her,—and is it not true? She farther says, "Feed me, and I will feed you." When we are ready to do this, we can receive all we require, and more too. If I mistake not, in olden times they were obliged to let the ground rest every seventh year, and in the old country, if I mistake not, they every now and then still practice the fallow. A year comes in which the ground rests; and I believe that here a kind Providence steps in and sends us a drought that our land may rest. I believe in the end this drought will prove a blessing.

I sometimes wish the farmers of Maine were obliged to cut up their farms into smaller patches—were obliged to get their living from a fourth part the land they now go over—they would then in a very few years neither complain of grasshoppers nor drought. As for a remedy, I believe that sheep culture is almost a specific for bringing in worn out pasture lands. Divide them into small patches, put on a small flock of sheep, and the work is done. I do not believe in plowing up old lands. It is too expensive, and we have not enough manure. In most cases we should do better to top dress, and we can do it by sheep better than in any other way.

Mr. Lucas. On five acres of ground, from which I hauled at least thirteen tons of hay last year, I got hardly three this year. That land was dry, rocky, gravelly land. It was in as good state of cultivation as any land in this county, except it be garden spots. Crops generally have been decreasing for some years. The same would apply to many farms in the town where I live, and to the best land, under the best cultivation. Now in view of this state of things what blame can attach to us, and how better should we fare if we confine ourselves to a small patch? I am free to admit that too much land is cultivated with crops that pay no profit. It is a fact, that we should give to the soil in proportion to what we take from it; but that is really a very difficult thing to do in a country like this. Crops are all more or less exhausting, and all except hay cost two dollars where we get one, when we take into consideration the price at which all those articles can be purchased in bulk.

Now, a word about fertilizers. Can we not supply a large deficiency in the way of fertilizers by going into our forests and filling our barn yards, our stables and our hog pens with leaves? And let me suggest that we take not only the crop of leaves of this year, but the crop of last year, and the year before that, until we get down to the ground. If you will haul in a hundred loads of that stuff, you will have it to use in the spring in place of barn manure, which you cannot supply, and it will be a pretty good substitute.

Mr. Buck. The gentleman says his crop has been decreasing for three or four years. I will ask if he has been in the habit of giving his land a liberal coat of top-dressing every year after he took the hay off?

Mr. Lucas. I have sowed plaster at the rate of two bushels to the acre every year. That is all the dressing I have given this particular land.

Mr. Brackett. I can hardly agree with Mr. Scamman in regard to high cultivation being the remedy for the condition in which we find ourselves this year. It has been my experience that grasshoppers destroy plants growing strongly, and upon land which has been highly cultivated, as entirely as they will those which are growing on light and poor ground. Then in regard to hay: I have a two-acre field that was seeded last year, (clay loam,) cultivated well, and a large amount of barnyard manure placed upon it. This year I did not get half a ton of hay to the acre. I do not think it was owing to poor cultivation.

Col. Swett of Oxford. There was one idea advanced by Mr. Chamberlain in relation to which I wish to say a few words. Last spring, I sowed six and a half acres to wheat; put more manure on it than on any piece I ever laid down, and I applied superphosphates besides. I sowed two acres of that piece with Alsike clover, mixed with herdsgrass and red-top. All came up finely. I thought I should get a good catch; but as the drought increased, and the grasshoppers came in legions, I found that all my grass, the Alsike clover with the rest, disappeared. After I cut my wheat, as I had to, for fodder, there came a light rain, and in a few days the Alsike clover appeared on those two acres quite thick, and a few days before I left home it was flourishing, while on the rest of the piece no grass was to be seen.

Deacon Chase of Lincoln. Farming has been my business, but only in a small way. I have been engaged somewhat in lumbering, but my experience teaches that we must return an equivalent for what we take from the farm, or we shall soon fail. I have for the last few years been in the habit of top-dressing more than formerly, and I find that to be the most successful way of keeping the life in the land and securing a fair crop of hay. Those persons who have suffered from drought and grasshoppers will do well, in my opinion, to top-dress instead of plowing. I have found that turning land over and reseeding is too expensive, and does not add much to the crop of hay; in a few years the benefit will all be lost. But when we plow, we should plow and cultivate thoroughly, manure well, and be sure to leave the land in a better condition, when we seed it down, than when we took it up. I plow only my poorest land. My aim is not to get very large crops from a part, but rather to farm in a way to improve all my land and put all in good condition; and I find that what was considered very poor when I commenced farming, now produces as good crops as that which was the best when I began.

Mr. Hersey. I have been engaged pretty extensively both in farming and lumbering for a number of years, and have wanted to get all the grain I could from the farm to help in the lumbering operations. I am willing to acknowledge that I have cropped my land too much, but I have always brought on to my farm more than I have carried off. I have used all my straw at home, and have never carried away a great quantity of hay; but I have cropped my farm to such an extent in days past, that it has been running down for the last twenty years. I cannot agree with all that has been said here with regard to the cause of the failure of grass this year. I know well enough that when there is a drought it will pinch, but I always calculate when there is a pretty severe drought one year I would have a better crop of grain the next year.

It has been generally remarked that oats greatly exhaust land. I will mention a fact showing that you can raise oats with peas on the same ground a long time without running entirely out. I have a piece that has been in peas and oats all the time for over thirty years, and about half of it bears a good crop now. I have never carried anything on to it.

Sec. Goodale. The topic before us is the lessons taught by the past season—our farm experience, and how to profit by it. That experience has been peculiar over a considerable breadth of the State, and some of the lessons have been clearly stated. One is, that our practice in the past has been injudicious, in that we have not kept up the natural degree of fertility possessed by the soil. We have not returned to it as much of the inorganic elements as we have taken out and sent away. It is an important lesson, and it needs that diligent heed be paid to it, for the error is one which cannot be easily nor quickly corrected. It will require time and money and patient continuance in well doing. But it can be done, for, as has been remarked, a similar error has not only been corrected in the mother country, but the fertility of that soil has been made, and to-day continues to be, far greater than in the centuries past.

Another lesson I conceive to be a most important one, namely, that we attempt to cultivate a greater breadth of land than we have means to supply with a fitting amount of manure and labor to give a profit on the farming operations. In the first place a great deal of land was cleared and put into cultivation which had better been left to grow wood and timber upon. The exhausting policy pursued on that first cleared after a while showing its legitimate results in diminishing crops, led not to a reform, but to the clearing of more land to be treated in the same way, until at length so much of the surface is bare of forest that we feel the climatic effects of the strippage in more frequent and severer droughts. Who ever heard of drought in Aroostook county? In the older portions you may hear occasionally of some season drier than they would like, but I have never known of anything there which would pass for much of a drought in other parts of the State. But the indications are that as the clearings extend their liability will increase. It will be well for the farmers of Aroostook to profit by the disasters of others. Never less than two-fifths, and better still, one half the area should be covered with trees. Now what shall be done in order to profit rightly by this lesson? I hesitate not to say that it would be good policy for the farmers of Maine to let one half their land alone, and concentrate their labor and manure and skill on the other half—upon one half as much as it has been spread over in years past. That which is let alone will not be idle, nor will it be deteriorating. It will grow wood. It will grow better. It will be undergoing the same process which made it fertile when it was first cleared—a slow process to be sure, but it is the method of nature's own providing, and a vast deal better than to be slowly retrograding towards barrenness.

I consider this to be a necessary first step toward the regeneration of the agriculture of the State; a first step toward a fundamental and comprehensive reform in practice. Not only will the smaller breadth operated upon yield more profit, and the half let alone be steadily improving, and at the same time contributing towards immunity from droughts by the climatic effect of living timber, but this same let alone half will be growing the most profitable crop which it is capable of yielding. What will an acre of wood and timber be worth forty years hence? I do not know and you do not know certainly; but if we can judge by the advance during forty years past it will be a great deal more than now. So long as wood is employed for fuel and fences and houses and a thousand other uses, there is no danger of the market for it being glutted. Just in this vicinity the people, I suppose, do not experience the dearth and dearness which attach to forest products in some other sections, but those who live in older and barer parts of the State feel the steady advance in the price of wood and lumber to be something serious; and I cannot but hope that the day is near when farmers will put themselves on the road to profit, in many ways, both direct and indirect, present and prospective, by providing for the certain wants of the coming generation in respect to this necessity of life.

But this suggestion even if adopted at once and by all, or by a great majority, would not insure a large grass crop next year upon the lands we are speaking of, ravaged by grasshoppers and dried by drought, until the roots are dead, or near dead. There are present needs to be attended to as well as future needs. The question is asked, What shall we do? Must we plow all these fields before re-seeding, or can we re-seed at once successfully, with or without top-dressing? The question, I conceive, is one which no man can answer directly and once for all. Circumstances alter cases. Unless some one can give us the results of these different methods as proved under similar conditions in years past, we must judge from analogy. What have we seen accomplished under circumstances most nearly resembling the present, and how? My own impression is that, upon lands which bore clover the past year, or are otherwise in good condition without much clover, seeding with grass, if done before the first of October and accompanied with top-dressing, may be successful. If it cannot be sown very soon I would prefer to top-dress as soon as practicable and defer sowing until early spring, or so late in autumn that the seed would merely get covered in the soil by the frosts and not germinate until spring.

Upon lands in condition to produce less than a ton per acre in a good season, I should hardly think it safe to depend upon seeding and top-dressing (unless it be a very heavy dressing) without the plow first; but I see no need of an intervening hoed crop, nor would I sow grain with the grass, at least not beyond enough to give shade to the young grass from the scorching sun. No one rule can be laid down which shall be equally applicable upon all fields or pastures, any more in the present case than in ordinary practice. Even top-dressing of grass lands, which for the most part is the more successful method to keep up a good burden of grass, provided it be adopted before the roots get feeble, does not succeed equally well in all cases. I have in mind one of the best farmers in the State, who has tried it again and again, year after year, and finds it does not pay, upon his land. Such cases are rare, so far as my observation goes, but they occur sometimes.

With regard to the suggestion of employing sheep for the renovation of grass lands and pastures, I think the object would be much sooner and more profitably accomplished by putting on a larger number than the growth would support and feeding them with oil cake or some other rich food (in place of buying manure) than by having fewer and giving no extra food.

I cannot but hope that the losses of the year are over-estimated. If early rains come, many of the grass roots which now pass for dead will start into growth, and we may have good fall feed where now nothing is expected. Drought is by no means an unmitigated evil. The land will be in a measure benefited by it, and a good share of the State has not suffered from it, nor by grasshoppers, and for those who must buy it is no small favor to have the necessity come when corn is so cheap as it is now and is likely to be for some time, cheaper than for many years past.

Col. Swett. Is the land to which you refer where top-dressing did not pay, moist or dry?

Sec. Goodale. Rather dry than moist; a soil of granitic origin, and not what may be called natural grass land. You probably know the farm—that of Samuel F. Perley, Esq., Naples. He has used a great deal of muck, weathered and composted, for top-dressing; he has used barn manure, and commercial fertilizers of various sorts, and his uniform experience has been, that top-dressing does not pay. I referred to it as an exceptional case. There are many more cases where top-dressing is successful than where it fails, where it is the cheapest and easiest means of keeping land in good grass.

COL. SWETT. The farm of Mr. Perley is mostly high ground, and I call it rather dry. My experience is, that on granitic soil it does not pay to top-dress, but on some other soils the case is very different. I had a piece which was too wet to cultivate, but which I cut for a number of years, although it yielded very little, and that of poor quality. I put on an acre and a half a quantity of leached ashes, for which I paid sixteen dollars. That was seven years ago this fall. The first year after, clover, both red and white, came up, and in some places so thick that it lodged. The first year, I got three-quarters of a ton of good hay to the acre; the second year over a ton to the acre. This past season it was about as good grass as I had. It has been mowed seven years.

I was on Paris Hill in July, and was astonished to see the amount of hay harvested, many pieces yielding two to three tons to the acre. The soil is moist and deep. "There, friend Swett," said they, "are the fruits of top-dressing." Three years ago some of those farmers were opposed to top-dressing, but promised to try it. A number of them told me this summer there was nothing like it to bring their mowing lands up and keep them up. My experience is, that top-dressing with barn manure or compost on worn out lands does not pay so well as upon land that is but partly worn. If I had a piece of moist land, badly run down, I would put on ashes in preference to manure.

MR. LUCAS. Do you sow grass seed between the times of plowing?

COL. SWETT. I never have; but Mr. Holmes of Oxford practices sowing grass seed wherever the roots seem thin, and he also goes over the ground with a harrow. His farm is noted for cutting stout hay. His crop is from eighty to a hundred tons.

MR. LUCAS. Mr. Hiram Burrill of Canaan, told me he sowed one half of his mowing land one year and the other half the next, and that he had succeeded in keeping up his hay crop in that way, without top-dressing. His crop this year was very nearly as good as it has been for the last five years, notwithstanding the drought and grasshoppers.

MR. HAWES. My opinion is that the larger part of these lands will have to be plowed before we get good crops of hay from them. Some may not require it, but I think mine will. But we must not plow too much surface. We can get fifteen acres into condition to keep a given amount of stock quicker than we can thirty acres with the same dressing. My experience has been very similar to that of Mr. Scamman. I have a piece of land that was turned over fifteen years ago and sowed to grass. The second year I took a part which is light and gravelly for a garden, and cultivated it as a garden for five years, then planted the whole with corn. The next year it was sowed to grass, with a top-dressing upon all except that part which had been used as a garden. It has been mowed four seasons since, and the garden spot has yielded four times as much in proportion to its area as any other part of the field. I attribute that to the deeper plowing, more thorough cultivation, and better manuring. We generally put our manure on too much ground.

Mr. Wasson. Alsike clover hay has been spoken of. I wish to say that in my section it has proved much hardier than either the red or the white. Both these have suffered severely, while the Alsike is doing well. With regard to sowing grass in autumn, the opinions of farmers vary a good deal. In my own practice I have never failed to get a good catch from fall sowing. In case of clover, it should not be sown until just before the ground closes with frost. I sow after corn, with no farther preparation of the soil but harrowing.

Adjourned.

EVENING SESSION.

The first paper presented was by Frank Buck, Esq., of Orland, on the

UTILITY OF FARMERS' CLUBS.

I propose to note the progress of agriculture in the past, and hope to be able to show that this progress is the outgrowth or result of discussion; and also, that the Club room is the place for discussion. I claim no originality of ideas, or to set forth new doctrines; but I hope to incite you, if possible, to greater effort in the cause of agriculture. It may be profitable to take a glance at the condition of our country at the time of its first settlement by Europeans, and perhaps step behind them and notice the modes and progress of agriculture as practiced by the natives. Coming from a country advanced in civilization, and better cultivated than any other except the Chinese empire, and finding a climate and soil different from any they had seen before, surrounded by savage beasts, and natives still more savage, if possible, with but few of the comforts of life, we wonder not at their toils and hardships, and are not surprised that they made slow progress, but rather that they made any.

They had no beasts of burden, and when a few cows were brought from the old country, the rigors of the climate and want of proper treatment soon thinned them off, or rendered them of little profit. The price of cattle was then so high, and the cost of transportation so great, that only a few of the colonists could afford them at all; and besides this, they fell an easy prey to the wolves and to the Indians. A red calf, in Massachusetts colony, sold for less than a black one, because so easily mistaken for a deer.

The relative value of different articles of food two hundred years ago, seems to us out of proportion. Common cows twenty or thirty pounds sterling, and oxen forty pounds per yoke, while milk sold for one penny per quart, and four eggs at the same price. At this time the grasses were not cultivated, nor were roots grown for forage, red clover being introduced into England in 1633, and the other grasses even later.

The average net weight of oxen slaughtered at Smithfield market was then but three hundred and seventy, and of sheep only twenty-five pounds. Now the one is over eight hundred and the other eighty. The cultivation of the grasses originated here. The first settlers were soon driven by necessity to produce something to keep their stock through the winter. The first stock brought here in 1624 was wintered on swale and salt hay, and from want of nourishing food and comfortable shelter many died. This treatment might be owing in part to lack of knowledge, coming as they did from where the winters were much less severe.

Tools were as scarce as live stock, only a few having been brought from the mother country, and the only metal to be had was so brittle as to be almost worthless. Corn, pumpkins, squashes, potatoes and tobacco were never seen by the colonists until they found them here, and they were not slow in learning the Indian mode of cultivation, as necessity taught them the value of these crops. For many years little improvement was made.

The natives being the school masters, let us look at their mode of farming. The women performed most of the work, cultivating all the crops except tobacco. Their plow, spade, hoe and fork were united in one article, made by tying a shoulder blade of a moose to the end of a stick. When they came to a place they wished to clear, they would set fire to the roots, then dig up the loose earth and put in their grain. They planted corn four feet apart each way, and hilled up, sometimes two feet high, to keep it from blowing over. In the centre of the field a booth was built in which one would stop to keep off the birds. For storing grain, pits were dug and thatched at the sides, and in these grain and beans after being dried in the sun were stored for winter use. It is said that one of these hidden granaries was found by the colonists when their supplies were reduced to five kernels of corn for each.

The wild grasses grew abundantly in the marshes about them, but no attention was given to them. The first plow the natives saw aroused their curiosity very much, seeing that it would dig as much ground in one day as they could in a month with their clam shells. The soil was then rich and fertile, and was sown with wheat until it would grow wheat no longer, then followed by corn, and when this would no longer grow, barley was sowed and beans planted. Up to this time almost everybody tilled the soil. There was but little mingling for social intercourse. Now and then came a raising or a hauling, when cider and flip were freely used to relieve the monotony. Courtships were longer then than now. After popping the question the first thing was to sow flax for the lady's wardrobe, which required two full years to get it ready for wear. Poor schools, and as late as 1750 only four papers in New England. Nobody was expected to know much except the parson and the doctor. If anybody presumed to try an experiment in farming, or if he did not plant just as many acres, and upon the old of the moon, wear the same kind of homespun, and hold the religious views of his father, he was considered a fanatic.

They knew little about the use of manures, and would often move their barns from the accumulated pile of dressing rather than haul it to their fields. Their cattle were left out during cold weather to toughen them; in the opinion of Virginia colonists it was death to a cow to house and milk her in the winter.

Very little attention was paid to the growing of fruit; a few cider apples being the extent in this direction.

Little is known of the extent of agricultural pursuits at that time, or in fact of any others—no census being taken until 1790, and this for a political purpose. The revolution wrought a wonderful change. The whole country was revolutionized; men got out of the old ruts and became active, thinking beings. Passing through a severe trial of seven years' duration, they came out purified and elevated.

The spirit of '76 has animated and inspired men ever since, and will to the end of time. Men soon became restive and talked of emigrating. Many actually took a Western fever and moved to Central New York, that being then a remote portion of the continent. Thinking men began to talk about the importance of agricultural pursuits, and in 1794 General Washington, then President, in a letter to Sir John Sinclair, said he feared it would be a long time before an agricultural society would be formed receiving aid from Congress. But he hoped this new county would not be content with making as slow progress as the old had done, and added, that an effort was being made to establish an agricultural society in Pennsylvania. The last time he met Congress in 1796, in his address, he spoke of the importance of giving agriculture a prominent place in legislation. A few had already begun to agitate this matter. South Carolina formed a society in 1784; Philadelphia the same year; New York in 1791; Massachusetts in 1792. The first agricultural papers that were ever read much were in the Agricultural Repository, and were noted for sound sense and good practical suggestions. The first National Agricultural Society was organized at Georgetown, D. C., November 29, 1809.

The fall of the same year Elkanah Watson exhibited three merino sheep under an elm tree in Pittsfield, Mass., which was the germ of the Berkshire County Agricultural Society. Mr. Watson met with much opposition and ridicule. J. Q. Adams' reply to a letter from him, asking aid, furnishes a good index of public opinion at this time: "You will get no aid from Boston. Commerce, literature, theology, medicine, the University, and universal politics are *against* you." He went to Boston, and tried a month to get aid, but without success. He went back, and went to work in earnest, and good results followed, and his name stands to-day among the foremost of pioneers in the cause of agriculture.

The Kennebec Agricultural Society was organized in 1800, and was incorporated the next year. Thus the leaven began to work, and the handful of corn has become a thousand, and all over our land to-day these societies are performing their mission work. Farmers now became social beings, and improved by rubbing together; like true metal, the harder the rubbing the more polish. They soon cast about for better implements, having very poor tools, and these of the ruder sort. In 1637 there were but thirty-seven plows in the Colony of Massachusetts Bay. Twelve years after the landing of the Pilgrims the farmers about Boston had no plows, and even later than that one man owned the plow and did the work for a whole neighborhood; and in fact one town paid a bounty to whoever would own and keep in repair a plow to be used in this way. The plows were large wooden ones, with a small steel point fastened to the wood with leather strings. It took two men to hold them. Plow, spade, wooden fork, with an occasional harrow, made up the list of farm tools. We have not time, nor do we care to trace all the improvements made in this, the most important of all farm implements, but only to say that in Massachusetts, in 1855, there were twenty-two plow factories, making annually 152,686 plows, valued at $707,175.00.

Mowing machines at length came along, and began to press their claims. At first they were very heavy and clumsy, but have now become so simple, light and durable that most farmers have come to the same conclusion that Daniel Webster did so long ago, that the hand scythe "hangs best on the tree." This brings us to stock.

In 1609–'10–'11, cattle were brought by the colony on James River, Va. Part came from Ireland, part from West Indies; and it has been stated that so much importance was attached to these cattle that for killing one of these animals the principal should suffer death, and any accomplice should have his hand burned and his ears cropped, and any person concealing the same should have a sound whipping for twenty-four hours. Importations followed into various parts of the country from England, Spain, Holland and Sweden, and from a mixture of these kinds came the so-called native stock of the country. No pains had yet been taken to breed cattle having any characteristics, size being the chief thing sought for. It occurred to Bakewell that something besides weight was necessary, or rather that the profit of breeding came not from weight alone. He wanted to obtain the greatest amount of saleable meat for the food consumed, and took the ground that smallness of bone, tendency to lay on fat, and early maturity, were necessary in growing cattle for the shambles. He traveled over England, Ireland and Holland, to find what he wanted. How well he succeeded, and how much he accomplished in this direction, is familiar to many of you. Though dead, he yet *lives.* What Bakewell, Collins and others have done in the way of breeding cattle was a marvel to the world. The perfection to which they brought the Longhorns, the Shorthorns, the Devon, Hereford and Ayrshire, is truly wonderful. If we want beautiful marbled beef, large and stately oxen, or cows that always give milk, we have not to spend a lifetime to rear them from the native stock, but in one of these breeds we can find what is wanted. Skillful breeding has been going on in this country until the pupils fairly outran their masters, won the race, and to-day hold the field. The champions of Europe have come here to buy choice stock.

Hours might be spent in relating interesting details regarding the increase in numbers of horned cattle and the amount of their products in meat and milk and butter and cheese; also in respect to the improvement and multiplication of sheep and swine and poultry, and concerning the ups and downs of wool growing and pork growing; about the crops of grass and potatoes, of corn, wheat and rye; about oats, peas, beans and barley, of hops and hemp, cotton and tobacco, fruits and roots, but our limits forbid. Are not these all written in the Books of the Chronicles called Census Returns? and can you not search therein and find them at your leisure? Therefore we proceed to remark concerning the connection between the progress which has been made and the discussions by which it has been brought about.

We are sure that no progress was made until these matters were agitated. Gen. Washington, while President, made his influence, regarding the importance of agriculture, felt both in and out of Congress. Elkanah Watson followed, doing valient pioneer work in a humbler sphere; originating the system of public exhibitions. Men began to compare notes—to read, think and talk; societies began to be formed; boards of agriculture to be established and to work, until agriculture has become a leading topic of the day, and has taken its fitting place in the foremost rank, and, as it underlies, so is it destined to overshadow every other material interest.

The Farmers' Club. It is also an educational institution; as well as a time-honored institution. It is there that the farmer learns to express his views with clearness and precision. Among farmers there are many like Israel's leader, slow of speech. Here they may become Aarons, if they will.

Again, do we not want less book farming and more of the experience of practical men? These men that write books are not always practical. Their theories may be good enough, and their books read well enough if one had the leisure. But we want more of the experience of the every day practical men among ourselves, and we get this at these club meetings. One comes in to tell us how he raises corn; first, upon what kind of soil, when and how many times it was plowed; what kind of fertilizers were used, if compost how he made it; what kind of implements he uses, and why he likes them better than others; how wide apart the drills; how many times hoed; the advantage of cultivating between the rows; then the yield per acre; if an extra crop, why; if a meagre yield, what there was in the season or land, or manner of tilling, or manure, or lack of it, that hindered better success. Another tells us he has bought a cow and is fattening her. He has weighed the animal; he is weighing everything she eats; he counts her worth so much now, and will tell us at some future time his gain or loss. Still another tells us we ought to raise cranberries; how he raised seven bushels on a little spot in his swamp; how he flowed the piece, how much sand he carted on, and how much it cost to pick the berries. Another tells us about cutting and curing hay; that top-dressing pays best for this crop, and how and when to apply it; he tells us that early cut hay will spend better than hay cut late, and that it will make more milk and more beef; and so we might go on. The secretary makes a digest of all that has been said and puts it upon the record book. The next week much of it gets into the county paper. At the next meeting the record is read and approved, and there it stands for reference; when, at any future time anything comes up that has been the subject of debate, we turn to our book and get the pros and cons.

And how much better this is than book farming! This is the experience of practical men; exactly. We have all our life long been crying down book farming, and now are doing the same thing, making books ourselves; and the reason why they are not better books is because we have profited so little by the books that have been made and given to us by others. Those books are storehouses of knowledge. In them is related the practical experience of some of the best farmers who have lived in this or any other age. Then let us read them, study them, and come to the club meeting and disseminate the knowledge obtained, both from them and from our own experience, that thereby we may be able to contribute our quota to those who may come after us, that it may be said of us by coming generations, "They have done what they could."

It is plain, therefore, that ours is no mean calling. It has received the Divine sanction. When the first Adam was commanded to go into the garden and till and dress it, a dignity was given to farm labor that has been given to no other. Then let us magnify our calling; let us see to it that it suffers nothing at our hands. It also plainly follows, that the prospect ahead means work. We find ourselves occupying a position never dreamed of by our fathers. Before and around us, instead of a waste howling wilderness, inhabited by savages, a country of vast resources, only very partially developed; its gold and its silver mines, its lead, its iron, and its copper, its coal and its oil; a people terrible in war, mighty in peace; a navy that bids defiance to the world; a commerce whose sails whiten every sea; its net of railroads destined by and by to bring the ends of the earth together; its teeming millions running to and fro, now reaching more than forty, and soon to be counted by hundreds, with its tide of immigration pouring in upon us like a flood from every nation, kindred and tongue, bringing with them all their native characteristics, and these to be found in our halls of legislation, in our ware-houses and counting-rooms, upon our farms and in our shops, and soon in numbers enough to hold the balance of power. How shall this multitude be fed? Certainly, if at all, by men belonging to the same craft as ourselves. And have we done our duty when we have fed them only? They need to be educated and christianized. When the Almighty stamped his own image upon the clay He had nobler purposes for man than merely that he gratify his senses; man has a higher nature than the animal. Let it be our endeavor to develop and elevate that nature.

Mr. Hawes of Knox county then read the following on

UNDERDRAINING.

It is not my purpose in this paper to treat of underdraining at length, in all its aspects and by the various methods which have been employed, but only to make some statements of my own experience and observation as a plain farmer, occupying a rocky farm, which go to confirm its great value. Several reasons might be given why we should be deeply interested in this work. There are thousands of acres in this State which are now almost worthless, but if properly drained and cultivated would be of very great value. The Creator of all things has made nothing in vain. It is our duty to learn their use, and so far as in us lies, put that knowledge into practice. In the section where I reside there are more rocks than farmers know what to do with. Many of the heaps of rocks in the fields and by the way side might not only be removed, but placed where they would be of great service. I think no better use can be made of them than by underdraining our land. It is evident that some lands, especially wet, heavy lands, are injured by their removal. I observed a few years ago a farmer clearing a lot which was very rocky; he hauled off the rocks and piled them on an adjoining piece. After clearing he cultivated the land five years, but did not get such crops as he expected. He then ditched the land three feet deep and two feet wide and forty feet apart, carted back the stones and covered them from twelve to fifteen inches deep. His expectations were now more than realized; corn, potatoes and grain yielded bountiful harvests. He said he was richly compensated by the increased yield of the first year, and that the crops for the last five years have been of three times the value they were during the former five years. This land seemed like new soil, light and dry.

Another farmer drained two acres which was considered worthless by the former owners of the farm, who had never plowed it, nor did it yield on an average more than five hundred pounds of hay. After draining, he plowed in the fall and sowed with oats early in the spring, which could not be done before underdraining. He had a fair crop. He sowed with oats the second year and the yield was great. The third year he sowed barley with herdsgrass, clover and red-top, giving it for the first time a fair dressing with stable manure. The barley gave an average yield, but the hay crop was very stout the next year. The present year is the tenth year since it was seeded, and cut one ton to the acre. Since being drained it has never failed of producing a good quality and quantity of hay.

I have practised underdraining on my farm for the last fifteen years, and am entirely convinced of its value. I have land which I consider as good as any on the farm, which formerly was not cultivated and was considered worthless. Some feel they cannot afford to underdrain, but if they will count the cost of keeping our highlands in a healthy state of cultivation and try the experiment, the results will be more convincing than any argument that I can offer. Underdraining when once well done is always done. It not only enables the husbandman to plow and sow in due season, but leaves the ground suitable for the mowing machine and horse rake, besides burying the stones out of sight.

Because our wet low lands have been unproductive we have let them alone. But there is a command to dress and till the land,

and if we will do so we shall be rewarded for the toil. Our low lands are often our best lands, for the reason that they have been during long ages receiving the wash and waste from the high lands adjoining, which are here rescued for our use and benefit.

As we are commanded to dig about the barren tree, so let us start right in the management of our low lands. First, thoroughly drain, then at the proper time plow and cultivate. I am satisfied that land well drained will hold out longer than undrained land of the same kind. That anything of value passes away from the land by the drains, I do not believe. It is evident that the greater portion of the water enters at the bottom of the drain, and the soil retains everything of value. The proper depth and width of drains, and distance apart, depend upon circumstances and can generally be decided best by the owner. In those parts where stones are not abundant, tiles are doubtless cheaper than rocks.

I am satisfied that much of our high lands would receive great benefit from being drained. Facts prove that rocks imbedded in low lands are of permanent benefit, and the same is undoubtedly true of ridges, and many of them are heavy, especially in wet seasons. Then again, much of the washing from the surface of high lands would be prevented by draining, as the water would then escape by the drains, and all of value in the soil would be retained in it. Much more might be said on this subject, and much quoted from writers on it, but I am more accustomed to work than to write, and my object is simply to bear testimony, from my own experience, that all the benefits claimed for under-draining by theory are fully realized in practice.

Mr. Lucas. I move that the paper be laid on the table. The necessity of underdraining is conceded by every one. As I understand, there is no objection to it in this age of the world.

Mr. Scamman. I fully agree with my friend in the necessity of underdraining, but instead of saying that it is conceded by every one, I should prefer to say that it ought to be so conceded. I know some pretty intelligent men in the State of Maine who have been farmers all their days, who do not believe in underdraining; and if it is so important, as has been said this evening, it is proper that we should endeavor to convince every man of its utility. I believe that on many farms of the State no one thing could be done that would be of so much benefit as underdraining. I have had some experience in this matter, having laid from six to seven miles of underdrains, mostly with tile, and I am convinced that it pays.

The tiles should be laid deep enough to be out of the way of the frost. It may be necessary in some places to dig the drain not less than four feet deep, three and a half usually answers. Some men are curious to know how the water gets into the tiles. Tell them that the tiles must be laid on an inclined plane, and as close together as they can be, and they at once ask, "How is the water to get in?" My answer is, that tile properly burned (and properly burned they have a cherry red color,) is porous, and if you put a tile into water, stopping both ends tight, in a short time it will be full of water. How did it get there? It went through the tile. When you have laid the tile it is necessary to prevent fine dirt from washing into the tile, to place something over the joints. Turf will answer very well; birch bark is very good; anything, in fact, that will keep the fine dirt from washing in.

Where stone is very plenty, and you want to get it out of the way, I should advise to dig a ditch and place the stone in such a shape as will give you a drain. But if you have to haul stone it is cheaper to buy tile than to cart stone. In some places stone will not answer. For instance, if you have a pond of water or low place to be drained, and the outlet is through sandy land, a stone drain is of no use, because the sand will wash in and fill the drain. Tile is necessary in such places, and the joints particularly well secured.

If you use stone on clay lands there is one difficulty in laying it, as many lay drains with stone, and that is, that the stone will come together so closely as to choke up the drain. I have seen one stone laid on one side of the ditch, another on the other side, and a flat stone on top; but clay is very slippery when it is wet, and somehow these stones slide together and choke the drain. I once wanted to lay a main drain where there was much water to run, and many smaller drains laid with tile to run into this main drain. I dug a ditch two feet and a half wide and from three and a half to four feet deep; then took large round stone, fifteen inches through, and laid on one side of the ditch, and then flat stone and laid one end of it on top of the round stone, and rested the other end on the ground on the other side, roof fashion. That drain has been laid a number of years, and it has never been obstructed; a very large amount of water runs through it every year.

On the farm where I laid the six or seven miles of drains, they improved the land so much that in six years the hay crop increased from forty to one hundred tons. That was evidence enough to my mind that the draining was of utility and profitable.

Mr. Wasson. My observation has led me to doubt seriously the wisdom or propriety of urging underdraining upon the farmers of Maine, in the present state of agriculture, attended as it is with so great expense. I am aware that all our leading agriculturists advise farmers to underdrain; but if you calculate the cost of digging the ditches, which it is said must be within four rods of each other, three and a half feet deep, and two feet wide, and add to that the cost of the stone, you will find that when the farmer has drained his lands, he has spent more than the value of his farm.

I wish to be understood in my position. I do not speak against underdraining as a principle; but against urging it upon our farmers in the present state of agriculture. If we were driven to the extremity that they are in England, with a population largely in excess of ours, a single square mile supporting a population as large as that of some of our large towns, the question would assume a very different aspect. Let us see how it is here. We cultivate the land, rotating the crops for a while, and when the soil fails to furnish remunerative crops, we have left in the West an almost immeasurable extent of highly fertile soil at a cheap rate; and when the time shall come, as in the future it will, that the entire West is taken up, our own farms must be divided and subdivided to accommodate the wants of our people, the question will then assume somewhat the same shape that it does now in England, and in Holland. The time will come when it will not be a question of choice, but a necessity, and farmers will not then stop to count the cost, because they will be driven to improve their farms by underdraining.

Sec. Goodale. I am a believer in underdraining, both in principle and in practice. If it is right in principle, it is right in practice, if it is wrong in principle, it is wrong in practice; and the principle being settled, then the question comes, Where will you practice it? It does not follow at all, that because it is right in principle it will pay to practice it on every acre that has been cleared in the State of Maine; no one so understands it. It is a question of dollars and cents simply. Wherever a given amount expended in underdraining will yield a profit, then do it; but if a profit cannot be safely calculated upon, then let it alone. You cannot afford to apply a principle, however correct, where it will not pay. It is a good principle to put manure on land, but if the manure costs more than the crop is worth let it alone.

There are many acres that it will pay to drain, and many that it will not pay to drain. I know of no one who has given the matter much thought, who has not been satisfied in regard to the importance of underdraining. I know many farmers have looked with wonder and astonishment at the results of draining done by their neighbors. They could not understand how it was, that merely drawing off a little water from below the surface should be followed by such enormous increase of crops. They see what was a mere swamp, that they would no more think of spending money upon than of throwing it into the sea, converted into a fertile field. I have seen a profitless swamp underdrained, and the next year sixty bushels of corn per acre on it. It is such results, where undeniably it does pay, that have stimulated underdraining in Maine more than all the talking and reading that has been done. You can talk and theorize about any operation in farming, but let a man carry it into practice and show it to be profitable, then others will be ready to inquire how much it will cost for them to do it, and how much good it will accomplish for them; and each can then intelligently decide for himself.

There are many acres in the State of Maine that would not be benefited by underdraining. Go fifty or a hundred miles into Aroostook, where the soil overlies a porous slaty formation, which instead of being like the hard-pan you find in many other parts of the State, perfectly impervious to water, and holding it like a pail, will drain itself; to put drains through that land would be as unwise as to put them through sand and gravel. I have known men who made underdraining a hobby, who would put drains in dry soil overlying porous subsoils; their idea being that it will be improved by admitting more air. The fact that a great deal of nonsense is talked about underdraining, does not invalidate the principle, and ought not to prevent its practice where it should be carried out; and there are places enough where it will pay abundantly to employ all the spare means and time which farmers have for the purpose.

Mr. Scamman. The gentleman who thinks so highly of the principle of underdraining, and so poorly of the practice, reminds me of the position of a man who was in favor of the Maine Law, but opposed to enforcing it! The idea of opposing underdraining because it will cost something, is mere nonsense. And again, as a State we have been paying money to induce Swedes to come here and occupy and improve our wild lands, and yet our friend here advocates sending the young men of Maine out West to find homes instead of setting themselves in earnest to the work of making them here!

We have been talking about the drought that has scorched some of our fields and pastures the past season, and there is no one thing that will benefit a large share of those lands more than to underdrain them. Let him look at lands where underdrains have been laid. Has the drought parched them as it has undrained lands? He will find to the contrary. I recollect, some years ago, when we had one of the sharpest droughts that we have ever had in this State, there was green herbage growing on drained land. Retentive soils always stand a drought better when underdrained.

Mr. Hersey. I have some land that I am satisfied would be benefited by underdraining, but the question has arisen whether it would pay to undertake it, the cost being so great. It is clay loam, and in the spring of the year is very wet, and when it is dry it is very hard. If any one present can tell me what is the cost, how deep and wide the ditches should be, etc., I should be glad of the information.

Mr. Hawes. I have never figured the cost. Most of my drains have been dug by the rod, usually from two and a half to three feet deep and about fifteen inches wide. I paid twenty-five cents a rod for digging. Most of it is hard pan. They are on high and naturally wet land, and I have always laid stone. I have drains eight or nine years old, and some much older which are serviceable yet. I have been well compensated for the expense, in every instance. On one piece that I underdrained, where the water, after a storm, formerly stood a foot deep on the ground for a week, you could see no water at all the next spring, after a heavy rain. I should put drains two and a half or three rods apart, for thorough draining. If you do not dig so deep, they should be put nearer.

Mr. Chamberlain. I have had digging done, on upland, rocky soil, not clay, for twenty cents a rod, three to three and a half feet deep. I will answer Col. Hersey's inquiry by recommending him to buy Judge French's work on draining. He is the best authority we have in the country. It is very pleasant reading, as well as instructive, and answers every possible inquiry that can arise in regard to the matter.

Sec. Goodale. The question whether or not it will pay to drain, is one which cannot be settled by talking. Every man must settle it for himself. He understands his own circumstances, and by observation and inquiry, he can ascertain very nearly how much he will gain by the operation. There are localities where, because of proximity to the dwelling-house or other circumstance, more can be expended with satisfaction than in others, just as I have known sometimes, in a rocky region, several hundred dollars expended in clearing an acre of land, because it was where the man wanted an acre of land in good condition to work, not because it otherwise paid as a pecuniary operation. So it is with underdraining. There are places, even where land is cheap, where a cheaply made drain, even if not more than two feet deep and with rocks tumbled in, which is the crudest mode of underdraining—perhaps hardly deserving the name of an underdrain—in many instances, will pay for itself the first year, and in others will pay in two years, and you will get the good of it for a longer time; how much longer depends upon the character of the soil. By-and-bye it will fill up, because the dirt will work in. But that is a very imperfect method.

If you want a perfect drain, there is no way so good as to use tile; and the difference in expense between tile and stone is generally in favor of tile. In fact, I have known cases where stone drains and tile drains were made on the same farm, where there was so much stone that it must be carted away if not used for the drains. The result proved that the additional digging necessary for the stone drains would have paid for tile, and something more. Those who are unacquainted with tile drains are not aware with how little labor they can be dug. It is an art by itself to dig and lay them as they ought to be, and in the most economical way. Tools are needed on purpose for the work. A man skilled in digging and laying tile drains does not put his foot within twelve inches or more of the bottom, where the tile goes. The spade for the lower part is long and narrow. He digs just wide enough to receive the tile, and above that he has barely width to stand in and a little ridge on either side upon which he stands. Now, when you calculate how little earth is moved in that case, you will find it so unlike digging a ditch two or three feet wide, that the figures will surprise you.

I have practised underdraining, more or less, for a good while. The first was dug before tiles were made in this country. It was three and a half feet deep, and laid with faggots. Small bushes were cut and tied in small bundles; over that was laid worn-out fence boards, and the first earth thrown in trodden firmly. That drain did good service for thirty years and more. None of it has failed except where moles and mice have worked in and by loosening the dirt caused obstruction. After that I put in tile brought from Albany—say 300 miles. That was laid more cheaply than I could have laid stone, even if the stone had been at hand.

Many benefits follow underdraining a soil that suffers from too much water. You can work the land earlier in spring and later in fall; the roots run deeper, they find more food, and plenty of moisture, so that when drought comes they do not suffer as those do which are stopped by stagnant water in spring. It virtually adds to the length of the season at both ends. The benefits are numerous, but the question whether it will pay in any individual case is for each man to decide for himself, in view of his peculiar circumstances. On some lands draining pays well in this State of Maine, on others the labor and expense would be an exceedingly poor investment.

Mr. Wasson. Nothwithstanding the sharp criticism bestowed upon my remarks, I have a word further to say, (although I acknowledge that my remarks were made partly with a view to enliven the discussion and draw out the other side,) for I seriously believe that some underdraining has been done which does not pay. I put some stone drains through a field of clay loam with a very hard clay subsoil, and it was costly work too, and no part of the field showed more falling off from drought than where those drains are. The main question is, will the expenditure, whether for tile drains or stone drains, or any other sort, increase the value of the farms as much as they cost? and I believe in a great majority of cases that question must be answered in the negative. There is a vast difference between urging a large expenditure upon an acre of land worth ten or twenty dollars, with a view of doubling its productiveness, and urging the same expenditure upon an acre worth one hundred or two hundred dollars. It is upon this simple question of expediency that I based my remarks. That the principle of underdraining is right, there can be no question. That it would very much improve our farms there can be no question. That the time is coming when underdraining will be of pecuniary advantage, there can be no question. That has nothing to do with our young men leaving the State for the West. That is simply because they believe that the West offers greater attractions. We may lament it, but the fact still remains. Our young men and women left Aroostook, and we imported foreigners to occupy those lands. I am glad the Swedes are there, and wish more would come. I believe my meaning cannot fail to be understood.

Adjourned to next day.

SECOND DAY.

WEDNESDAY, September 20th.

The Board met at nine o'clock; the President, Mr. Thing, in the Chair.

Mr. Z. A. Gilbert of Androscoggin, was introduced as the first Speaker, who delivered the following lecture on

THE COOKING OF FOOD FOR FARM STOCK.

Stock husbandry must ever be the leading business of a large majority of the farmers of Maine. A small number of land holders near cities, with here and there an individual in the remote towns, will have tastes leading them to follow some specialty not necessarily connected with the keeping of stock; but the great mass of farmers, conforming to circumstances and conditions which man may modify but never entirely control, will follow some of the various kinds of special or mixed farming, where the growing of stock feed and its economical use will claim their chief attention. Nowhere in our broad country should economy in the use of forage receive closer attention, than in our own State, where neat cattle and horses must be furnished their entire food for six months in the year from the supply which the providence and labor of the owner has placed in store.

Our pastures, formerly luxuriant with a thick growth of rich grasses, are rapidly failing, and now refuse to carry through the season in thriving condition anything like the amount of stock formerly fed upon them. In consequence of this deterioration of pasture lands, the stock now kept upon them must be fed from other sources, in part, for two months of the six usually devoted to pasturing, making eight months out of the twelve, in which stock must be fed from the barn. Should the present ratio of deterioration of pasture products be continued, but a few years will elapse before our large animals—cows, oxen and horses—will require feed from the barn the year round. The production of food, and economy in its use, then, are two great questions for stock keepers to study. We have all learned that there is no royal road to success in anything, and it is well for us to inquire whether we should not deviate from the beaten paths of the past, and endeavor to meet with an intelligence commensurate with the conditions surrounding us, the demands now made upon us. If by any improved method of preparing and feeding out stock feed, thirty-three per cent., for instance, can be saved, or in other words if two-thirds of the same can be made to carry as much stock as the whole is now feeding, and carry it in the same condition, then we can keep the present number in the herd and have one-third of the feed for sale; or the stock can be increased one third and still be carried on the same amount of feed that is now consumed. Where the farmer has barely been able to make the income from his stock meet the outlay, he would by this saving be enabled to realize a very handsome profit. In the winter feeding of stock a saving of one third of the feed would be equivalent to taking away one third of the winter, or reducing the feeding from six months down to four.

With the view of economizing the food of stock when confined to the barn—and particularly dry food—careful experiments have been conducted, and results have been attained quite satisfactory to those who instituted the experiments. In some cases experimental practices have been so long conducted, that it is now a fixed fact that a great saving can be made; and these experimenters are now ready to stand out as a guide for others to follow.

It is a fact well established in the minds of those who have long practiced it, that there is economy in the use of the straw cutter; that hay, staw and corn fodder are rendered of more value as food for stock by being cut. The labor of cutting is more than compensated for by the saving in quantity. I am aware this opinion is scouted by many small farmers, but it has been proved by long continued practice, both on a large and on a small scale. In the large cities nearly all the horses are fed on cut feed, and with those used on the omnibus lines and street railroads the practice is universal. A feeder of large experience, says that the economy of the straw-cutter is as well established with him as is that of the mowing machine. If the cut feed is wet and allowed to lay in mass and soften, it is still more valuable. This method of preparing feed is now being practiced by many farmers, and invariably with the most satisfactory results. The philosophy of this will be made apparent hereafter.

Another practice, with the view of economizing the food of stock is that of steaming the hay, straw, corn fodder, and all other dry feed used. This practice is comparatively new, having been practiced in this country only about fifteen years, and its advantages are not apparent to farmers generally. Neither is it well understood what apparatus is needed or what would be the cost of the same. In conversation, some two years since, with a man closely identified with the agriculture of this State, the belief was expressed that the feed-steamer would in half a century become as common as the mowing machine then was. The idea was a novel one to me, as I had then given the subject but little thought. Since that time it has attracted my attention to a considerable extent, and has been studied from every standpoint available, save that most important one of all, personal experience. But had I practiced it myself my testimony would be worth no more to you than is the testimony of scores of others better qualified to judge in the matter, whose opinions are available to you. I have consulted all that has been published upon the subject in this country —have examined the different kinds of steamers now in use for the purpose—have visited those who are practicing it at the present time, and have conversed with them upon the subject—have examined their apparatus, and the arrangement of the same, and have witnessed the process in operation—have examined the stock fed upon the steamed food, its health, its condition, its thrift, and have obtained facts and figures substantiating confirmed opinions. During the time I ask your attention, I propose to tell you of some things about the subject which I know, rather than what I believe. The chemical ingredients of which the different kinds of feed are composed and the change which they pass through in the process of steaming, will be alluded to as briefly as possible, and left mainly for those who are qualified to describe; for I am well aware that Abijah Wilkerson expressed opinions not confined to himself alone when, in his journal, he wrote, "Writin' folks that don't know nothin' about it seem to have a sort o' run to chimistry, and I suppose its because more 'n half the people don't know whether they are talkin' sense or nonsense. When an old farmer writes a letter and begins to bring in oxides and acids I begin to doubt him."

Steaming cattle food in a crude manner has been practiced in a small way by many feeders among us for many years. The hay or straw for a cow or horse is cut, and the quantity of meal or shorts allowed the animal mixed with it, and the mixture being placed in a tight box or cask is wet with boiling water, covered tight and left to steam and soften. In all cases where this method has been practiced, that have come to my knowledge, it is believed there is a great saving in the expense of keeping, besides the additional advantage of keeping the animal in better condition; and in no case has the practice been discontinued because it was thought the operation did not "pay." The most extensive experiment in preparing feed in this manner which has come to my knowledge was made by Mr. Charles Haskell of Auburn, last winter. Mr. Haskell is reported to have fed thirty-six head of cattle on feed prepared in the manner described, and believed that he made a great saving thereby. If this imperfect steaming will give results so satisfactory, when practiced on a small scale, and of course at a much greater relative cost, there can be no question as to its advantages when thoroughly done, and on a large scale. The labor and expense attending its preparation on a small scale with imperfect fixtures is much greater per animal than when practiced on a large scale with improved appliances.

It is a Yankee trait, and one that may well be commended, to know the reasons why results are attained, that they may understand for themselves why opinions are set down as facts, and whether those so called facts are reliable. In order to make the subject plain to all, it will be necessary to consider for a few minutes, the advantages of cooked food over that fed raw—though it shall be brief as before promised—and also to refer to some experiments which have proved its greater value.

All plants, seeds, and in fact all organized matter is made up of minute vesicles, or cells adhering to each other. The outer coating of these cells is cellulose or woody fibre, and is the material that gives toughness and solidity to the parts of the plant. These cells contain water which holds in solution the nutritive properties of the plant—gum, starch, sugar, oil, &c. The growth of the plant is simply the constant multiplication of new cells. In order for an animal to obtain any nutriment from a plant or its seeds, the cellulose must be dissolved or broken so that the nutriment contained within may be assimilated. But it is insoluble in cold water, and an animal must first moisten it with the saliva in the mouth and then on passing to the stomach it is dissolved by the action of vital forces. Starch, too, one of the principal nutritive substances contained in plants, is insoluble in cold water. Hot water readily dissolves it, or the same is done by the saliva and other secretions of plant-eating animals, when it readily digests. Experiments made by M. M. Raspail, of the French Academy of

Sciences, established the fact that the globules constituting meal, flour and starch, whether contained in grain or roots, are incapable of affording nourishment as animal food until they are broken; and that no mechanical method of breaking or grinding is more than partially efficient; and also that the most efficient means of breaking the globules is by fermentation, by heat, or by the chemical agency of acids and alkalies. He also proved by recent experiments that when grain and potatoes are fed whole in a raw state to graminivorous animals, a large proportion passes through the intestines wholly unaffected as when swallowed. Braconnot says that a considerable quantity of alimentary matter is lost by the use of potatoes in the unboiled state. Hence, he concludes, "if cooking is absolutely necessary in rendering the nutritive properties of roots and grains all available to the assimilating faculty of the animal, it is equally necessary in breaking the sacks which contain the alimentary substances found in hay and straw." But granting, for the time, that all aliment contained in hay and straw is assimilated when fed to the animal whole and dry, it is well known that a vast amount of vital force is expended in masticating and digesting it. This force is supplied from the food given, and of course a certain amount is required for this purpose alone. Now if the heat which is expended in dissolving the coating of the plant cells can be supplied artificially, and mastication and digestion so far assisted as to save a large portion of the vital force otherwise expended, while at the same time the food is rendered more valuable by a preparation which renders all the nutritive matters assimilable, the triple work of supplying animal heat, saving force, and rendering otherwise valueless nutrition available, is accomplished. Theoretically, then, there should be a great saving made by cooking the food of domestic animals, whether grain, roots, or dry hay and straw. It remains to ascertain whether experiments prove the hypothesis correct.

There have been more experiments conducted with a view to ascertain the comparative values of cooked and uncooked food when fed to swine, than there have when fed to cattle and horses. In the feeding of grain to pigs there are many careful experiments on record, conducted with a view to ascertain the comparative values of cooked and uncooked food when fed to animals of that description. Among the large number consulted, with a single exception, they all show a greatly increased value to the food, derived from cooking, as was abundantly proved by the increased growth and thrifth of the pigs to which it was fed. The exception alluded to was an experiment conducted by Mr. Johnson, at our State Industrial College, in feeding meal. The conclusion arrived at by this trial was, that cooking the meal did not pay. This single trial, even if carefully conducted, does not disprove the multiplicity of testimony on the other side. It is hoped that it may be repeated, to learn if the result would be the same on another trial.

A few only of the many experiments on record will be here copied, from the fact that the object of this paper is to bring before you mainly the cooking of food, hay, straw, &c., for cattle and horses.

Hon. George Geddes of New York, as reliable authority as we have in the country, said in a discussion at the New York State Fair, that two bushels of raw corn meal wet in cold water and fed to pigs, would feed no longer nor make any more gain than one bushel of the same when thoroughly cooked and fed. By cooking the bulk is doubled and the feeding value is doubled.

S. H. Clay of Kentucky, fed two pigs four hundred and five pounds of raw corn in thirty days, and they gained forty-two pounds; while two other pigs were fed two hundred and seventy pounds of cooked meal in the same time and gained eighty pounds. At the same rate four hundred and five pounds of meal cooked would have fed the two forty-five days, and would have made a gain of one hundred and twenty pounds. The feed was then reversed—those having been fed on corn were changed to cooked meal, and those fed on meal were changed to corn; and the results proved very nearly the same as before. A bushel of raw corn made five and three-fourths pounds of pork, while a bushel of meal cooked made seventeen and one-half pounds.

James Buckingham, in a communication to the Prairie Farmer, says he "put three hogs into as many separate pens. One ate three and a half bushels of corn in the ear in nine days, and gained nineteen pounds; another ate in the same time one and three-quarter bushels meal, and gained nineteen pounds; the third ate in the same time one bushel cooked meal, and gained twenty-two pounds."

The Shakers of Lebanon, N. Y., say they consider three bushels of meal cooked equal to four uncooked. Vegetables, also, especially potatoes, are of much greater value as food for pigs when cooked than if fed raw. Harris, in his recent work on the pig, says: "We have never known any one who has tried steaming or boiling, with even ordinary conveniences, that was not perfectly satisfied that it was more profitable than to feed raw." Indeed, this is a question which might, perhaps, be safely said to need no further proof, for experiments almost without number are being tried every year here among our neighbors, which, though not sufficiently accurate to be put on record, are nevertheless proof positive to those who try them that cooked food is of much greater value than raw.

This increased value of cooked over raw food is not confined to its use as food for pigs. The experience of all common farmers has proved to their own satisfaction that the *same kinds* of feed are greatly increased in value by cooking when fed to neat stock, as well as to pigs; and the experiments which have been carefully conducted and recorded, as will be seen hereafter, prove the conclusions correct. In proof of the statement that grain and roots are greatly increased in value as food for stock of all kinds by being thoroughly cooked, we thus have the almost unanimous opinion of all feeders. But on the main question under consideration—that of cooking dry hay, straw, corn fodder, &c.—experiments are limited in number, and we have a smaller amount of testimony in support of the practice; although the number who are practising it at the present time is much greater than those who are not familiar with the subject would suppose. The practice, too, is greatly on the increase.

Among those who have practiced steaming food for stock, familiarly known to the reading farmer, may be mentioned E. W. Stewart, North Evans, N. Y., H. S. Collins, Collinsville, Conn., William Birnie, Springfield, Mass., George A. Moore, Buffalo, N.Y., S. M. and D. Wells, Wethersfield, Conn., Augustus Whitman, Fitchburg, Mass., B. A. Avery, Syracuse, N. Y. Scores of others might be named, but it is not necessary. The testimony of these is enough to establish a fact in the mind of any one open to conviction. It is proposed to review some of this testimony bearing upon the subject, that a knowledge may be gained of the results attained by the practice, and the advantages secured thereby.

Mr. Stewart has probably had as much experience in steaming as any man in this country. In the course of a series of articles written for Hearth and Home, he records some of his experiments by which he proved the advantages gained from the practice. The care with which the experiments were conducted, and the accuracy with which they are detailed, furnish good reasons for quoting at length from the articles.

His first experiment was with two fresh milch cows in January, weighing about 800 lbs. each. "The two cows were each fed 16 lbs. per day, namely: 10 lbs. hay, $1\frac{1}{2}$ lbs. oil-meal, $1\frac{1}{2}$ lbs. pea-meal, and 3 lbs. bran, well steamed. The produce was 8 lbs. each per week of butter for two weeks. They were then put upon the same quality and quantity of food uncooked, and on the second week of the trial the quantity of butter was tested and found to be 4 lbs. 13 oz. The cows appeared to lose flesh. The uncooked food was then increased from 16 to 24 lbs. in the same proportions. On this the butter increased again to 8 lbs. per week. They were then put back again upon cooked food, and were fed 18 lbs. per day, namely: 10 of hay, 2 of oil-meal, 2 of pea-meal, and 4 of bran. On the second week of this trial they made 10 lbs. of butter each. The milk was apparently increased in proportion to the amount of butter. From these experiments," says he, "as well as many others of a similar nature, we come to regard cooking as equivalent to a saving of one third of the raw material."

He further says, "Hay alone was tried by feeding animals in the same stable—five upon 16 lbs. cut and cooked hay each, and five upon 24 lbs. each of the same hay uncooked. Those upon the cooked hay had every appearance of thriving best. A trial was then made of a mixture of 12 lbs. hay and 12 lbs. straw cooked, and the animals would not quite eat it all, but did better than upon uncooked hay. Next on trial 10 lbs. hay and 10 lbs. straw, well steamed, were found quite equal to 24 lbs. hay uncooked."

"A fresh milch cow giving 18 quarts strained milk per day was fed on 8 lbs. hay, 8 lbs. straw, 2 lbs. corn-meal, and 4 lbs. bran, cooked, at a cost of 22 cents per day, which is one eighth less than it would have cost to feed on 25 lbs. uncooked hay alone." He concludes by saying that all these experiments were so satisfactory, as to economy, to him, that he has cooked for all his animals in winter for the last twelve years.

B. A. Avery, Syracuse, N. Y., has practiced steaming for a large stock of cattle for four years. He says in his first year's experience he saved ten dollars per head; the second year he saved nine dollars per head in four months and a half. In an essay on the subject of steaming food, published in the New York Tribune, the author makes a statement of what he saw and learned by a visit to Mr. Avery's farm. He says the proprietor showed great care in making his statements, evidently desirous of keeping below the limits of actual facts, lest some might be misled. His experiments have been conducted with the same caution and care, and his figures have been accurately kept. By cooking the food the average milk product has been increased nearly one quart per day for every day in the year, or over 300 quarts per year to each cow. This increase is principally in the winter, when the product sells at the highest price. At the same time that this increase in the milk product is obtained, there is a saving in the cost of keeping of ten dollars per cow, which added to the cash value of 300 quarts of milk, gives the amount saved per animal by the process of cooking.

Dewey and Stewart of Michigan, after having fed a large stock of cattle, sheep and horses on steamed food, say they have saved one-third the expense of wintering their stock.

Wishing to avail myself of all the information upon this subject within my reach, and wishing personally to inspect the apparatus in use, and the stock fed upon the cooked food, I improved an opportunity presented to visit the barns and stock belonging to Mr. Birnie, and also those of the Messrs. Wells. Mr. Birnie has steamed for twelve years, and Messrs. Wells for eleven years, and with increasing satisfaction from year to year. The longer they practice it, the more they are confirmed in the profit and economy of the operation. Mr. Birnie is very positive that he saves 33 per cent. in the operation. His head herdsman assured me the estimate was none too high. If dry feed for any reason is substituted for one day in place of the cooked, there is a falling off in milk of one quart per cow. A statement of the average daily cost per animal of feeding his stock in the winter of 1869, was published in Hearth and Home of January 23d, of that year. He was then feeding twenty-one mature animals, mostly cows in milk, seven two years old, ten one year old, and five calves. Also, three work horses, three three years colts, and three one year colts; in all fifty-two animals. This stock was fed on steamed food morning and night, and dry hay at noon. It should be borne in mind that the stock was kept in good flesh and condition. The cost is figured as follows:

1350 pounds poor hay at $12.00 per ton.................	$8 10
112 pounds bran at $1.70 per cwt........................	1 90
44 pounds cotton-seed meal at $2.25 per cwt.............	99
Total cost of steamed food for 3½ days....................	$10 99

Cost for one day	$3 14
Extra meal for three horses, 24 pounds	60
Extra shorts for twenty cows, 70 pounds	1 19
12 bushels roots at 16⅔ cents per bushel	2 00
170 pounds good hay at $20	1 70
Daily cost of feeding fifty-two animals	$8 63

Average cost, 16 3-5 cents.

The Messrs. Wells fed in the same manner, with very similar results. On no account could they be induced to abandon the practice and return to dry food. Changing from steamed to dry feed for one day will make a difference, with their cows, of ten per cent. in the flow of milk, and it will take three days to get them back again to a full flow. Many times has this been proved. In summer their cows are soiled. The last green crop cut in the fall is rye, sown thick on lands where garden seeds have been grown and harvested. This is considered the best green feed grown. Cows in milk, taken from this and put upon steamed food will keep up their flow of milk. They do better upon steamed food than upon the best second crop hay dry, with all the grain it is safe to feed.

Augustus Whitman of Fitchburg, Mass., a noted breeder of short-horns, has fed his stock on steamed food for five years. In a letter to me upon the subject, of recent date, he says: "Of the desirableness, the *necessity* of some practice akin to this, I am satisfied beyond all question. It is surprising to see how the hay holds out, and how cattle thrive when fed chiefly on straw, corn-stover or swale hay." A trial was made in the winter of 1870 of the comparative value, or rather the comparative results of feeding dry hay uncut, and steamed food. Two dry cows of large size were fed for three weeks upon all the good dry hay they would eat, and at the end of that time it was found to average twenty-eight pounds per day. At the same time two other cows of nearly equal weight were fed for the same length of time twenty pounds per day of steamed mixed food. At the end of the three weeks each pair was again weighed, and the pair fed on dry hay barely held their weight, while the pair fed on the steamed mixture gained an aggregate of ninety pounds. The feed was then reversed for three weeks, the pair first fed on dry hay receiving the steamed feed, and the pair first fed on steamed feed receiving the dry hay. The result, as before, proved the superior value of the steamed feed; the pair this time being fed on it making a gain of seventy pounds, while the others, as before, made none. The mixture steamed was made up of three hundred pounds of good hay, six hundred pounds corn fodder or straw, one hundred and eighty quarts of wheat shorts, sixty quarts cotton-seed meal, and sixty quarts corn meal.

His rule of feeding in the winter of 1871 was five pounds of dry hay at night, and a box full of steamed food morning and noon. The two boxes of feed contain three pounds of good hay, six pounds of straw, one pound of shorts, and one and three-quarter pounds meal, half corn and half cotton-seed. This is for mature animals not giving milk. The monthly record shows a good gain on this feed. Cows in milk were allowed an additional feed of grain fed raw, viz: one quart corn meal, one quart cotton-seed meal, and four quarts shorts. The supply of shorts being discontinued, trial was made of feeding the same quantity of meal cooked, when it was found that the two quarts of meal cooked made as much milk and kept the stock in as good condition as the meal and four quarts of shorts fed raw.

George A. Moore of Buffalo, at the New York State Fair discussion in 1864, said that he was feeding sheep on raw feed and was making a gain, by actual weight, of two pounds per head each week. By steaming the same feed, the gain was increased to three pounds per week. He had also steamed for a large herd of cows. By this experience he was of the opinion that cutting and steaming combined insured a gain of at least thirty-three per cent.

Mr. H. H. Dickey of Lewiston, is the only man in this State, so far as I have learned, who has practiced steaming food for cattle in a systematic manner. He may be put on record as the pioneer of the practice in this State. Although a manufacturer, and owning only a small farm, he brings to his work a study, and manifests an interest in agricultural progress, which may well be imitated by farmers owning broader acres, whose interests are exclusively agricultural. A year ago Mr. Dickey purchased a Prindle steamer and steamed the food for five cows during the winter of 1870–'71. Although he neither weighed nor measured the feed, still he was perfectly satisfied from the experience that the operation was a paying one, and that the practice may well be followed by others.

I have dwelt thus long on this point, that I might bring before you, not only the opinions of a large number of feeders, but also the results, as far as possible, of the experiments on which those opinions are based, well knowing that common farmers call for practical experience rather than mere theorizing. The experiments of many others might be alluded to, but these are deemed sufficient. The men whose experience I have drawn upon are well known in the community, and are men upon whom reliance can be placed. It is true no allusion has been made to experiments from high scientific authority, like the experiments in other directions of Messrs. Lawes and Gilbert, Dr. Voelcker and others; and from the fact that the record of any experiments by scientific men, with a view to ascertaining the comparative value of cooked hay and straw is not at hand, and so far as I know no such experiments have been made. Thus far, if I mistake not, they have been made by practical men, seeking economy in the use of their stock forage. The tests have been made with the living organism, rather than with retort and crucible, and the results recorded in quarts of milk or pounds of Ayrshire and Short-horn, instead of being figured up in a chemist's laboratory. This is only another instance where truth developed by practical experience antedates the recommendations of the devotees of science.

Having alluded to some of the advantages of this method of preparing stock food, and having given the opinions of those who have practised it, I propose now to describe the fixtures needed, together with the arrangement and cost of the same, that all—scoffers as well as honest inquirers—may have an idea of what is wanted, where to obtain it, and what to do with it. There have been many mistakes made, and not a little money wasted in arriving at the present state of progress in this matter. That perfection has not yet been reached is very plain, even to an unschooled observer; still, fixtures are in use that are giving very good satisfaction, and from which the advantages heretofore enumerated have been derived. The steaming is done by a steam boiler or generator, connected by a steam pipe to a vat containing the food to be steamed. The cheapest as well as the most simple steamer I have any knowledge of was described by a correspondent of the Country Gentleman; and it is claimed to be efficient as well as inexpensive. The correspondent went to the village furnace and selected a kettle holding about fifty gallons. For this he had a cover cast, with a three inch hole in the centre, through which to fill it. This cover was fastened to the kettle by bolts through the rim, and made tight by steam packing. Into this an iron gas pipe was screwed, for a conductor; and this was his steamer. The cost thus far was

$19.55. A trifling additional cost was incurred in setting the kettle in brick, and also for the tank or steam box. When steaming, the hole in the cover is stopped with a wooden plug. Certainly no one can dispute the simplicity or the small cost of such a steamer.

D. R. Prindle, East Bethany, N. Y., is the inventor and patentee of a portable agricultural steamer, which has many qualifications to recommend it for the use designed. These qualifications will be made apparent in the description which follows. It is a furnace, steam boiler, and caldron, all in one. It is made in two sections, and when complete is a steam generator; but by removing the dome the lower part may be used as a caldron for all boiling purposes; the change can be made in a few minutes. The furnace is constructed for wood or coal, as desired, and has an air-chamber provided mostly around the fire-box to prevent the radiation of heat. It is also provided with a self-acting safety-valve, which renders it absolutely non-explosive and safe. It is made to fit the ordinary stove-pipe, and can be set up out of doors when necessary. At the New York State Fair, at Utica, 1870, one of these steamers, standing in the open air, cooked a barrel of mush perfectly in twenty-six minutes, taking the meal and water cold; a barrel of potatoes in twenty-three minutes, and twenty bushels of cut feed, in a tank at a distance of thirty-five feet, in thirty-nine minutes, and all from the same fire. It is manufactured of several sizes, numbers two and three being the sizes usually bought by farmers. These sizes, fitted for burning wood, are sold at the manufactory for sixty-five and eighty-five dollars, respectively. They are kept by the agricultural implement dealers of Boston, who take pleasure in showing them to all parties interested.

The Elmwood steamer is manufactured by Harry Sedgwick, Cornwall Hollow, Conn. I have never seen this steamer. The description is taken from a circular issued by the manufacturer. The steamer is made in tubular sections of cast iron, planed and ground and set together. The smallest contains three sections, and the number is increased according to the size wanted. The smallest size has a water fire surface of thirty-six square feet, and the large size has a water fire surface equal to six horse-power. Every steamer is proved before it leaves the shop by a hydrostatic pressure of two hundred pounds to the square inch. The safety-valve opens at a pressure of twenty to forty pounds, but may be kept down to eighty pounds with perfect safety. The steamer is supplied with an iron water-tank, in which the water by which the boiler is supplied is heated before it is let on to the boiler. The price at the manufactory, complete with all the fixtures, is $90, $105, $120, $135, for numbers two, three, four and five, respectively. From the peculiar construction of this steamer, which gives so great an amount of fire surface, I should judge that it could be run with a very economical expenditure of fuel.

For cooking hay and straw the more common steamer in use is the common upright tubular boiler, used in small manufactories, of about four horse-power capacity. Second-hand ones can frequently be bought for $50, and a new one costs $100. The reason of these being used more than those before described, may not be because they are better adapted to the work. When steaming was first practiced there had been no steamer invented, designed expressly for the work, hence those looking for steamers were forced to take such as they could find, and they were found to answer the purpose so well that they have continued in use to the present time. The Prindle and Elmwood are late inventions, and their merits may not have become generally known. Besides, those who practice steaming frequently attach a small engine to the boiler to cut their hay and roots, saw wood, &c., and a boiler made expressly to drive an engine, and for that alone, may be presumed to be better adapted for the purpose than any other. Judging wholly from appearances, I should say the upright boiler would consume less fuel than the Prindle, and perhaps less than the Elmwood.

All the apparatus needed to go with the steamer, is a steam-box or tank for the cut feed, a steam-pipe to connect it with the boiler, a flexible pipe to heat water, cook mush, and boil roots for pigs, and a plenty of water. It is of course desirable that the water be under pressure, so that it may be let on or stopped at pleasure by a stop-cock. The tank should be made of one and one-half inch plank, double, with the grain of the inner plank at right angles with the outer, enclosed by a strong framework to prevent bulging. The top should be movable, that it may be taken off when the tank is being filled, and also should be made to fit as tight as convenient to prevent the escape of steam. An opening is made in the side near the bottom, out of which the steamed feed is taken when fed to stock. This is closed by a heavy swing door, made to fit tight. The size of this tank should correspond with the number of cattle to be fed. Mr. Birnie's is six feet square and eight feet deep, and will hold feed enough for fifty head of cattle three and one-half days. Messrs. Wells have a tank six by seven and eight feet deep. Some writers recommend tanks costing much more than these, and constructed in a very different manner, but those who are using tanks constructed in the manner above described are well satisfied with them, and assured me that when necessity compelled them to construct new ones they should build in the same manner with lighter lumber and at a less cost. These, together with a cask in which to cook food for the pigs, are all the fixtures needed on a common farm.

The boiler room should be constructed with a fire proof floor. The management of the boiler and the vat must depend upon the arrangement of the barn. It is desirable of course that they be located as near each other as possible, to avoid an expenditure of steam, but they may be separated a hundred feet or more if necessary. The objection to their being separated far is, that a greater pressure is required to drive the steam through that length of pipe, and also that there is a waste of steam in heating that length of pipe. The tank containing the feed should be situated on the same floor with the stock to be fed. The boiler may be upon the same floor, or in the basement beneath it. When food is to be cooked in considerable quantities, everything should be arranged as conveniently as possible, that the cost of labor attending its preparation may be reduced to the least possible amount. No precise directions can be given that will apply to all cases, for much must depend on other arrangements, and these other arrangements depend upon locality, and the taste and opinions of the owner. The cost of the fixtures aside from the steamer will be a mere trifle, as all will readily see. If an engine is set up to drive the feed cutter, saw the wood, &c., the cost will be correspondingly increased. Mr. O. S. Lewis, in a paper read before the Orleans County (N. Y.) Farmers' Club, describes his arrangements in full. An eight horse-power boiler is used to drive a six horse-power engine. The engine runs a feed cutter, steams the feed, pumps the water for the stock, grates the roots, threshes the grain, saws the wood, shells the corn and grinds it. The whole machinery for cutting, shelling, grinding and steaming cost $850.

Augustus Whitman wrote me that his boiler and a four horse-power engine with all the fixtures cost, set up last autumn, $562, and added that this cost was not high.

Of course none but extensive farmers, with abundant means, would set up such fixtures as the above, in connection with a feed steamer; and these figures are inserted only to show that even all those appliances are not beyond the reach of many of our first class farmers. Small farmers, searching for the cost of a steamer for steaming food alone, should not lose sight of the small figures before named, in viewing these larger.

When it becomes necessary to steam a "batch" of food, the fire is lighted under the boiler, and the men go to cutting feed. The cover is removed from the vat, and the cut feed, after being mixed with the meal or shorts used, and thoroughly wet, is trodden firmly into the vat. This is continued until the vat is full, when the cover is adjusted and the mass left to steam. The steam pipe enters the vat at the bottom, and the steam is kept up till the whole mass is cooked, and steam escapes from the top. This requires from two to three hours, according to the amount of food steamed. Different kinds of fodder—such as straw, corn-fodder, swale hay, and good hay, are usually mixed when steamed. The flavor of the good fodder pervades the whole mass; and all, coarse as well as fine, is softened and made palatable and nutritious. Cattle eat it with increased relish and all is consumed without waste. The day of my visit to Mr. Birnie's stables chanced to be the day devoted to steaming. On approaching the stable and before entering, that peculiar pungent aroma, so regaling to the appetite and so inviting to the smell, was plainly perceptible; and on entering, the stable was found filled with the fragrant odor. The same odor characterizes the feed after the process of steaming is completed, though three-fourths of it be made up of corn-fodder and straw or cheap hay. So completely are the qualities of the different kinds mingled, that all alike is greedily eaten, and no choice made. Mouldy and mow-burnt hay is rendered palatable, and all injurious effects from the long continued feeding of such, usually made apparent, are completely overcome by the steaming. Indeed it is one of the strong points made by those who have practiced it longest, that cheap or injured hay can be fed with greater economy, compared with good hay, when steamed, than if fed dry and whole.

The increased cost attending this process is a question which likely presents itself at this point, and quite likely has been in the minds of some from the first. And it is well to consider it carefully, for when taken in the hand and handled, it does not appear so frightful as when viewed at a distance. Two men will cut a half ton of hay by hand power in two hours, or will do it in half that time if the cutter is propelled by horse or steam power.

Sprinkling, mixing meal and treading into the tank will take up another half hour. Just here the cost of *labor* ends. The fuel required for that amount of hay, is from thirty to forty pounds of coal, or its equivalent in wood—the coal costing fifteen or twenty cents, and the wood perhaps less, according to locality. The half ton of hay will feed twenty head of mature animals two days. The labor of giving the feed to the animals is less when steamed than it is when fed dry. While the process of steaming is going on, all the food for the pigs can be cooked, thus saving any consumption of fuel for that purpose alone. The actual cost, therefore, will be reduced to a very small figure per diem.

Another, and still more important consideration, is the health and thrift of the animals when fed in this manner. However much may be saved in the expense of keeping, if the general health of the animals is impaired, if the constitution is injured, if longevity is not promoted, the practice cannot be recommended, and never will extend. Realizing the importance of this when viewing stock under this treatment, I took special pains to ascertain their health by close examination and by searching inquiries of those who had the stock in charge. Special pains was taken to see and examine the young stock, the calves and yearlings, and note their appearance. In no case could any ill effects from the practice be detected. The Messrs. Wells, who, as before stated, have steamed for eleven years, have one of the finest looking herds it was ever my pleasure to examine. Over fifty head stood in their stalls, all in high condition, not one of which showed any sign of disease. Their eyes were bright, their coats sleek and glossy, their skin clean and soft to the touch. Some of the cows were quite old, and had been regular breeders every year. At Mr. Birnie's was a large number of young animals, some of which were in the yards taking their daily exercise. There could be no doubt to an observer that they were in perfect health and thrift. E. W. Stewart, in a communication published in Hearth and Home, says he has fairly tested the effect of cooked food on the health of horses, cattle and sheep, and he knows of no instance to give countenance to the idea that it is in any way injurious. He further says that he owns three horses which have been fed on cooked food for twelve winters. Their work has been mostly to draw loads to and from the city, fifteen miles distant. At eighteen years old they are able to do good work, and instead of having their stamina injured he believes that had they not been fed in the manner they have they would have long since been broken down. He has come to regard steamed food as a specific for colds and incipient heaves in horses.

This is reliable testimony, from a man who knows whereof he speaks; and when we consider what the change is which the food has gone through in the process of steaming, we shall not be led to doubt it. It is softened, is more easily digested, and more can be assimilated than when fed dry. Cooked hay is more laxative than in a dry state, and so is grass more laxative than after being dried; and yet grass is the nearest perfect of any cattle food we have. No cooking can render dry hay more succulent than grass. I am, therefore, safe in the opinion that no fears need be entertained on this point, if among all those who have practiced it longest no testimony can be found of any injurious effects.

"Honestly, now, *is steamed food for cattle practicable among common farmers?* Is it not rather a fancy operation, fit to be indulged in only by fancy farmers—retired business men, men of wealth, who may as well spend their money in this way as in any other notion which fancy may dictate?" These may be honest questions, honestly asked, or they may be intended as a sneer at what are sometimes termed "fancy farmers." Among those "fancy farmers," however, many of the best practices originate, and it is only by their example, by their influence, long and stoutly resisted it may be, that we are lifted out of the deeply worn ruts in which we have been long driving, and started on the highway of progress. I take the question as honestly asked, and consider it in the same spirit.

When you take into consideration the advantages derived from the practice, when you consider the great saving made, when you figure up the cost attending it, what do you find to hinder a man of small means adopting it? The cost? This is not the case. It has been but a few years since the fact was accepted that the grass crop was to be cut by the mowing machine. Yet where is the man owning twenty acres of smooth mowing, whether incumbered by debt or not, that does not own a mowing machine? The fact is he cannot afford to do without it, rich or poor. Here is a machine—a steamer—costing less than the mower, and if it is as valuable to him and he can be made to see that it is, why cannot he possess it as well as the mower? The economical expenditure of a crop of hay is certainly of more importance than the economical securing of it; for what does a crop of hay avail, if it is not so disposed of that a profit over the cost of production is realized?

Unpleasant as it may be, farmers are forced more and more every succeeding year to study the question of feeding stock, as the pastures decrease in productiveness, and the crop of hay grows "smaller by degrees" and alarmingly "less." Especially does it come up to all the farmers of New England at the present time, when empty barns and hungry cattle present a problem hard to solve. Especially *will* it come to the farmers of Maine now that the system of associated dairying is fairly inaugurated, and the farms are to be stocked with cows, and those cows are to be made to give a liberal flow of milk. The alphabet of feeding cows for milk is yet to be learned in this State. Occasionally a man has studied his way through several letters only to realize that there is still much more to learn.

It is hoped that while thought is being awakened upon feeding stock, while research is being made, the subject of steaming food may receive due attention; and that others may be induced by their own convictions to follow the pioneer example before alluded to. That there are to be broad strides of progress in agriculture I fully believe. That business on which all enterprise, all prosperity is based, is not to remain entirely stationary while other branches of industry are rapidly progressing. Compare the slow march of progress in agriculture with the rapid improvements now being made in manufactures. Fifteen years ago the steam engine was almost unknown in a shoe manufactory—to-day no extensive one is without it. The engine, as well as the school-master, is abroad. Both are educators, and both are fulfilling their mission. The school-master confers his blessings alike upon all—the farmer as well as the mechanic; and may we not have faith that steam has yet a mission for the farmer?

SEC. GOODALE. The subject before us has been treated so exhaustively that scarcely anything remains to be said upon it. It is a matter to which I have given considerable thought, and the more I have looked into it the more its great practical importance has grown upon me. I was first led to consider it from the statements of those who had used cooked food, and who seemed to be trustworthy men; and if it is true that we can virtually add a third to our forage crops by this method of feeding, and thereby keep our cattle better, and reap a much larger profit from them than we now do, there is certainly a very great gain within our reach. With regard to the testimony, I see no possibility of impeaching it; and when we come to look in detail at the several points, where is there one in which a flaw can be detected? The standard of forage for cattle is June grass; that is to say, a mixture of good English grasses in the month of June. That is the very best food you can give them. When your grass is in perfection, when it has reached the proper degree of maturity, and contains the largest amount of nutritive matter, together with all the juices, in just the condition in which the Creator designed it to do the most service, it is so good that you can find nothing else equal to it.

Now the question comes, Is there any possible way by which we can retain these same properties, or if we cannot retain them, is there any way by which we can restore them? It seems to me that this process of steaming goes far towards doing it. A good deal of our hay is necessarily cut late, and after it has passed the stage when it has the greatest amount of nutritive matter in it. More or less of the sugar, starch, gum, oil, and other nutritive substances in it become converted into woody fibre or cellulose. It appears by careful experiments that a portion of that can be reconverted into nutritive food by steaming, and if so, it is certainly a great thing to know it and to secure the benefit of it.

There has been a wide change in the practice of the farmers of Maine, so far as I have been able to observe, in the matter of cutting hay. They now generally cut earlier than formerly, and thereby secure great gain. But no man who has a large surface to cut can cut all of his grass at just the right time. Some of it may be fit to cut earlier than other parts, and some a little later; he will of course take advantage of this; but if he has many acres to go over there will be some necessarily cut later than it ought to be. Then, again, we have a large amount of comparatively coarse and innutritious fodder. Not so much straw as in grain growing sections, but we have corn-butts and corn grown especially for fodder, and this kind of food has increased largely of late. We have a great deal of what is called "meadow hay," but more properly bog or swale hay, hay not of very good flavor, and not containing a great deal of nutriment; and this can not only be much improved in flavor by cooking, but also in its nutritive qualities, by the addition of a little cake or meal, or something of that kind, so as to make a really good food of it.

Look at it from a little different point of view. Most of you have known of hogs being turned into a pasture, and where they have good grass, with a fair share of clover in it, they will get along and thrive some. But suppose you should take those hogs out of the pasture and feed them on dry hay, would they not be sure to go back? Now, if you can convert that hay into something like June grass,—if you cut it up, steam it, and break up all those little cells which contain nutritive matter, so that the hogs can assimilate the nourishment which it contains, it is very possible (and some experiments have been tried showing the fact) that they can be made to thrive on steamed hay.

There is another aspect in which you can look at it. All animal heat is furnished by food just as all strength comes from food; and it comes in this way. The food is digested, the carbon in it is oxidized,—it is, in fact, the same as if slowly burned, and heat is given out in the system. Now, all the heat you put into your food when you steam it, is actually equivalent to a given amount of food, and you get so much out of your wood or coal. Mr. Gilbert spoke of the health of animals being much improved by the practice; and if you will look to the bottom of the trouble with regard to the health of your animals in winter, you will find, I think, that most of it arises from the causes which induce constipation. They do not generally get laxative food enough at that season; they get "bound up," as we say, then their hair begins to "stare," and they are not comfortably well and do not thrive. The steaming of food has a very good effect in such cases. Many use roots to a limited extent, and a great part of the efficacy of roots, when so used, is due to their effect in opening the bowels, and the same result is effected by the use of food which has been thoroughly steamed.

There is still another benefit to be derived from it, which, if I recollect aright, the speaker did not allude to, and that is, that the manure from animals fed on steamed food is nearer ready for application to the soil, it will give fertilizing effects sooner than such as contains much undigested matter. In the first place, you get more nourishment from the food, and what remains for manure is in better condition.

The more I think upon this subject, the more its importance grows upon me, and I am convinced that the time will come, and not a generation hence either, when the practice of steaming food will be generally adopted. We need not look one generation back to find mowing machines very scarce, but now a man who has twenty or thirty acres of grass can hardly afford to be without a mower. Twenty years ago when you talked with him about cutting grass by horse-power he looked very incredulous. True, the machines were very imperfect then to what they are now, and I have no doubt that great improvement will be made in steamers. Even now you can put in a good enough steaming apparatus at the cost of a mowing machine. Where is the farmer to-day owning one mower, who would not buy another to-morrow, if he was convinced that by running it he could increase his grass crop one-third ?—and if you can make what you have do a third more service, is not that as well ?

There is one point to which Mr. Gilbert did not allude, upon which I would be glad to have the result of his observations, and that is, whether a steaming apparatus necessarily involves increased risk from fire.

Mr. Gilbert. That is a point to which I gave very careful consideration, and one that I was aware would arise in the mind of every practical farmer. The idea prevails that fire in the vicinity of a barn greatly increases the risk, but if you take into consideration the fact, that in every house, several fires are usually kept burning in winter, and at least one during nearly all the warm season; and the further fact, that very few of the fires that occur are caused by these conveniences, you will see that the risk is not much greater from having those fires in the house. The arrangements are such that they are almost perfectly safe, and when fires occur, it is from carelessness in handling combustible material, or lighted lamps, or something of that kind used in the house or buildings. With equal care in the construction of your steaming apparatus, and in the arrangement of your room, the risk of fire is very little increased. You may have for the steaming room an earth floor, a brick floor, a cement floor, or a paved floor, at less cost than a wooden one, and you thereby render that room almost fire-proof, so far as your steamer is concerned, unless there is a defect in some of the connections. No fire can come from a thoroughly built chimney, unless it comes by way of sparks from the top, and very seldom does anything of that kind occur; occasionally, in the hot weather of summer, a building is burned from sparks flying from the chimney; but even in that case, a barn is as liable, perhaps, to take fire from the house chimney as it would be from a chimney connected with a steamer. In consideration of all the facts, I am inclined to think that the idea of increased risk from fire is a bugbear that will disappear when the practice becomes general.

Mr. Hersey of Lincoln. I would like to know if Mr. Gilbert has seen sheep fed upon cooked food?

Mr. Gilbert. I saw one small flock of sheep so fed, but I am not able to give the result in that case. I have the testimony of various individuals in my possession, which the length of my paper would not allow me to quote from, giving their experience in reference to sheep as well as other stock, and in every case, with all kinds of animals eating hay and straw, the result is the same—great advantage from the use of steamed food.

Sec. Goodale. There is still another aspect in which we can look at this matter. When we use poor or coarse fodder, it is difficult to induce animals to eat enough of it to gain much; the most we can expect from it is to keep them along. It is proper to look upon each animal as a machine to manufacture something; to convert vegetable products into animal products, into milk, or growth, or strength for labor. It takes a certain amount of food to keep that machine running. It takes a certain amount to furnish animal force for locomotion, to keep the machine in running order, fit to manufacture what you desire. Now, when you give only coarse, poor fodder, all which the animal can be induced to eat will furnish only about enough for this purpose; there is no absolute gain. But if by steaming the food and rendering it more palatable you can induce them to eat more, and by rendering it both more nutritious and more digestible you can enable them to convert that additional amount into milk or meat, you obtain positive gain. This furnishes an explanation of the large increase in the quantity of milk yielded, as stated by Mr. Gilbert in his lecture. If you can get a given amount of milk, or meat, or strength for labor—animal force—from three animals, by means of cooked food, when it would require six to give you that amount if they were fed on uncooked food, then you have a gain of one-half of all it costs to keep them—I mean, to keep them alive and just in condition to go along. So that I believe it is practicable to get along with a much smaller number of cattle and get the same results by means of cooking, for that reason—they will eat, digest, assimilate and convert into valuable products, a larger amount, at a smaller cost for running the machinery.

Mr. Robinson of Piscataquis. I listened with great interest to the essay of the gentleman from Androscoggin. The plan seems to have theoretical merits, at least, and if it could be reduced to practice, it would have practical merits. The trouble is the old one, "The destruction of the poor is their poverty." A man with thirty head of cattle must have a farm that will cut about one hundred tons of hay. With such a force, undoubtedly, this process would be a great advantage. The point here is to reduce it to practice in such a way that it shall be valuable to the average farmer on a farm in the State of Maine. One apparatus has been named costing $800; others are cheaper; but there is many a farm in this State which yields a comfortable support to its owner and his family which can be bought for that sum—and that farmer lacks the means to invest a large sum in a steaming apparatus however desirable it may be. I wish to ask of the Secretary if this process of steaming adds anything to the intrinsic amount of nourishing matter contained in the fodder, and I wish further to know if there is not some other way, some cheaper mode of accomplishing the same object.

Sec. Goodale. It adds only in this way, as I conceive, that which is indigestible and unavailable is converted into a form in which the animal can digest it and assimilate the nourishment contained in it, and thus thrive upon it;—just as smelting ore adds nothing to the iron or other metal in it, but it converts it into a form possessing practical value, when before it was useless.

Mr. Hersey. I would ask Mr. Gilbert if an apparatus sufficient for a common farmer could not be made quite cheaply?

Mr. Gilbert. I was thinking to reply to Mr. Robinson that I hoped he would consider the small figures which I presented, as well as the large ones. In case of that costing $800 there was a steam engine of six horse-power, connected with a boiler of eight horse-power, both greatly beyond the needs of our common farmers, as well as a large amount of other machinery. I said, also, that good and sufficient apparatus for a stock of twenty to thirty head of cattle could be had for one hundred dollars, or even less; and farther, I will now say, that if any one wishes to test the plan, he can do so after a fashion which will, at least, serve to satisfy himself whether he could do well to be at the expense of an apparatus specially designed for the purpose, at an exceedingly moderate outlay; and in this way: you all doubtless have a common farmer's boiler in which you cook food for your swine. It would not cost much to provide a water-tight cask with a close-fitting cover, which would hold the cut feed to be steamed; perhaps you have one without buying it; it would not cost much to provide an iron pipe, such as you could get of any gas-fitter, to conduct steam from the boiler into the bottom of the cask. Now, then, fit a stout wooden cover to the boiler, to be screwed on to the rim, and made tight by steam packing; that constitutes your steam boiler. Into its cover screw the iron pipe, the pipe being of suitable length and having the necessary bends, and leading to the bottom of the cask. Have also in the cover a hole, to be closed with a cork; that will serve as a safety-valve, and through it you can pour your water into your boiler—that is all. Fill the cask with the cut fodder, mixed with what meal or bran you propose to add to it; have the boiler half full of water, cork the hole in the cover of the boiler, and put the close-fitting cover of the cask into its place, and then put fire under the boiler. The steaming of the feed can then be accomplished. Of course, unless the boiler is of good size and the cask a very large one, you cannot steam enough at once for two or three days for a large stock, but you can steam every day, and enough to give the plan a pretty fair trial.

SEC. GOODALE. Would you not thoroughly moisten the feed before it goes into the cask?

MR. GILBERT. Certainly, always. It is next to impossible to steam cattle food unless it has been thoroughly moistened. It should first have as much water as it will take up.

MR. HERSEY. How soon after it is steamed will it be cool enough to feed out?

MR. GILBERT. Usually, they begin in the morning, cut their food, and build the fire under the boiler. They get up steam in the course of twenty minutes, and steaming goes on while they fill the tank with food, and by noon it is sufficiently cooked; say in two and a half or three hours. Then the fire goes down, and at night they feed it out. It is rather hot still, but if you have practiced feeding much to cows in winter you know they will take it pretty warm.

MR. CHAMBERLAIN. The question was well put by the member from Piscataquis whether there was any other method by which we could secure the benefit which is realized by cutting and steaming. If there is I know not what it can be, except possibly, by cutting and grinding the coarse fodder, which might be of partial assistance. But even this would involve the use of machinery which does not exist, and to create it would be more expensive than to obtain suitable apparatus for steaming. The latter would be both the cheaper and more effective mode.

SEC. GOODALE. The inquiry brought to mind a paper published in the last number of the Journal of the Royal Agricultural Society of England, by Dr. Voelcker, Chemist to that Society, a very able man, and careful in his statements. He alludes to a method of preparing straw for cattle food which has been practiced for some years by a Mr. Jonas with highly satisfactory results. It interested me very much, and was suggestive in relation to other points connected with cattle food. It is simply this: Like many of the large farmers there, Mr. Jonas employs a steam engine to thresh his grain. The straw is cut into chaff at the same time and by the same power. With each ton of the straw chaff he mixes a hundred weight of green rye or green tares, which is also cut fine, and a bushel of salt. The mixture, as I understand, is trodden close and soon generates heat, which effects a sort of slow cooking by which the woody fibre is chemically changed into something more easily, or more fully digestible by the animals than the cellulose of which the straw largely consists. At the same time the texture of the straw is softened, and the whole mass becomes impregnated with a pleasant flavor closely resembling that of good hay. The results attained by feeding straw thus prepared show that its nutritive power is greatly increased by the process.

Now for the suggestions, or corollary. We all know that there is a method of curing hay which latterly has come into use among some farmers in this State, which has excited considerable interest and not a little controversy. We heard something about it at our session in Farmington last winter. The grass is cut as soon as the dew is fairly off, and after drying what it will during a few hours, is put into the barn in the afternoon of the same day. When a mow is full they cover it with a foot in depth of straw; and it is claimed that hay thus treated is equal in flavor and in nourishing power to any hay whatever. Other good farmers and equally trustworthy men, tell us that they have tried this same method and that the hay was spoiled; that it was a dead loss, or fit only for manure.

In my feeble attempts to reconcile the conflicting testimony, and to sift truth from error, I have got so far as this; that the probabilities are that the grass which is successfully cured by this method is never cut very early, never cut when it contains the largest amount of nutritive constituents; in fact, when questioned as to the stage of maturity in which it is cut, the answer usually is, "in the second blossom," and when that is you know as well as I. It is probably after a portion of the sugar, gum, starch, etc., have been converted into woody fibre, and at the same time a good deal of the moisture contained in the grass during its early bloom has exhaled from it. In this condition, or rather, dried a little beyond this point, it goes to the barn, and if it came out as it went in, I cannot understand how it could be truthfully said to possess so good a flavor and to be so nutritious as is asserted. But if it is true that the heat to which that late cut hay is subjected in the mow, and that heat is represented as being very considerable and continued for a good while, I say, if that heat slowly cooks it, if it reconverts woody fibre into gum, sugar, starch and albumen, or if it causes chemical changes in its constitution equivalent to such a reconversion, then we may readily believe that this method has sometimes been attended with success, and we may understand somewhat of the conditions upon which that success depended. We can see also that, in all probability, those whose hay was spoiled by the same method, cut their grass when it contained an amount of sugar, albumen, gum, &c., which *needed only preservation,* and could not safely be subjected to so great heat, and especially if accompanied with so much moisture as grass contains at that stage, or diminished by only a few hours of drying exposure.

Adjourned to afternoon.

It seems well to insert in this connection the letter of Mr. Jonas to the Secretary of the Royal Agricultural Society, together with Dr. Voelcker's paper giving the results of his investigations concerning the actual and comparative value of straw prepared by Mr. Jonas' method:

To H. M. Jenkins, Esq.

Dear Sir:—The following note is written in compliance with your request from the Journal Committee, that I would furnish them with my opinion of the value of straw-chaff for feeding purposes, and the best manner of preserving the same. I had for many years been a great advocate for the consumption of a large portion of straw-chaff for feeding purposes before we had the advantage of the scientific aid of such a man as Prof. Voelcker, who in volume 21 of our Journal furnishes us with an analytical statement of the materials contained in the straw of our cereal crops, which is highly valuable and satisfactory. Some years ago our chaff was cut by hand, and used fresh from the knife without the least fermentation, and was consequently little used by us, or appreciated by our cattle and sheep. Since then a plan has gradually been adopted in this locality, of cutting and storing chaff in a large mass, and using it when from six to twelve months old. It is, if well managed, thus rendered by fermentation as sweet as well made hay, and eaten by our flocks with great avidity. It has in two seasons, with no turnips, enabled me to winter my sheep and fold the land, leaving sufficient folding to produce a good crop of barley, not from the chaff alone, but from its being the means by which I enabled my sheep to consume with it large quantities of bran, malt culms and oilcake, sufficient to keep them in good health and condition, and to leave the land in a good state for the following crop of barley, which I could not have done by any other means. The turnips were such a complete failure, that the same two winters all my fat cattle were fed, without having a root to eat. I had two coppers hung in the mixing house, ground my corn, and broke my cake with an American mill. These were mixed together with malt culms and boiled, and after a certain time were emptied boiling hot into a prepared bed of my old straw chaff; these were stirred over, and mixed well together, and used for the stock in a warm state. They did well so fed, and became good fat bullocks and paid for the expense of attendance and food, which they very seldom do.

One of my sons has carried out this plan by fattening sheep in a yard well littered with wheat straw, (which is better than barley straw for their feet,) and feeding them entirely with boiled food and straw-chaff, no roots. These sheep paid very well for their food. Myself and sons have carried out this system of storing old chaff to such an extent, that we are using on our occupation, (which consists of 4,200 acres of arable land,) seven barns, which were previously used for storing corn. My plan of cutting and storing is as follows:

I use a twelve horse-power engine, by Horsby, which enables me (when used on home premises) to thresh, dress, and sack the corn ready for market, and cut the straw into chaff. I use one of Maynard's powerful chaff-cutters, which sifts and puts the chaff into bags ready for being carried into the chaff-house. The straw when delivered from the threshing machine, is carried by rollers to the height of nine feet; it then comes down an inclined plane. Three men get in the straw and hand it to the chaff cutter; it is then cut and carried into the chaff barn and well trodden down, mixing about a bushel of salt to every ton, and also a certain quantity of green stuff. Tares or rye cut green into chaff are sown by hand as the chaff is brought in. This causes it to heat, and adding the amount of green stuff required to give it a proper heat is the secret of the successful operation of storing chaff.

Respecting the quantity of green chaff to be mixed with straw chaff to cause a proper fermentation: I use about one cwt. to the ton of straw-chaff, and one bushel of salt to the ton of chaff. But some judgment is required as to the state of the green stuff. If it is green rye in the ear, a full cwt. is required; if very green tares, a rather less quantity will do, as the degree of ermentation depends upon the quantity of sap contained in it. This is done in spring and summer; the chaff is not used till October and the winter months—I can thus thresh and dress the corn crops, and cut the straw into chaff in one process; the expense of cutting and storing the same being about one shilling per acre—the principal additional expense is for about four hundred weight of coal per day, and we thresh and cut from eight to ten acres per day. I am not stating that straw-chaff can be rendered as valuable as hay-chaff for feeding purposes, but that it may, by judicious management, be made a very important auxiliary to the production of meat food for our fast increasing population. I agree with Prof. Voelcker, that the straw used for chaff should be wheat and oat, for these may be cut without loss in a far greener state than is generally done; but barley, to be of good quality, cannot fairly be cut too ripe.

Yours faithfully,

SAM'L JONAS.

Chrishall Grange, Saffron Walden,
November 6th.

ON THE BEST MODE OF PREPARING STRAW-CHAFF FOR FEEDING PURPOSES. By DR. AUGUSTUS VOELCKER, F. R. S.

In Volume VI. Part 1, 1870, of this Journal, Mr. Samuel Jonas, of Chrishall Grange, Saffron Walden, gave an interesting account of a plan of preparing straw-chaff for feeding purposes, and preserving it for winter use, which he found extremely useful in practice.

The peculiarity of Mr. Jonas's plan consists in the use of a small quantity of green rye, or green tares, as a fermenting agent.

Mr. Jonas, who for many years has been a great advocate for the consumption of a large portion of straw-chaff for feeding purposes, uses a 12 horse-power engine, by Hornsby, for threshing, dressing, and bagging the corn ready for market, and cutting the straw into chaff at the same time. With a ton of straw-chaff he uses about one cwt. of rye or tares, cut green into chaff, and one bushel of common salt. This is done in spring and summer; the chaff is not used until October or the winter months.

The addition of the green stuff causes the straw-chaff mixture to heat; the volatile and odoriferous principles produced by the fermentation are retained by the straw-chaff, itself undergoing a kind of slow cooking process, and they impregnate the whole mass with an extremely pleasant flavor, scarcely inferior to that which characterizes well made meadow hay.*

It appeared to me interesting, if not useful, to compare the nutritive properties of straw-chaff prepared according to Mr. Jonas's plan with ordinary wheat-staw, and I therefore made a careful analysis of a sample of chaff taken from the bulk at Chrishall Grange, and kindly supplied to me by Mr. Jonas.

The following results were obtained in the analysis of this straw-chaff:

Moisture	7.76
Oil and fatty matter	1 60
Albuminous compounds (flesh-forming matters)†	4.19
Sugar, gum, and other organic compounds, soluble in water	10.16
Digestible fibre	35 74
Woody fibre (cellulose)	34.54
Insoluble mineral matter (chiefly silica)	3.20
Saline mineral matters (chiefly common salt)	2.81
	100.00
† Containing nitrogen	.67

In explanation of the term woody fibre (Cellulose) in the preceding analysis, I would observe that it applies to that portion of the straw-chaff which remains behind after successively boiling the material with water, dilute sulphuric acid, and dilute caustic potash solution, and exhausting the residual dried substance with alcohol and ether. There can be no doubt that the different alkaline and acid secretions in the animal organism exercise similar, probably even more, energetic effects upon straw than these successive exhaustions with various chemical agents in the laboratory. The treatment with dilute acid and alkali, therefore, affords a better

* It should scarcely be necesssary to remind the reader that, in England, and in fact almost anywhere out of Maine, by "meadow hay" is understood not bog or swale hay, but what is often called here "English hay"—that is, a mixture of the most nutritious grasses of upland growth. S. L.

insight into the digestibility of the bulk of straw than the mere exhaustion with water. Let us now compare the preceding analytical results with the composition of ordinary wheat-chaff.

The following is the composition of a sample of well-harvested wheat-straw, which was neither under nor over ripe:

Moisture	13.33
Oil and fatty matter	1.74
Albuminous compounds (flesh-forming matters)*	2.93
Sugar, gum, and other organic compounds soluble in water	4.26
Digestible fibre	19.40
Woody fibre (cellulose)	54.13
Insoluble mineral matter (chiefly silica)	3.08
Saline soluble mineral substances	1.13
	100.00
* Containing nitrogen	.47

A comparison of the composition of ordinary good wheat-straw with that of straw-chaff prepared by the system pursued by Mr. Jonas brings out several points of interest, on which a few observations deserve to be made.

1. In the first place, it may be remarked that both kinds of straw-chaff contain about the same proportion of oil. The oil exhausted from straw by means of ether has a bright yellow color, is sweet to the taste, and renders straw more palatable and more nutritious than it would be without this constituent. It is appreciable in quantity, for according to the preceding data 1 ton of straw-chaff contains about 39 lbs. of oil.

2. It will be seen that fermented straw-chaff contains rather more than 4 per cent. of albuminous or flesh-forming compounds, whereas ordinary wheat-straw contains in round numbers only 3 per cent. The prepared wheat-chaff, therefore, is one-third richer in materials which produce the substance of the lean fibre of meat, or the muscle.

3. Common wheat-straw of good quality contains about 4½ per cent. of sugar, gum, and similar soluble organic compounds. In over-ripe straw the amount of these soluble matters is less. On the other hand, in the sample of fermented straw-chaff analyzed by me, the percentage of sugar, gum, &c., amounted to 10.16, or to nearly two and a half times the amount which occurs in good unprepared wheat-straw. The much larger proportion of sugar and other soluble matters in the fermented straw, no doubt, is due to the green stuff employed in its preparation; but at the same time, the process of heating the mixture, it is quite probable, may have had the effect of rendering the chaff more soluble in water.

Bearing in mind that the chaff prepared by Mr. Jonas contains so large a proportion of succulent matter, it is no wonder that cattle and sheep are fond of it, and thrive upon it in a much higher degree than upon ordinary wheat-straw.

4. A comparison of the relative proportions of digestible and of woody fibre in fermented wheat-chaff, with their proportions in common wheat-straw, exhibits striking differences, which cannot fail to arrest the attention of stock-feeders.

Taking together digestible and woody fibre, we have in the fermented straw-chaff 70.38 per cent., and in ordinary wheat-straw 73.53 per cent.; showing a slight difference in favor of the fermented chaff, which, being richer in sugar and other matters soluble in water, contains about three per cent. less vegetable fibre than common wheat-straw.

When the vegetable fibre of each kind of straw-chaff, or the material insoluble in cold and boiling water, is treated with dilute acid and alkalies of the same strength, for the same length of time, and in all other respects precisely alike, a certain proportion of the vegetable fibre is rendered soluble. This soluble portion figures in the preceding analysis as digestible fibre, whilst the matters insoluble after treatment with the various chemical agents is termed indigestible or woody fibre (Cellulose.)

Although it is not meant to convey by those terms the idea that animals have the power of resolving crude vegetable fibre into digestible and into woody fibre, in precisely the same ratio in which we can separate them in the laboratory, a tolerably good opinion may be formed of the relative digestibility of various foods consisting principally of vegetable fibre, by submitting them to the process usually employed in laboratories for the determination of woody fibre.

In the cases before us, it will be seen that, of the total amount of vegetable fibre present in the fermented wheat-chaff, 35¾ per cent. were rendered soluble by the treatment described, and 34½ per cent. (in round numbers) left behind as indigestible woody fibre, whilst the 73½ per cent. of vegetable fibre present in common wheat-straw chaff were resolved, by treatment with dilute acid and alkaline liquid, into 19½ per cent. only of digestible, and into 54 per cent. of indigestible, woody fibre. In other words, the same treatment rendered soluble 50.85 per cent. of the vegetable fibre of the fermented prepared chaff, and only 26.38 per cent. of the fibre of common wheat-straw.

These differences are very marked, and well calculated to explain, in a great measure, the great superiority of the fermented chaff as a feeding material over common straw-chaff.

The fermentation to which the straw is submitted in Mr. Jonas's plan thus has the effect of rendering the hard and dry substance which constitutes the bulk of straw more soluble and digestible than it is in its natural condition. But useful as the effect of the slow and moist heat, developed in the mixture of straw-chaff with green rye or cut tares, no doubt is in rendering the fibre of the chaff more digestible, this is not the only recommendation of Mr. Jonas's admirable plan of preparing a really very nutritive and important food for stock.

Another recommendation is the extremely delicate flavor and the palatable condition which is conferred upon the straw in the process of fermentation. The prepared straw-chaff, kindly sent to me by Mr. Jonas, had all the agreeable smell which characterizes good green meadow hay, and a hot infusion with water produced a liquid which could hardly be distinguished from hay-tea.

Although fermented chaff resembles hay so much in taste and smell, it need hardly be stated that the latter is more valuable for feeding purposes. However, the differences in the nutritive properties of meadow-hay and straw-chaff made from rather under-ripe wheat-straw, prepared and fermented in accordance with Mr. Jonas's directions is not so great as might be imagined by some. A little cake ground into meal and sprinkled over the chaff would go far to obliterate the difference in the feeding quality of the two kinds of chaff.

I would particularly recommend for that purpose a cake rich in albuminous compounds. Green German rape-cake or decorticated cotton-cake, added to the straw-chaff in but small quantities, will bring up the percentage of albuminous compounds to what it is in good meadow-hay. Best decorticated cotton-cake contains about 40 per cent., green rape-cake about 33 per cent., and the finest linseed-cake from 30 to 32 per cent. of albuminous compounds. About 2 cwts. of decorticated cotton-cake ground into meal and added to one ton of fermented straw-chaff, presuming it to have always the same composition as the sample analysed by me, I find constitutes a mixture which agrees closely in composition with good meadow-hay.

In order to enable others to compound a mixed food from straw-chaff, resembling in composition good meadow-hay, I have placed in the following Table the analyses of ordinary wheat-straw, of the fermented sample, and the mean results of 25 analyses of common meadow-hay :

	Compositions of		
	Common Meadow Hay.	Fermented and prepared Straw-chaff.	Wheat Straw-chaff
Moisture	14.61	7.76	13.33
Oil and fatty matter	2.56	1.60	1.74
Albuminous compounds (flesh-forming matters)*	8.44	4.19	2.93
Sugar, gum and other soluble organic compounds.	41.07	10.16	4.26
Digestible fibre	....	35.74	19.40
Indigestible woody fibre (cellulose)	27.16	34.54	54,13
Mineral matter (ash)	6.16	6.01	4.21
	100.00	100.00	100 00
* Containing nitrogen	1.35	.67	.47

Meadow-hay, it will be seen, contains rather more than twice as much albuminous or flesh-forming matter as the sample of straw-chaff of which the analysis is here given; hence the advisability to add to the latter some oil-cake, which, moreover, will have the effect of raising the percentage of oil, and bringing it up to about the same amount as is found in meadow-hay.

Chaff, especially if it be made from over-ripe straw, is not much liked by sheep or cattle, on account of its insipid taste and harshness; and considerable difficulty is experienced to induce stock to consume straw-chaff in as large a quantity as is desirable. To meet this difficulty, several stock-feeders with whom I am acquainted have found it useful in practice to use straw-chaff with some treacle previously diluted with sufficient water to impregnate uniformly the chaff with the sweet liquid. The only fault I have to find with this otherwise good plan of rendering chaff more palatable, is that the farmer has to pay from 13*l.* to 14*l.* per ton for the treacle, and obtains in that material only about 54 to 60 per cent. of sugar, the rest being water and impurities of no feeding value.

By Mr. Jonas's plan straw-chaff is not merely made more palatable, but, as it is mixed with a little green food, it undergoes a slow cooking process, and becomes more digestible, and permeated by a delicate hay-flavor. Thus the most is made both of the green stuff and the straw, and an excellent food is produced at a trifling expense, greatly superior in feeding properties to treacled ordinary straw-chaff, which costs more money.

The great simplicity of preparing and storing straw-chaff, and the inexpensiveness of Mr. Jonas's plan, are further advantages, which all who consume much straw for feeding purposes may secure to themselves.

The more one looks into this subject, the more one becomes impressed with the great practical value of Mr. Jonas's plan of preparing a most useful and nutritious auxiliary food; and it is much to be desired that this extremely simple, inexpensive, and in all respects excellent plan of dealing with straw for feeding purposes may be spread throughout the length and breadth of the country.

11, Salisbury Square, Fleet Street, E. C.,
1871.

AFTERNOON SESSION.

The first paper read was by Hon. Samuel Wasson, on

THE COMPARATIVE VALUE OF HAY AND INDIAN CORN.

The manuscript having failed to reach me, I am unable to present it here. The conclusions reached by the writer agreed substantially with the opinions expressed in the discussion which followed.

WARREN PERCIVAL of Kennebec. I have never made careful experiments to determine the comparative value of corn and hay. I am no chemist or physiologist; I have never steamed food; but I have had a plain farmer's eye to the value of corn, compared with hay and I think it depends very much upon circumstances how much corn equals a ton of hay. It depends partly upon how it is fed, to what animals, and at what time it is fed. Corn fed to a working horse is worth decidedly more than if fed to a milch cow or to growing animals. It depends also on how it is fed, whether cooked or raw, ground or unground; whether it is fed wet or dry; whether with hay, with straw, or with roots. In a general way, I may say that as usually fed fifteen bushels are equal to a ton of hay. I think ten bushels of Indian meal, fed by a careful feeder, a man who understands what he is about, and one ton of hay, are worth as much as two tons of English hay fed to certain animals. It is very well known that if a man understands his business, and the condition of his animals, and attends to the feeding himself, there is no loss incurred. But if you depend upon hired help, very likely the condition of your animals is not understood, and that a portion of the meal is wasted; very likely an animal will get at times double rations, and at other times half rations, which makes all the difference between ten and fifteen bushels. I regard corn at present prices as cheap, certainly, as hay at $12.00 a ton.

I find myself in this predicament: the grasshoppers have treated me roughly, as they have many others in my section. I have a large stock of thoroughbred animals, and am surrounded by people who are waiting to get nice animals at cheap prices. They ask me what I am going to do? I tell them I hardly know, but one thing is sure, if my courage and credit holds out, I shall not sell Shorthorns at four and a half cents a pound. I know there is a large grain crop in the West, that corn is for sale, and that if I can buy enough, with what hay and straw I have, with judicious feeding I can run my Shorthorns another year; and if so, you can run your Jerseys, or Herefords, or Devons, or anything that will live on hay and corn, without giving up and selling out at ruinous prices. So I have bought corn, and put it in store; I have half hay enough, and some rough fodder which must be used; I mean not a pound shall be wasted, but the whole carefully fed with the hay, and with Indian meal, having proper reference to the health and condition of the animals; and I believe that fifteen bushels of corn, and one ton of good hay, properly fed, will winter a full grown beast, and will serve for younger animals in proportion.

Mr. Adams of Franklin. I have been in the habit of feeding meal in spring to oxen and cows, and I feed it myself. My method has been to feed it at night, especially to the working oxen; and always to wet the meal. I have considered corn at $1.25 a bushel as cheap as hay at $10 a ton. When hay is worth $20 a ton, and corn sells for ninety cents a bushel, as it does now at our depot, it does seem to me that farmers can afford to buy and use it. I made up my mind, when I closed up haying, not to sell my Herefords at four cents a pound this year. They are in good condition, and I mean to keep them gaining, and that they shall pay me more than that, unless the price of corn goes out of reach. Ten bushels of corn have proved equal with me to a ton of hay; but if I were to trust to hired help it might require the other five bushels.

Mr. Wyman. I think three quarts well scalded will go further than four quarts given dry. It is better to give it at night, after they have cooled off, than in the morning; while the ox is at rest he digests hearty food better than when travelling.

Mr. Lucas. There is an important question to be taken into consideration in connection with the wintering of stock, and especially this season, when so many are short of fodder, and that is, Whether we can afford to winter stock, and if so, what kinds? My conviction is, that no farmer in Maine, nor any one in New England can afford to raise stock for beef purposes; we cannot compete with the West. The few we sell now are but as a drop in the bucket compared with what comes from the West, and these few we do sell make us poorer; we cannot get for them what they cost us. We might as well attempt to raise wheat and sell flour in competition with the great West, as to raise bullocks to sell beef. But we can profitably use on our farms a certain number of oxen for labor, or if not profitably, we are compelled to use them or abandon farming. Now, so many as are required for this purpose we may winter, even if we have to buy corn to help feed them; and so many should be well wintered, and should be generously fed all the time, summer as well as winter, so as to be pretty near choice beef at any time.

We may raise and keep, and winter over, even in a hard year as this, so many good milch cows as are needed for dairy farming; but we cannot, so far as I can see, afford to winter any whatever which are intended for beef purposes, whether yearlings or two or three years old. We never got the cost of raising the young stock which has been sold to go to Massachusetts for farmers there to fatten, not in the most favorable years; and we certainly cannot afford to winter over such stock now, in view of probable prices next year or the year after.

We all love to have horses, whether we can afford to keep them or not; we must keep some for we cannot get along without them. But, generally speaking, horses are not a source of much profit, as they are bred and raised; there might be and ought to be a great improvement in that direction; and we must winter some sheep, for on the whole sheep are profitable in their place, and we cannot do without some. It is a question, however, with many now whether swine or sheep pay the best. I suppose it depends upon circumstances. If a man has a healthy, rugged wife, used to work and really loving work so as to be happier with it than without it, I think swine kept in connection with the dairy would be very profitable; but if he has a wife unhealthy enough to be fashionable, better contented to be occupied with the piano, or in reading novels in the parlor, than with the work in the kitchen, that man had better keep sheep. What I mean to say is, that we cannot afford to keep any stock over such a winter as the next, with our present means to keep them, except such and so many as we ourselves have urgent need for. If my farm was a dairy farm I would keep as many cows as I could to advantage, and as many hogs as I could to advantage on the slops from the dairy, and make the most manure from them which I could. I would buy a yoke of the best oxen I could find, whether Shorthorns or Herefords, or grades, and I would do my work with them and turn them for beef when I could spare them from work; and so on. That is the only way that I see for our farmers to make any money by farming.

Mr. Robinson. I have followed the gentleman in his argument pretty closely, and I think if his logic is correct the only additional advice our farmers need is to close up and take to the woods, since Illinois furnishes all the beef, Ohio the hogs, Texas the sheep and Vermont and New York the butter and cheese.

Mr. Percival. I did not so understand the argument. But I would ask him where he proposes to buy his oxen? He began with great, heavy oxen, and so far as my observation goes such oxen don't drop down ready grown. They are born calves, and then they grow into yearlings and two year olds and three year olds. His plan does not provide for raising any of these, and it seems to be faulty on this score, unless he intends to send out West to get them, which would be rather a change from what has been done heretofore. We in Maine have prided ourselves somewhat in raising fine oxen, and they have invariably been dropped as calves, and not ready grown, fit for the yoke. So I go back to first principles, and will say a word about raising calves. I begin to feed meal to them pretty early, especially if the hay crop is short; and it is an important question whether the meal shall be fed wet or dry. A man is not a good farmer unless he makes a calculation in the spring to have a lot of roots in the fall to be fed with his rough fodder, his corn stalks, oat straw, wheat straw, and swale hay. Good English hay is the standard by which to judge what feed an animal wants in order to keep it well. Grass was provided by our Creator as the food for animals, and when we cannot furnish that, we must find a substitute; and when we can make a food for our animals the nearest to what our Creator designed, we have done the best we possibly can.

Many people have the idea that rough fodder is good for nothing but bedding. It is worth a good deal for bedding, but it can be used for a better purpose, provided we have some corn and roots to go with it. Make your calculation in the spring to have a large quantity of roots in the fall, and when your animals go to the barn cut the rough fodder, steam it, if you can, use roots of some kind with it, and a little meal, and make your food as nearly as possible like the food designed by nature. Begin with the calves, and they will grow until they become oxen. Meal should always be moistened before it goes into the stomach of the animal, either by steaming or by mixing it with roots, or if you cannot do this moisten it with water. You can't feed meal economically without the addition of water in some way.

As to the time of feeding, that too depends upon circumstances. When working animals come in at night, they are apt to be heated, and not in a proper condition to take this food. After they rest a while Indian meal can be safely given; that should be fed at night, long enough before they are put to labor that they may receive the proper benefit from it by thorough digestion.

Now as to feeding swine. The query was put, will hogs eat steamed hay? They will if you educate them to it. I feed my store hogs, after the pigs are taken away in the spring, upon grass. If I have a pasture to turn them into, I do so; if not, I mow and give them the grass, and, strange as it may appear, my hogs become so habituated to eating hay and grass, that in the winter, my breeding swine have actually eaten up all their bedding when it has been straw. Hogs will live upon hay; and I have no doubt they will live better upon cooked hay, especially if you cook a little meal with it. Meal is the cheapest food for hogs. I am feeding about fifty now, of all ages. I have fed my breeding swine for the last month with corn fodder, cut up and given with drink once a day. For drink I put Indian meal into a half hogshead, and add scalding water, once in two days. The meal becomes partially cooked, and settles to the bottom. I tell my men: Give those hogs that are living upon corn fodder some meal water to drink once a day, after the meal has settled, and when you get to the hogs that are to be fed better, go a little deeper; and give the pigs that are to be fed well, some of the water and some of the meal. It requires some judgment to feed it properly.

Mr. Lucas. Would you really feed cattle that were two years old last spring, and carry them through the winter, with the expectation of selling them next spring for what they are worth to-day, and the cost of keeping them through the winter in addition?

Mr. Percival. No, sir. But when you get the animals up to two years old, if they are heifers, they begin to pay for keeping, by their milk; if they are steers, you put them to work, and by the time they get to be oxen, they have paid for themselves over and over again, and you have the beef besides; we get pay as we go along and a good profit at the end.

The subject was laid on the table, and the following paper was presented by Mr. Scamman of Cumberland, on

THE CONDITION AND IMPROVEMENT OF PASTURES.

In some of our sister States, particularly in districts devoted to butter and cheese making, the pasture demands and receives more attention than the mowing field. What is true of these localities may be true of every locality. In our own State no part of the farm is of more importance, as connected with good husbandry and profitable farming, than the pasture. This is readily seen by a glance at the fact that the base of all farm improvements is the manure heap, and the base of all manure is derived from farm stock. Much time is spent in securing sufficient food for that stock during the season of the year when it can be obtained only by the foresight and provident care of man. How important then that while busy brains and hard labor are making provision for the cold winter, that all farm stock should be abundantly supplied with the rich grasses necessary to make it thrive and grow fat when it comes to the barn, requiring less to winter it than if poor, and all the time improving and making ample rewards to the farmer in growth, labor, milk and manure.

Yet, important as the pasture is, experience and observation compel us to the conclusion, that it is less thought of, and less cared for, than almost anything else about the farm. This is perhaps a strong expression. But, if any doubt it let them observe the bare knolls and barren hill-sides, the sunken ravines and submerged swamps, the running junipers, sweet fern, hardhack, lambkill, thorn bushes, briars, Canada thistles, hassocks, and a hundred and one worthless weeds and nuisances that infest so many pastures; as unfit for farm stock as pebble-stones are for soups, or sawdust for puddings. This is no overdrawn picture, for many a farm stock is turned into just such a pasture and expected to live, thrive, and grow fat. The owner of such a pasture may work hard to improve and enrich his fields, but seems rarely to consider that good grasses and luxuriant feed will no more grow among weeds and bushes, and without manure in the pasture, than they will in the field. In the newly settled portions of our State, and on some of our intervales and ravines, are found many rich and luxuriant pastures, but these are the exceptions and not the rule, especially in the older portions of the State.

It is astonishing to see how the dry seasons of the past two years have affected many pastures; causing almost all vegetation to cease, becoming as barren and dry as if fire had passed over them. Pastures that once carried large herds of cattle, horses, and sheep, will hardly support half a dozen cows. Such is the condition of many of our pastures.

Now the question very properly and naturally arises, can anything be done to remedy this state of things? and what? The question is well answered in one of the maxims of an old English farmer, "feed your land before it is hungry, rest it before it is weary, weed it before it is foul." Yet it will be necessary to be a little more particular in the investigation of this important subject, and inquire somewhat into the causes that have brought about the deterioration which exists, and allude to some of the remedies that may be applied, calculated to secure the object in view.

The practice of many farmers of turning out their stock in early spring, before the ground becomes settled and the sod firm, thus poaching them up and tearing out the grass roots, and keeping them there until the snows of winter force them to give shelter in the sheds and barns, has had much to do with making our pastures what they are, and should never be repeated.

Again, many of our pastures have been overstocked and consequently too closely fed year after year, until they are literally starved to death; a result perfectly in accordance with the laws of vegetation, of production, and reproduction. For when the soil becomes exhausted of the elements entering into and constituting food for the grasses, they must necessarily dwindle and die. This close feeding by farm stock, and the closer feeding by the grasshopper the present year in some localities, have stripped the roots of every leaf of foliage, depriving the plant of its breathing apparatus by which it absorbs nutriment from the atmosphere, and vitalizes that drawn from the soil by the roots. Hence their forlorn appearance.

Now if something is not done to reseed or somehow to renovate these pastures, many of them will come up to weeds and bushes instead of sweet grasses. Something will grow there that can send its roots deeper into the soil, to find food to live upon, than the nutritive grasses can, or something that requires a different kind of food. Mother earth is sure to deck herself with garments of green, and with something good for man and beast, unless the exhaustive policy of man has deprived her of the means necessary to do it. Reeds and rushes are better than utter barrenness, but grasses that will make your flocks and herds look sleek and fat, are much better; and these you *can* have.

Re-seeding and manuring are doubtless necessary on many of these pastures. They have been so closely fed that no grass has gone to seed to renew the plants, and now that the old roots are dead, seed must be supplied, and fertilizers of some kind must be applied to compensate for the excessive draft made upon them. Whether renewal of such pastures is to be effected by plowing, where the plow can be used, or in some other way, must be left to the discretion and good judgment of each one that has the work to do. But in some way it must be done. Gypsum or plaster is a cheap application, and on loamy and clayey soils will return more for the outlay than any other. In many cases its effects are truly astonishing. On light soils ashes or lime are good applications. A compost of muck with lime or ashes is an excellent preparation to spread upon all high lands. Most farms have a good supply of muck, and these dry seasons afford an excellent opportunity to cart it out and to make the application. Even without lime or ashes it will be highly beneficial on many old pastures that are deficient in vegetable substances.

Sheep husbandry is another method of reclaiming old pastures. In answer to the question, propounded to one of the best farmers in York county, a few days ago, "How can we reclaim our old pastures?" the prompt and emphatic reply was, "By sheep husbandry." We have made a mistake in disposing of our sheep because wool is low. Good mutton always bears a remunerative price, and is one of the best meats on our table, and this, when taken in connection with the manurial value of sheep on our farms, insures a good profit from sheep husbandry.

Another method of improving pastures is to clear them of worthless bushes and weeds that infest so many of them. These, in nature's system of rotation, are occupying the land because it had become exhausted of the suitable food for better herbage. But they should be eradicated as soon as possible. A day or two now and then, when other work is not pressing, will accomplish wonders. No farmer can afford to raise them.

Our low, wet lands demand a moment's attention. Many of them in fact possess more elements of fertility, and can be made to supply a greater amount of food and more luxuriant herbage than any other when properly cared for. But I find this part of my subject so fitly expressed by another that I give you his language:

"Another great cause of the inferiority of our pastures is the superabundance of water. We have looked over many New England farms, and there are few on which the kind and the quality of the grasses, both in the mowing and grazing fields do not plainly indicate that the land is cold from being water soaked. This is particularly true of the pastures. The meadows have in many instances been drained, but the pastures that have been underlaid with tile, are few and far between. Why this unaccountable distinction between mowing and grazing lots? Do not the latter sustain the stock more months in the year than the former? Is not sweet herbage as essential in the summer as in the winter? As a consequence of this water soaked condition of the pastures, we have arrow grass, reed grass, spear grass, bushes and hedges, growing where red-top, white clover, blue grass, timothy, meadow fescue and orchard grass should grow, and it requires four acres to summer a cow, whereas it should require only one. We speak after much observation and consideration when we say that water is the great bane of New England pastures. Sweet herbage cannot grow in soil which is wet and cold; and the amount of this wet, poached up grazing land in New England will astonish those whose attention has not been particularly called to it. It is not necessary to traverse the pastures, and mire our feet, to find out the wet places. The cattle have discovered them before us, and the neglected, innutritious, water grasses too plainly reveal, even at a distance, the cold soil. When cattle are first turned out to grazing in the spring, they may eat some of this wiry, unpalatable herbage, for after their long confinement to dry hay they are ready to devour any green thing, but after the sweeter grasses get a start the dumb beasts soon discern between good and evil, and the marshy places are neglected. The rushes and sedges may make good litter for stables, but were never designed to be transformed into dairy products without first undergoing fermentation in the compost heap."

But, says one, what a task you are laying out for us to perform.

Our fields are in such a condition that they demand all our time and all the means we possess to put them in order. When and where can we find time and means to accomplish it? Our pastures cover so much area that it is a hopeless task. A very proper inquiry and demands a corresponding reply. Well, then, as the last suggestion I will make by the way of improving our pastures, I say rest them. That was not an unmeaning or useless command given to the Israelites of olden time—that every seventh year the land should rest. They did not manure the land as we have the means of doing, therefore it was necessary that the land should recover itself and be ready to bear new burdens. So then, if like them you have so much land you cannot properly care for it, rest it. And I would suggest that it be done in a way to add beauty to the landscape, and which in the end will be remunerative to you and your posterity. Our worthy colleague from the Maine State Society, has, from time to time presented several excellent papers, suggestive of the utility and importance of planting forest trees, and has persistently urged its necessity. Now an excellent opportunity is offered to initiate the noble work, and to set apart a portion of these old worn-out pasture lands for the growth of forest trees. If they won't bear grass without too much expense to warrant the trial, they will bear trees. The elements of food for them are there. It is nature's system of rotation. Hard wood trees will take root and grow rapidly on loamy, heavy soils, and evergreens on lighter soils. Their roots will go deep into the soil and find the elements they need to live upon, and bring them to the surface, which taken in connection with the annual deposit of leaves, will create a new soil, so that in addition to a crop of wood when you or your children shall need it, you will have land as rich and fertile as the best now is.

Mr. Percival. The improvement of pastures is, if possible, more important than the improvement of mowing fields; for an animal well pastured is half wintered, to say the least. Our pastures are suffering severely, having been stripped by the grasshoppers, and we are applying all the fertilizers we can get to our mowing land. The consequence is, animals go out in the spring poor, they work hard all summer for a bare subsistence, and go into the barn in the fall poorer, sometimes, than they went out in spring. How shall we improve them? I have a great many knolls which have become moss-covered. Should such pastures be plowed, smoothed down, one or more crops taken, and then seeded in order to produce more grass? If so, what shall I do with my herds while resting my pastures? Can I rest them by dividing? Can I make two, three, or four of one; occupy one a while, and then another, and so on? Will that rest answer the purpose, by allowing the grass roots time to spread? Or shall we take up our pastures and cultivate them, and turn our mowing lands out, and rest them that way? The objection to that is, that a very large portion of the lands that are used for pastures cannot be plowed. I wish very much that somebody would tell me how to do it, if possible. My experience, which has been limited, and is probably worth but little, you can have.

A portion of my pasture cannot be plowed. A portion of it was completely "bound out," as the saying is, and had many moss-covered knolls. It was so far distant that I could not haul manure. I plowed about ten acres, and the first year planted potatoes with plaster, and had a fair crop. The next year sowed with oats, and got a good crop. I mowed it two years, and I got from one to one and a half tons to the acre. I put on no fertilizers except plaster. That land has since produced four times the amount of feed, and of a better quality, than it did when it was taken up. Why is this? Is it because the fertility of the soil lay so deep that the grass roots could not reach it, and by turning it up, and exposing it to atmospheric influences, it became productive? If that was the cause, everybody should turn their pastures over. But what shall we do with the pastures that cannot possibly be plowed? If it can be done with fertilizers, what fertilizers? If it can be done by reseeding, without fertilizers, when shall we apply the seed, and in what quantity?

Mr. Gilbert. The subject of pastures has been talked about a great deal; it has been considered by the members of this Board heretofore; it has been studied by the people generally; the changes have been rung upon it in the newspapers; and the conclusion of everybody seems to be,—*I don't know what to do.* A number of years ago, some member of the Board of Agriculture wrote upon this subject; it went into print, and I read over the index, found the subject, and turned with interest to the pages, to read what was there to be found. The sum and substance of it was, that you must go into your pastures, look at their condition, study the situation, see what is wanting, and go to work and do it. I went into my pastures, and over my neighbors' pastures; I looked at the condition; I studied the situation, with a view to ascertain what should be done to improve their condition, but I did not find out so fully as I would like what was best to be done, and perhaps I did not do so much as I ought to have done. It is a serious matter, as I said this forenoon. If the deterioration of pastures continues for twenty years at the rate it has been going on for twenty years past, a large part, if not all, of our mature animals must be fed in part from the barn all the year round. I must say, that after this examination, study, and consideration of the subject, year by year, I find myself more and more of the opinion of that *Tribune* philosopher, who has been writing what he knows about farming, and if I mistake not, wrote to Theodore Tilton that he could raise cabbages for less than seven dollars a head! He said, a number of years ago, that every acre of pasture a man had was a curse to him, and I do not know but I shall yet become a convert to that doctrine.

Cattle cannot thrive in a poor, thin pasture, producing scanty herbage; they may, perhaps, grow a little, but only a little. Stock-raising in that way never will pay. We must grow animals rapidly to grow them with profit. We require a large product from our cows, but you cannot get it from a thin, scanty pasture, where the cattle have to labor hard from early morning until late at night to sustain existence. In order to thrive, they must obtain grass enough in one, two or three hours in the morning to sustain them for half a day; then they can lie quietly in the shade upon the cool hill-side, and grow, and make milk. Towards night, as it becomes cool, they want to feed one, two or three hours more, and that is all that should be required of them. But how is the fact? They feed all day long, and come up, many times, hungry at night. More cattle in the State of Maine go hungry in summer than in winter.

The question is, What is to be done? There are thousands of acres of pasture lands in this State that can never be improved by our common farmers, because they cannot be plowed without a greater expense than will be profitable. A man cannot lay out twenty-five or fifty dollars on an acre of pasture, when, after he as laid out that money, it is not worth more than fifteen dollars. Good pasture lands bring from fifteen to twenty dollars per acre, perhaps, and they must be well in grass to be worth that. We have thousands of acres of pasture land in that condition. It is no use to talk about clearing them, plowing them, and renovating them in that way. If the land is rocky, you cannot do it without removing the rocks. Again, we have thousands of acres of pasture land that have at some time been plowed. These pasture lands for a number of years after being plowed, produced a fair yield of grass, but it gradually grew thin, and the land is overspread with moss. Such lands must be plowed again. My experience is, that pasture lands which have been plowed once must be plowed again. There is no way to avoid it. And by plowing, that class of lands may be improved and brought into grass again. It is a sort of rotation, part of the time in pasture, a part in tillage, a part in mowing. That is very well; but there are comparatively few acres that can be managed in that way.

Mr. Thing. I should like the opinion of practical men whether it is well to feed close. My observation is, that the closer a pasture is fed the longer it will keep in grass.

Mr. Gilbert. The close gnawing of pastures this summer has resulted in the pulling out of the ground of many grass roots by the cattle. I have one pasture that has never had a plow in it; the bushes and brakes have been mowed every year for bedding. I do not know how long it has been pastured, but my impression is, that until last year it carried about as much stock as usual. Last year, the drought was as hard upon the pastures as this year, and held on considerably later.

Question. Has it been top-dressed?

Mr. Gilbert. Twice in twenty-five years it has had a dressing of plaster; nothing else. It has been pastured a great part of the time with sheep. One great trouble is that we bring in our cattle at night, and keep them in the barn-yard until the next morning, keeping all the manure there.

Col. Swett of Oxford. For the last seven years I have produced milk for the market. That has led me to seek for summer feed. I have seen my pastures deteriorating, and I have studied and inquired how to renovate them. I received much valuable information from Mr. T. S. Gold of Connecticut, at our session a year ago. I told him of a piece of land that has been used as a pasture almost seventy years; about half of it had been plowed, the other half is so covered with knolls that it is almost impossible to drive a cart across it. That part which has not been plowed has produced more feed to the acre than the other. It is true, that on the top of the knolls there is not much grass, but I cut off the bushes and brakes that grew on them, and in the hollows there is a thick mat of sweet feed. On the plowed part the grass is thin. Mr. Gold said he had a pasture similar to mine, which he bought twelve years ago, that did not produce feed enough for one cow on four acres. He mowed the brush on the knolls and burned it, then sowed grass seed, thoroughly harrowed it in, and spread compost, ashes and plaster. He said he has now a perfect mat of grass on those knolls, and each acre produces feed enough for a cow. I tried the experiment, and I find it works admirably, and although it has been so dry, and we have had such a host of grasshoppers, there is grass; and I have come to the conclusion, that it is not good policy to plow pastures. I spoke to Mr. Bliss, of the Vermont Dairyman's Association, and he told me the same thing. Said he, "Don't plow your pasture; you can never get a thick mat of grass after you have plowed it; you can renovate it better without plowing."

Mr. Percival. At what time of the year did Mr. Gold sow his pasture?

Col. Swett. I do not know. I sowed in the spring, but I think the better time would be in the fall.

Prof. Fernald. I have it upon good authority, that the method of keeping pastures in the dairy districts of New York in good heart, is by top-dressing, and wherever there are knolls that are barren of grass, they sow and scratch in the seed. Their best pastures have never been taken up, and they keep them in good condition by top-dressing, applying ashes, compost, or whatever fertilizer they can command, for that purpose. They say that when they once get them into good grass, different varieties of grasses, such as come forward at different seasons of the year, they find the old pastures give better results in milk than do the reseeded lands. They find that from reseeded land, thirteen quarts of milk are required for a pound of butter, but from old pastures that have these rich grasses, that have been maintained for thirty, forty or fifty years, ten quarts of milk will make a pound; consequently they decidedly prefer the old pastures.

Mr. Wasson. In 1861, I purchased a farm which I have been running ever since. I do not know that sheep had ever been upon it, certainly not for many years. I found the pasture overgrown with weeds and bushes of all sorts. I immediately put in a small flock of sheep, and since then that pasture has carried sheep, cows and horses, and now, after ten years, it will carry double the stock that it carried when I bought the place, and I attribute it to putting on the sheep. The pasture is free from stones, and could be easily plowed; and at the suggestion of some old farmers I put in the plow to help the sheep improve it, and after two or three years experience I find that the land which has been plowed will not carry so much stock upon two acres as can be carried upon one acre that the plow has not been in. I have applied no fertilizer to the unplowed land; did nothing, except put sheep where sheep had never been before. In opposition to the opinion entertained by my neighbors, that putting sheep into the same pasture with cows is detrimental, I put in horses, cows and sheep, and fed them there for ten years, and my pasture will now carry double the stock it would ten years ago.

Col. Swett. I noticed for several years back that on the plowed part of my pasture there is no white clover, but on the unplowed part, in the hollows, there is a good deal. Mr. Gold said that in their section they could not get white clover to grow for any length of time where they plowed, but it would grow well where they did not plow. With regard to close feeding of pastures, my observation and experience are both against it. Pastures will produce more and hold out longer when not cropped very close, and the roots will be less likely to be pulled up.

Mr. Buck of Orland. I am sometimes accused at home of riding hobbies, and one of them is, sheep as a specific for barren pastures and fields. My experience has been, that my pastures increase in fertility as long as my flock is large enough, but if my flock diminishes in number my pastures produce less luxuriantly. Another hobby is, when my meadow lands are in good heart never to plow them when it can be avoided, but to keep them in good grass by top-dressing, using only the best manure I can possibly give to them. About four years ago I began to plow and cultivate my pastures, and have done more or less each year since, with very satisfactory results. It appears to me to be the better way, where land is knolly, mossy and rocky, to get out the rocks, level the knolls, and bring in good sweet grasses. The land will then carry more cattle and feed them better than if covered with mossy knolls.

Mr. Robinson. There are many pastures where yellow weed or butter-cup has nearly full possession. If pastures are not to be plowed, I would like to know how they can be eradicated, so as to allow grasses to grow.

Mr. Buck. Put in sheep.

SEC. GOODALE. It is undoubtedly true that throughout the best dairy sections in the United States the opinion prevails that pastures should not be plowed, and that opinion is the result of long experience. The principal reason alleged is this: that if lands be plowed and reseeded a long time is required to get it stocked with a *sufficient variety af grasses.* They are not content with herdsgrass, with redtop and clover, but they desire as many sorts as can grow together, the more the better; better because they come to maturity at different periods, some very early, some very late, and some all the way between; better, also, because these different grasses themselves take different food, or the same food in different proportions out of the soil; so that the land can carry a heavier burden of grass than if only a few kinds occupy the land. They want a thick, dense, velvety turf, with hundreds of plants on every square foot. A sward where each plant occupied on an average a square of three or four inches would give those dairymen very little satisfaction. Of course it requires good land and in good condition to bear so heavy a burden, and they do not hesitate to devote the best they have for pasturage; and when such lands become fully stocked with a sufficient number of different kinds of grasses, is it any wonder that they are unwilling to plow? Go on the green hills of Vermont, or to Litchfield county, Connecticut, where Mr. Gold resides, or to Herkimer county, in New York, and you will find farmers very loath to allow the plow to go into their pastures under any circumstances.

But that it is equally beneficial to allow our pastures to remain in grass all the time, does not follow necessarily, because the conditions are different. What they call pastures are unlike what we usually describe as pastures; they use their best lands for pasturage and not their poorest. They reason in this way: "My profit comes from milk, and milk is produced mainly in summer; I must give my cattle the best feed when it will produce the most." They are content to take the poorer lands for mowing, and they are content with a smaller amount of forage per acre for their winter feed than they are for summer feed.

In 1862 and '63, I traveled to some extent over Herkimer county, New York and the adjoining counties, also in Litchfield county, Conn., and on the Western Reserve in Ohio, with the special object of gathering facts in regard to dairying. I found that farmers there devoted an acre and a half of choice land for the summer feed of a cow; land that would produce two and a half or three tons to the acre, if allowed to grow. And what do they get in return? Five hundred, six hundred, and sometimes seven hundred pounds of cheese to each cow.

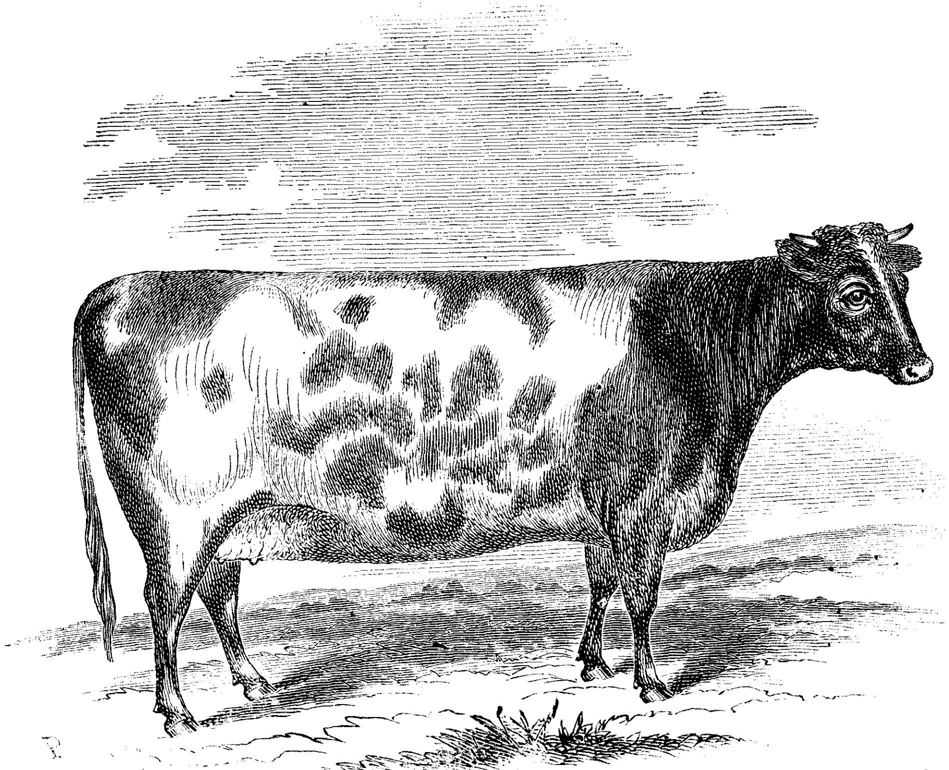
The soil of Herkimer county is not only rich, but it is underlaid with what is called "Utica slate," a rock that contains an unusual amount of organic matter, and which decomposes easily and constantly adds to its fertility; and that is one secret of their great success. But we are differently situated; our soils to a large extent are granitic—formed from different rocks altogether—older rocks and not so readily decomposed; they have not so great natural fertility, and they have only slow and feeble accessions to it. Besides this, we have been in the habit of taking our best lands for mowing, and devoting the poorest to pasture; we have been taking from these pastures all we could get for twenty, fifty, or a hundred years, and how much has gone on to them? The phosphate of lime has been mostly taken from them, and you cannot have milk without it; you cannot have bones in your animals without it; they cannot get it from the atmosphere; they cannot get it from water; they can get it only from the soil; and our soils never had a great deal, and the little they had has been drawn upon until it is nearly exhausted. What keeps them as good as they are is the small amount which is annually liberated from the rocks. The effect of weathering, freezing and thawing, is to liberate and render soluble a little phosphate of lime, and that little is what keeps our pastures from utter exhaustion.

Then, again, we have taken out a good deal of potash. We are beginning to recognize a large value in ashes as a top-dressing for grass land. Why is that? Because ashes contain potash, and you put back what you have taken out. Unleached ashes contain more potash than leached, but leached ashes contain fully as much phosphate of lime. When you put ashes upon your land, you replace those two substances. Everybody acknowledges the good effects of ashes. The gentleman from Oxford has spoken of their wonderful effect in his neighborhood. I recollect, years ago, a man in his town came to me, and with a sober face, asked if it would pay to put leached ashes on his farm. I told him that would depend upon whether he needed them or not, and how much they cost. He said he would have to cart them four miles, and pay fifty cents a load besides. "How much do you call a load?" "What I can haul with four oxen." You cannot go to Paris now and buy leached ashes for that price. About the same time I visited a farm on the banks of the Kennebec, and the owner told me he had just bought several thousand bushels of very old leached ashes at two cents per bushel, and he wanted to know whether they were good for anything. They were piled up as waste when potash was made there, and he was afraid they had lost their virtue. I told him they were all the better for the long weathering; that he would sooner get the benefit of the potash and phosphate in them. When we put back what we have been taking off, we soon see the effect. It is a serious question for us to consider how this deterioration in our pastures was caused. It came about simply because we drew upon the soil continuously, making no returns or very inadequate returns. We cannot do that without having the bills to pay some day or other, and after a season of drought and grasshoppers such as this year, the bills come in thick and heavy, and faster than they do some other times.

What is to be done? You cannot command ashes; you have not the means to buy potash in any other form; in fact, it is hardly in the market. Of late you can find German potash salts for sale in the large cities; and that reminds me to say a word about them. There was discovered in Germany, not long ago, an immense amount of salts, of various kinds, a vast deposit, such as you might expect if an ocean was boiled down in a kettle a hundred miles broad, and nobody knows how deep. They have dug a thousand feet without reaching bottom, and near the surface of this immense saline deposit are found potash salts, which are being worked up into marketable form and used in agriculture and in the arts. But the price, although decreasing, is yet beyond the means of our farmers.

I believe the time is coming, and I hope is not far off, when we shall be furnished with potash from sources nearer home,—from our own rocks. We have abundance of feldspar which contains as much potash as any hard wood ashes you ever burnt. But it is combined with silica, closely locked up in an insoluble state. You might grind a ton of it to fine powder and spread over an acre without more immediate effect than from so much sand. But I believe that one of the future contributions of science to agriculture will be by converting the potash so locked up into a soluble state. The chemist can now so convert it, and without great difficulty. What remains to be done for the farmer is, to contrive to do it cheaply enough and on a sufficiently large scale.

There was a time in the world's history when all the potash and



Ayrshire Cow "HATTIE," 430, the property of H. L. Stewart & Son, Middle Haddam, Ct.

all the phosphate in it was locked up in rocks—when no plant could get at a particle of either. That of course was before any plants grew, for no plant could grow until some was unlocked and brought within their reach. The agencies of nature have liberated nearly if not quite all which plants now use, but skilled labor will by and by do it faster; just as soluble phosphate is now to some extent prepared from Canadian and South Carolina rocks, which without chemical treatment would be as useless as any other rocks. If what potash is locked up in the rocks of one town in Androscoggin County could be once liberated and distributed over the cultivated lands of Maine, wood ashes would bring no better price than in the days of the first settlers here, before a want of them was felt in the least.

But I have rambled away from the subject in hand—what to do *now* with our pastures. It is a difficult subject to deal with. To begin right, it is necessary for us to acknowledge and to have "a realizing sense" of the fact that our means are insufficient to deal with as much land as we have under cultivation, and, as I said before, I can make no better suggestion than that you *let one-half your land alone*, and allow it to grow wood. Wood will be a good crop, and a profitable crop before many years, and thus you can put all your means on the balance. Bestow the whole of your labor and the whole of your manure on the remaining half, and you can have it steadily advancing in fertility and all the while be obtaining more profitable crops than can be had from the whole. There would then be fewer complaints of disasters. It is not land in the best condition that suffers most, but the reverse. The saying that "the destruction of the poor is their poverty," applies to land as well as to men. When it is poor it suffers more, and when rich it suffers less. I appeal to the experience of any man whether the best land does not stand the drouth and all other misfortunes better than poor land.

But you may say that this is only negative advice, when you need positive; that you want to know what to do, and I tell you what not to do. The allegation might be admitted without invalidating the fact that situations do sometimes occur where a "masterly inactivity" is the very best policy which could be adopted.

I will go further then, and offer some positive counsel with regard to the half which is not to be let alone. The gentleman from Androscoggin told us that if the present rate of deterioration of pastures continued, twenty years would not elapse before we should be compelled to feed more or less at the barn all the year round. Can you not conceive of such a style of cattle-husbandry as indicating no calamity at all, but rather a highly advanced condition of agriculture, *provided only*, that it be adopted voluntarily, deliberately and of wisdom aforethought, and not by compulsion? Have you never heard of SOILING, and of the wonders accomplished by it in increasing fertility? How it speedily doubles the amount of available manure, and how this increase gathers volume and force after the fashion of compound interest, so that, where long and fully practiced, forty beasts have been fully fed on fifteen acres? And besides this, how it goes far towards abating the most burdensome of farmers' taxes, the fence tax? Have none of you practiced it a little, a very little, just enough to get a taste of its quality, by sowing corn for green fodder, and after trying this, did you abandon the practice as useless or unprofitable? If not, why refuse to extend the practice so as to embrace the period from May to November, as well as a part of August and September? Soiling is nothing more than that same style of proceedure perfected, and run throughout the season.

If soiling has accomplished what nobody denies or doubts its having done, why wait to be compelled to feed at the barn, or near it? If six weeks of it does as well as you admit, why not try six months? Can you tell me of any one who after a fair trial has abandoned it as poor policy? One of the most sagacious farmers of Massachusetts, after full and lengthened trial, gave it as his deliberate opinion, that the continued practice of soiling cattle would in time enable farmers to keep easily one head for every cultivated acre. If it be objected that Indian corn is not in condition for green fodder during a whole season, the ready reply is that clover can be cut before corn, and green winter rye before clover.

If you will look in the report of this Board for the year 1859, you will find a very valuable article upon this subject by our long tried and never-found-wanting friend who then and ever since has so ably represented the Maine State Agricultural Society at this Board, and which ought to have borne more abundant fruit than I have yet seen grow from it. But it is good seed; if tardy in germinating, it is rather the fault of the soil it fell upon, and I am confident it will yet produce an hundred fold. Let me commend it to your perusal.

Adjourned to evening.

EVENING SESSION.

The Board met at $7\frac{1}{2}$ o'clock; the audience was larger than could be seated. President Allen of the Maine State College of Agriculture and the Mechanic Arts, occupied the chair. The first exercise was a lecture by Hon. D. H. Thing, his subject being, "Pay as you go." The manuscript of this lecture not having reached me, I am unable to present it here. Its general tenor, however, may be gathered from the discussion which followed.

President Allen being called upon, responded as follows:

To say that I have been deeply interested in the subject that has been presented, would be only to reflect, I am sure, the sentiment of all those who have listened this evening. The idea of compensation—the idea that we must pay, and pay as we go, or else in the future a dread responsibility will come, and a fearful amount of delinquency must be met—is one of great significance and importance. Each day brings to the farmer his duties, his cares, and the responsibilities that he owes to his profession, and if this day's work is not done, to-morrow's burden is doubled; and if he does not pay as he goes, he will find himself bankrupt, at the last. But this idea of *pay* does not always come so clearly to the mind without thought and reflection. I saw, one day, a little boy engaged in some slight though beautiful experiment in natural science. His father came and looked on, and as he saw the boy's employment, he watched him with a father's interest for a little while, but at last turned away, saying, "Well, there is no money in that." To his mind, that little experiment by which the opening mind was enlarging itself, and expanding, seemed valueless, because there was no direct pecuniary return apparent to him as likely to come from it.

There are too many who, with the idea of pay, associate merely pecuniary results. Here is a well-conducted experiment by a farmer, which increases his knowledge, and the influence of that knowledge extends all around him. "Does it pay?" asks one. What does he mean by the question? He means simply, did that experiment put more dollars into that farmer's pocket, or not? If there was no direct pecuniary result, the idea is that it does not pay. But let me say to you, any experiment, fairly tried, does pay. More than that, an experiment which is not what you call a success may pay. It bounds your knowledge on one side; it gives you some idea of that which will not be profitable, and keeps you within those boundaries which in the hereafter it will be well that you have tried and known. In the very fact that there comes to you in these experiments more of the knowledge of nature; in the fact that the mind grasps great principles; in the fact that the soul is enlarged by the contemplation of these great truths of nature; in the fact that we are rising higher and higher in the scale of intelligence, learning more and more of the great thoughts of the Deity as we understand these works of His hand, that our souls are enlarging—in all this, there is pay, although there be no money that we can show as the result. It is a low view when a farmer thinks that nothing pays except that which adds to his deposit in the bank, or which enables him to buy a little more real estate, or put up a few more showy buildings, or exhibit some mere external splendor. That which enlightens the mind *pays*. That which enlarges the heart *pays*. That which makes the individual more of a man *pays*. And in this is the great value of agricultural education. The value of conventions like the present, or agricultural societies, or farmers' clubs, is not merely in the fact that the farmer, by attending these, can attain more profitable results from his farming, so far as dollars and cents are concerned, but in the fact of social intercourse, binding heart to heart; in the fact that the warm hand can grasp the warm hand, and the man lives out of himself, feels for others, and has a larger, nobler heart within him casting off these bonds of selfishness and isolation. I say that this very social principle that is cultivated *pays*, although there be no pecuniary result that can be shown.

More than this, these gatherings together of the Board of Agriculture, these farmers' gatherings, all these agricultural researches and productions that are studied and read, they all pay, although there be no great pecuniary advantage that can be directly shown in this wealth of the soul, this enlargement of the mind. And we are to carry this idea out into a broader field. When I ask for facilities for the education of the industrial classes, when I ask for special opportunities for them, it is not merely (although this will surely be the result) to add to the pecuniary value of the farms, and of the products of mechanical toil in the State; it is not merely the fact there will be these direct results, but the fact that these educational facilities add to the intelligence of the community. It is to give to my boy who goes on to the farm the same grand and noble privileges which I am to give to my boy who goes into a profession. It is to give to my boy who is to be a mechanic the same privilege that I am to give to my boy who is to be a lawyer; that he shall have an educated mind; that he shall have a liberal education; and this will be pay in better coin than that which is reckoned in dollars and cents.

Now, in all this value of learning, in all these advantages which come to us from study and education, there is a double recompense. It is not only that educated labor, skilled labor, is more profitable, so far as money is concerned, but beyond this and above this, that they are to be men, whole-hearted, noble men, and it is this culture of the mind that will pay; for the mind is of more value than what we eat, or what we drink, or wherewithal we are clothed.

Prof. M. C. Fernald being called upon, said:

An idea suggested itself to my mind as the lecturer was proceeding, that seemed to connect his subject quite intimately with the one under discussion this morning. This idea of paying as we go in all the transactions of the farm, is one of very great importance, and especially when we endeavor to do so in making proper returns for what is taken away from the soil. Now, it is unquestionably the case, that when the soil has been robbed of its nutriment for a long period of time, as is the case with many of our farms, the soil has been supplying food for plant-growth, without sufficient returns being made to it, and in time it becomes impoverished, and something must be done to renovate it. This, of course, has been through disregard of the principle of the lecture, of "paying as we go." If we have been doing this year by year, we have been taking away its vitality, and yet we expect it to produce, and go on producing; but the time will come when that soil will refuse to yield the returns we desire; and the only system by which our farms can be made to produce satisfactory returns, is to be just to them. If we take off large crops, we must carry back large amounts of fertilizers, in order to keep that land in a good state of fertility; and unless that be done, the time will certainly come when we shall find our farms bankrupt.

The discussion of this afternoon, with reference to pastures and how to renovate them, was an interesting one, and the subject of this evening is pertinent in connection with that, and not only in connection with that, but also with every operation that is carried on upon the farm. It is the idea of returning what is necessary to maintain the fertility of the soil, so that it shall produce as we shall make demands upon it. We know very well that if we have money on deposit in a bank, and each year or each month we go to the bank and present a draft, our demands may be honored for a time; they may be honored this month, and the next, and the next, but the time will come when, if we follow this course without making any deposit, our demands will be no longer honored. It is precisely so with our farms. Nature has put into your soil the elements of growth for plants that will continue for a certain period of time, it may be ten years, it may be fifty, or it may be a hundred years; but if we make demands upon the fertility of the soil without making returns, the time will come when these demands will not be honored. And if our pastures are in the sad condition which the remarks of several gentlemen here to-day have indicated,—and that is unquestionably the case,—something must be done. Well, what shall be done? Some have said they would plow and reseed to get the ground into sod again, and so on. And what then? Suppose they succeed, and that those pastures are brought into a condition to produce grass; will it answer to go on cropping them year after year without making returns? By no means. As was stated to-day, every cow that feeds upon these pastures is appropriating from the soil phosphate of lime for her bony skeleton, and also for the manufacture of milk, so that every quart of milk, every pound of cheese, that is manufactured on the farm takes from the soil more or less phosphate of lime.

Now, if this process goes on indefinitely, what will follow? Why, of course the pastures must be impoverished, and the only way in which that can be prevented is by making *suitable* returns, —that is, pay as we go. If we rob our pastures of phosphate of lime and of potash, we must return the potash in the form of ashes, or in some other form, and we must return the phosphate of lime in the form of bones, or in some other form. What is the rational system? Why, carry back the bones. How? Grind them. There is no benefit in putting a bone that has not been pulverized into the soil; it will remain there for years, and do no good, or but very little good. But if it be ground fine, or especially if it can be reduced by the use of ashes, or acids, so that the plants can appropriate the nutritive material of the bone, then it is in a condition to subserve a valuable purpose in plant economy, otherwise not. We must, then, return the phosphate to the soil.

One gentleman said that he fed his cows on ground bone. His pastures do not yield the phosphate of lime which his cows demand, and wherever they can find a bone, they will gnaw it. He supplies this want by feeding large quantities of ground bones to his cows; but would it not be very much better to take this ground bone, or superphosphate, or something of the kind, and put it upon his pasture land, and let it do double service there; let it supply nutriment to the soil, so that it will yield richer and more abundant grasses, and thus make use of his ground bone, or superphosphate, rather than feed it directly to the animal? At any rate, do what is necessary, no matter whether it be in the case of pasture lands or mowing fields, or ground cultivated for any purpose whatever. The only system by which we shall not impoverish our farms is to make returns as we take away our crops, to "pay as we go."

MR. ROBINSON. I would like to be able to hold your attention for a few minutes, to say some words here, especially to the young gentlemen present, students in the State College of Agriculture and the Mechanic Arts, who have so deeply interested us by their very promising appearance, and to whom we look with such confident hope for the elevation of all the honorable industries and the building up of the prosperity of our State.

It is upon the question of population, of emigration, of home. Underlying all industries, all wealth and all success in every department of life, business, or labor, is population. No country, no community, no people, can ever succeed without population. The great drawback on the State of Maine to-day, that which paralyzes to a great extent her agriculture, especially, and not only agriculture, but every other pursuit, is the spirit of emigration. If Maine to-day could number her whole native population to which she would be entitled for the last twenty years, instead of a population of some six or seven hundred thousand, she would reckon by millions; and if we had that population scattered over the length and breadth of Maine, in the pursuit of agriculture, gathered round our water-falls, centered on the bays of the sea, what a magnificent spectacle it would present; what a contrast to the present state of things! Our first effort should be to retain our population; and unless that succeeds, nothing succeeds. This idea occurred to me, and I would have entered upon it at the time, if I had thought it proper or prudent, in connection with the remarks made by the gentleman from Somerset.

His proposition was, that we should restrict our agriculture to certain things, because the West and South are in competition with us. Such is the fact; but unfortunately for the argument, it is equally true with regard to the articles in his catalogue—oxen, sheep and hogs. There is nothing produced here by agriculture, unless perhaps hay, in the production of which we do not compete with the West and South, so that if the whole duty of man and the whole object of life, is to raise cattle, or corn, or hogs, the sooner we all emigrate the better, because it certainly can be done cheaper at the South and West than it can be done here. But consider for a single moment this proposition. Is the whole duty of man,—the whole object of life, embraced, first, in the accumulation of property; and, secondly, in the production of cattle, and corn, and hogs? If it is, let us, as I said before, emigrate. If it is not, then let us stay at home and be content. Because you perceive, that while this spirit of emigration is upon us, it is utterly impossible for us to make any considerable progress, or to settle down upon any basis, or status, which will hold us steady, and from which we can make advances and improvements. For instance, the man who intends to sell his farm the first opportunity, cares very little about improving it; a man who intends to sell his house makes no improvements upon it, further than simply to keep it along from time to time.

There are two ideas growing out of this which I wish to impress upon you. The first is, suppose we should all emigrate, what then? We should simply destroy the principle of supply and demand; we have ceased to be demanders here; we go to the West and become supplyers; and we destroy all trade, disturb and upset the principle upon which the law of demand and supply rests. But the great consideration is this: the communication between the East and the West is such now, that information is constantly brought East of the state of things in the West. So far as I am able to learn, the average of happiness and comfort in life in the East, in Maine, is quite equal, if not superior, to the average in any of the States of the West that are so much boasted of. It is conceded by every one, that the advantage there, if there be any, is to the capitalist, who is able to make investments. He can seek opportunities in the West to make investments which will far exceed his gains in the East. But as to the ordinary laboring man, I have the testimony over and over again, that the condition of the West offers no real inducement for emigration.

The reports brought from there are exceedingly deceptive in this: it is only the successful man of whom you ever hear. The man who has made money you hear from, and the prize that he has gained is held out to dazzle and allure you. But the thousands who have met with no marked success you never hear of, or if you do, you hear that they have not improved their condition at all.

Another idea: Take these two counties of Penobscot and Piscataquis; look over the statistics for the two last decades, from 1850 to 1870, and you will find that the population outside of the city of Bangor has not increased, but rather decreased. At the same time, if you turn to the statistics of wealth, you will find that in both localities it has absolutely quadrupled in those two decades. So with the current of population against us, such are the inherent resources of these two counties, that the wealth has doubled over and over again, showing, most conclusively, that there is room and scope enough for every industry and every enterprise to thrive and succeed in these two localities; and these, perhaps, are fair samples of the whole of New England.

Again, while we are constantly grumbling, it is conceded that so far as the fruits of the earth are concerned, so far as all the necessaries of life are concerned, so far as all the advantages growing out of civilization are concerned, New England is vastly superior to the West, or to any other portion of the United States, or, indeed, to any portion of the world. Then why this restless, feverish, uneasy spirit of emigration? What do we expect to gain by severing all the ties of kith and kin, and becoming wanderers in a distant land? It is a question that we should seriously ask ourselves before trying the adventure. I was told the other day, by a person who had returned from one of the most prosperous of the western States, that New England men, New England capital, and New England enterprise, were to be found everywhere.

Only look to-day at the expenditure of money upon the avenues of natural wealth in this State. Take the line of railroad running from Bangor to the Provinces; take our line running from Bangor to Moosehead Lake—the broadest lake in New England—with a water line of nearly two hundred miles, in the heart of a timber country of more than one hundred townships, why is it that enterprising men, that the capitalists of Maine, desire to leave such enterprises as these, and seek their fortunes among strangers, in distant States, away from their homes, away from father, mother, brothers and sisters? If this spirit of emigration could only be laid, if the people of the State of Maine could feel sure to-day that they could hold their own population, then they could engage in such enterprises with their capital as would give the State of Maine an impetus which would double its population in the next ten years.

Look at this industrial college, imposing taxation upon the State which we cheerfully bear, in the hope that it will repay the outlay expended upon it, in the culture of those young men which it sends forth into the community. In other words, that from that institution are to radiate the science, the knowledge, and the home feeling that will hold these young men to her efficient service. If we hold them, well and good; we have made a grand bargain; but if the moment they are educated they fly out of the State like so many partridges, then the expenditure is a dead loss. I sincerely hope that the enterprise, in this particular, will prove a success. In other words, I hope that we shall keep these young men in the State, as our hope, indeed, our only hope, for the future. But if we fail, then it will be a heavy burden upon us; and that consideration should commend itself strongly to the young gentlemen of that college.

A single word of advice. Young gentlemen, educate yourselves as farmers; make up your mind to follow agriculture as a pursuit. How many of you are thinking to become doctors I do not know. How many are intending to be lawyers I do not know. Perhaps some are looking to both of these professions. Let me warn you that the average gains of the law, about which I know something, do not equal the average gains of the farm. I know little about the other profession, but so far as my judgment goes, I should say that that stood about the same as the law; that the average of gains is not above that of a successful farmer. Surely, in respectability, it is not above that of agriculture; and as to labor, let me say here what I know, and that is, that no distinction can be won in either of these professions without the most intense labor, and labor of which the agriculturist knows nothing, and never can know. Now then, let me say to these young men: in the first place, let them educate themselves well; let them cultivate a love of the pursuit of agriculture; let them throw to the world the results of their knowledge acquired in that institution, and I look for great results there. When they graduate, let them go and take up farms; at the proper time let them marry "and increase, and multiply, and replenish the earth," and make the State what it ought to be. Then we shall lose this restless, feverish spirit of emigration. Then they will feel the whole force and beauty of the word *Home*—one of the three most beautiful words in the language—Home, Mother, Heaven. With such a determination, with such efforts, with such acts, these young gentlemen have the power to make this State prosperous, beautiful and grand. Let me again commend to them that line of conduct, that effort, and assure them, that success awaits them if they pursue the advice which I have given.

Adjourned.

THIRD DAY.

THURSDAY, September 21, 1871.

The Board met agreeably to adjournment. Hon. Mr. Porter of Burlington, having been invited to occupy the chair, Mr. Adams of Franklin county read the following on

MANURES, COMPOSTS, AND THEIR APPLICATION.

There is no subject of greater importance to the farmers of our State than the saving, the making and the application of manures. It is not my intention to treat this subject scientifically, being only a plain farmer, but my desire is to impress upon plain farmers like myself the importance of the matter, and to tell them how I have succeeded in increasing the productiveness of a run-out farm.

The hay crop, which is our main dependence, was very poor last year, and much smaller still the present year, so that many feel discouraged and fear lest we may never get as good crops again as in the past. But I see no reason for discouragement, and I believe that if all will save what is within their reach, and use it to the best advantage a great change for the better will be experienced. In no other branch of business could so great waste go on as every year goes on in farming without coming to poverty, and in no branch of farming is there such waste as in respect to manure. As a general rule we do not make what we easily might make, and we do not save what we have.

The farm on which I live was purchased by me in 1840. It had naturally a fertile soil, of clay loam, sloping south, but was badly run down, and then cut only from twelve to fifteen tons of hay annually. The first improvement I attempted was with the barn yard, which was reduced in size, and banked up on the lower side, thereby preventing the wash from it from passing into the road, and from thence into the brook. The yard was supplied with muck, loam, leaves, and the like, to absorb and save what was possible, and so much as escaped after that was conducted by small channels to the grass fields in the rear. The course of the channels being changed and extended from year to year, I was able thus to enrich an extended surface, from which by means of the wash which conveyed the dissolved part of the manure I have harvested many tons of nice hay, and this by means which had been formerly entirely neglected. Then I built a yard in connection with the hog-house, which is kept constantly supplied with loam and muck for dry weather, and at wet seasons with brakes, thistles, and other sorts of vegetable rubbish, obtained from the pastures, and sometimes with potato vines, &c., about the time of the fall rains. During the summer this is forked up several times, and sometimes ears of corn and potatoes are thrown in. The searching and rooting over to get at these by the hogs, goes far towards reducing the coarse ingredients into good stuff to put on to the land. By this management the product of manure from the hog-yard is increased ten or twelve cords from what it would be if neglected.

At the time of my purchase all the droppings of the stock were thrown out of doors, and fully exposed to the sun and air and rain, and to the drippings from the eaves, which certainly involved a very serious loss. I soon arranged the stables so that all the droppings went under cover, and by that means their value was preserved. My dependence in saving fertilizers is mainly upon muck and other vegetable matter, partly upon loam, and of both of these my calculation is to have a good store always on hand, under the sheds and dry.

After the leaves fall I take the oxen and carts to the wood lot and bring home as much as possible of the leaves and of the decayed matter under them; these when dry make one of the best possible absorbents for the liquid voidings, and add greatly to the amount and value of my stock of manure.

The manure which has thus been manufactured in the hog-yard is hauled out as early as August and placed on the land to be planted with corn next year, and in August or September that from the cattle-yards is hauled out in like manner and placed along side. After being shovelled over and mixed evenly it is ready for application to the soil.

It will be seen that I have spoken repeatedly about muck.

Indeed, I believe we can hardly place too much value on this resource for enriching our farms if it be properly used.

The proper application of manures is a matter of great importance, and sometimes it is difficult to ascertain the best way to do it. The variation of soils and manures, and circumstances, are such that no one method is alike applicable in all cases. It may safely be said, however, that manures containing a large proportion of muck are used on dry, loamy, sandy or gravelly land to better advantage than on wet soils which have mucky matter enough in them. Covering manure deeply in the soil is also attended with loss. As a general rule it cannot be too near the surface, provided it is incorporated with the soil. My practice is to apply manure after plowing, and before harrowing to spread it as evenly and then to incorporate it with the soil as thoroughly as possible.

The points which I have thus briefly touched upon might be expanded to great extent, but my object is mainly to impress upon farmers the importance of employing and economizing the means of fertilization which are within their reach. The use of manures lies at the foundation of improvement in agriculture. Without them products would dwindle to barrenness, and all other management would fail of success without their application. The matter also concerns others besides farmers, for every man who eats food or wears clothing is dependent upon agriculture, since scarcely a fibre woven into his clothing, and not a particle of his food comes from any other source.

Hon. A. M. Robinson of Foxcroft. I want to ask a question, and I would like a direct and explicit answer, and that is, whether it is profitable to sow superphosphate broadcast upon fields which are beginning to be exhausted, and if so, how much to the acre, and how that would compare with ashes, and with plaster? Perhaps the Secretary will give me some information on this subject.

Sec. Goodale. There are some questions which appear simple enough at first glance, which yet do not admit of a direct and precise answer which shall be equally correct in all cases. If I were to tell the gentleman that I had suffered injury from a neighbor, and ask him whether I had better prosecute for damages, before he gave a direct and explicit reply he would be likely to inquire whether the injury was one recognized by the law, and was computable in dollars, whether it could be proved to the satisfaction of a jury, whether the party was responsible for damages if recovered, and I know not how many other questions. So in this case, I should say that the reply must depend on whether the land needed a soluble phosphate. If that was the principal constituent necessary, doubtless superphosphate might be profitably applied; if not wanted the application would not pay. It is a fact that most of the fields, and especially the pastures, in the State are lacking in available phosphates, consequently its application is frequently profitable; but the land may lack potash quite as much, and plants cannot grow well unless *all* which they require is furnished to them. Ashes supply both potash and phosphate, consequently they are almost always useful. Some of the needful constituents are usually present in soils in sufficient quantities, such as silica, alumina, magnesia, &c. These are equally necessary as the scarcer ones, but there is no need to be at any cost or trouble to supply them. The first which commonly fails is phosphoric acid, and the next is potash; and when these are present, if you would have a vigorous growth of the grasses, it is also needful to supply ammonia, or nitrogen in some other available form.

And this leads me to say, that the best manures commonly sold in this country under the name of superphosphates contain ammonia as well as soluble phosphate, and their value when applied to grasses depends oftentimes quite as much upon the ammonia as upon the phosphate contained in them. In England such manures are sold under the name of nitro-phosphate, or ammoniated phosphate, or some other name indicating the presence of nitrogen; and what is there known as superphosphate is a manure containing nothing of value except its phosphate.

Sometimes the needs of a soil depend more upon its mechanical condition than upon its constituents. If I should plant corn or potatoes in a stiff, hard, baked soil, the crop would be meagre, let the season be what it may, and be the elements of fertility in it what they may. In such case the crop would be largely increased by merely pulverizing the soil; perhaps also by the addition of inert sand, which would keep it friable and permeable by the roots of plants.

Generally, however, manures of any and of all sorts are useful and profitable on Maine farms. We have been negligent in economizing all the resources at our command; nor do we, as a State, use as much as we make. The amount of ashes sent out of the

State is astonishing. Farmers elsewhere bid higher for them than our own people do. A good many vessels go out loaded with bones to fertilize other fields. Of the fish manure made on our coast probably four-fifths is sold to go out of the State. The amount made is very large. Being near the coast the other day, I was told by a man there that he had been pressing about a thousand barrels of porgies daily since the season opened, and he had on hand several hundred tons of the refuse, which would probably be sent out of the State.

I saw also that a new industry had been inaugurated, one which I suggested in 1861, after travelling the length of the coast from Kittery to Quoddy Head, to investigate our resources in the matter of marine manures. In the report for that year the drying and grinding of sea-weed was recommended, so that it might be carried to a distance in the interior; and some attempts were soon afterwards made to utilize it, which met with small success. But one man persevered, and last year he dried and ground several hundred tons, which was put up in bags, neatly labelled as "Kelp Fertilizer," manufactured and sold by a company in Connecticut; and it all went for the use of Connecticut farmers. I did not learn that a single ton had been used in Maine. It is certainly very commendable in those who manufacture valuable manures from material gathered from the sea to do so; the State is richer by all the money these bring into it; but if Maine farmers would buy and use them, the State would be richer still by all the profit which that use would yield. There are other reasons, therefore, than simply a lack of manure in the State for the small crops we have.

With regard to plaster, there are some soils on which it is the cheapest manure which you can use; and as long as it does good I would advise its employment; when it begins to fail try something else. On some strong soils it will enable you to get a large growth of clover. If you can get good crops of clover, *and use them aright,* you can get good crops of almost anything else. But remember that the manurial value from clover, fed out, is mostly in the urine, and whoever does not use absorbents to save it knows little of its worth for enriching his land; yet even he gets considerable benefit from the decay of the roots in the soil, for these run deep, and they take a large amount of potash from the subsoil, and they get nitrogen from somewhere, probably from the subsoil, for there is small probability that they can get it from the atmosphere, and those roots decay in the soil and enrich it. I believe it to be a fact established beyond doubt, that if you grow clover in connection with grasses you get a larger crop of grass than you would without the clover, and the latter is so much in addition.

The grasses and clover belong to distinct species of plants. Clover wants chiefly mineral manures, the grasses want chiefly nitrogeneous manures. The roots of clover store up a good deal of ammonia; insomuch that soils, from which large crops of clover have been taken for two or three years, have been analyzed and found to contain more ammonia than they did before the clover was grown upon them. So I say, apply gypsum wherever it has a good effect. There are places where it has no effect at all. I have put it on my own lands many times, and never saw any effect whatever, good or bad, either upon heavy or light soil. As a general rule it succeeds better on strong, heavy soils than upon light, and better in the interior than near the sea shore. But I uniformly get excellent effects from both ashes and superphosphate.

Mr. Robinson. Can you give any general rule as to the application of superphosphate to grass lands?

Sec. Goodale. If there is any, it is that it does best upon lands which have been used to grow bones in young animals, and to make milk. In former years, more than now, and still to some extent, Maine farmers have grown cattle to sell at from one to three years old, and not very fat; but they had as much bone as if fatter, and the phosphate in the bones all came out of the soil, and taking into account the exhaustion attendant upon the growth of bone and lean meat, those cattle, as a general rule have not brought so much as they cost. I agree fully with the gentleman from St. Albans, that a profitable cattle husbandry, upon soils like ours, is impossible by any other means than by keeping no more cattle than can be *fully fed;* and by keeping to full maturity and fatness. Fat contains only elements which are found in air and water, namely, carbon, hydrogen, and a little oxygen; but skin and bone, hoof and horn, draw heavily upon nitrogen and phosphate.

Again, there are localities near the coast where, when the land was first cleared, the wood, instead of being burnt was shipped to Boston or elsewhere for fuel; consequently, the land lost so much phosphate as was in the wood. An intelligent farmer in the eastern part of Washington county told me he was satisfied that this was a principal cause why ground bone and superphosphate were so serviceable there. I was shown lands in, or near Pembroke, where ground bones had proved far preferable to stable manure for grass. In other sections where this cannot be the cause they do equally well. I am told that in the vicinity of Winthrop and Readfield an ammoniated superphosphate has proved in many cases the cheapest and most effective means to keep up the fertility of grass lands which has ever been tried; on other fields not far distant the effect is much less noticeable, yet it is said that nearly as much is used in that vicinity for grass as for tillage purposes, which is rarely the case.

Mr. Robinson. What is the value of muck as plant food, for grass or other crops?

Sec. Goodale. Ordinary muck contains a large amount of vegetable matter which is not in a condition immediately available for plants, but which can be made so by the admixture of dung which furnishes ammonia, or of almost any alkali. Unleached ashes are as good as anything you can mix it with.

Mr. Robinson. How about lime?

Sec. Goodale. Lime answers tolerably well, but is not so good as ashes; but if you slack the lime with salt water thereby liberating some caustic soda, it will have nearly the same effect upon the vegetable matter in it as ashes. This method is very much preferable to mixing muck with dry lime. The *Muck Manual,* by Dr. Dana, and *Peat and its Uses,* by Prof. S. W. Johnson, are books which treat exhaustively of the whole subject, and which should be in every farmer's library. The value of muck is not sufficiently appreciated. Vast quantities of it exist, which might be made to contribute largely towards the renovation of our lands. All who can procure it without too much cost should have a good stock always on hand, well dried, and kept dry, to use, at least in sufficient quantities to absorb all the liquid excreta from their stock. To this extent there is never the least doubt regarding the profit of using it.

Mr. Robinson. How would it do to mix with ashes or lime, and then sow broadcast on grass land?

Sec. Goodale. Usually very well. I have known cases, however, where muck has been used as top-dressing after being composted with a variety of substances, and the experimenters got no more benefit from the compost than would have been realized from what was added to the muck, but such cases are quite exceptional. The usual result is that it pays well.

Mr. Robinson. What is the effect of applying lime alone upon land?

Sec. Goodale. Not many of our soils are so destitute of lime that it needs to be used to furnish plant food, but we have large breadths upon which it might be applied with great benefit, chiefly heavy loams or clayey lands, also upon many which are not clayey but comparatively barren from uncertain causes. Upon clays its effect is to render them more friable, and consequently more fertile. It also causes changes in the chemical condition of the constituents of various substances of the soil; it probably assists materially in liberating potash from its insoluble combination with silica, and in divers ways, none too well understood, it assists indirectly in rendering many soils more productive. In years past, especially in other parts of the country, and in other countries, lime has been used very extensively and with excellent results; but, as happens sometimes with other good things, too much came to be expected from it, disappointments were consequently realized, and it fell into disuse to a degree equally unwarranted by its real merits.

Mr. Robinson. I suppose you would say it was unnecessary upon soils underlaid with limestone?

Sec. Goodale. I would not say so until I had proved its uselessness by actual trial; for upon many soils, in Pennsylvania and Western New York, underlaid by limestone, its application has proved more useful than upon many others which had no limestone beneath them.

A thought occurred to me as the paper was being read, which I will give you. It is certain that we have been sending away elements which have reduced the productive power of our soils. The animals and the products sold have carried away much which can only come from the soil, and to such extent that we cannot restore the land to the condition in which it originally was without *adding* something to it. But the question whether it will pay to do this depends upon the character and distance of your markets, upon the price of land and of labor, and upon many collateral circumstances. And yet I think we may learn a useful lesson from experience abroad, where they have been through this same debilitating process until they reached a point where they were compelled or actually driven to improve it. Throughout Great Britain, crops have increased very largely within fifty or a hundred years. Their lands were in a condition approaching that of ours, so far as regards exhaustion by over-cropping or by under-manuring, and there they have found it profitable to buy large amounts of manure. The amount seems to us to be enormous, and it has long been steadily increasing; to give some idea of it, let me quote from a communication published in a recent number of the London Agricultural Gazette. The writer says:

"The question of manure dressings is becoming one of great interest throughout the large and important district from which I write. The various manure dressings are mainly applied to produce roots and winter food crops—green crops. The quantity and weight per acre in some instances used is prodigious. Chemical manures are still increasing in favor and also in variety. The demand for Peruvian and other guanos, of superphosphates, blood manures, bones, kainit, (a crude German potash salt,) &c., is vastly increasing, and no one has yet discovered the limit to which any of these applications may be kept or profitably used; in fact, the more liberal the application, if judiciously given, the larger and more profitable is the crop.

"I am a farmer of many years' standing, but my old-fashioned notions and estimates of crops in weight and quantities have altogether been at fault. I used to apply liberal dressings, in accordance with the times, but now they are in some instances exceeded in a ten-fold ratio, and certainly the crops grown are much heavier, and amply pay for the extra outlay. Last year the mangel crops were unusually good; this has led growers to try a still further outlay in artificial dressings for the present seeding. My next neighbor produced upwards of sixty tons of mangels last year; he is now putting in one ton of artificial aids: i. e., I believe one-fourth guano to three-fourths superphosphates and salt, upon ridges manured with some twenty loads of fold-yard dung, and upon land also previously manured and plowed in the autumn or winter. He asserts that his crops abundantly pay for all, and he is no small farmer, as he occupies some 2,300 or 2,400 acres of land. Certainly sixty to seventy-four tons per acre, which I can fairly show was produced last year, is worth a good deal of money as stock food, to say nothing of what might accrue from sales, but which most tenants are forbidden to take off their farms.

"For my own crops, I am using sixteen good loads of fold-yard dung in ridges, about four hundred weight of salt and six hundred weight of superphosphate, and on one crop kainit in place of salt. This is thought to be inadequate, and I believe the public or prevailing idea is right. We are too timid—we avoid expense—and lose the extra ten tons. For turnips a similar course is laid out, but not quite so profusely, mangels in this district being the popular food crop. The large breadth set with potatoes throughout the neighborhood has been manured in like manner. I passed one field to-day upon which seventeen hundred weight of superphosphates per acre was applied, besides fold-yard manure. The fact is that farmers are becoming in a sense real commercial men—buying and selling every crop."

These quantities as you see, are much larger than those which the most enthusiastic admirers of what are sometimes called "chemical manures" have yet used among us; although the average quantities here used have been steadily increasing from their first introduction to the present time.

In another number of the same journal we find a detailed account of a noted farm of between 400 or 500 acres, where the practice is "to crop all and sell all." Not a hoof nor a horn is fed upon it, except the working force of horses. Except what is needed for this purpose, all the hay, straw and grain is sold, and *the breadth of grain annually harvested is equal to three-fourths of its whole area.* The only fertilizers used are artificial manures; and both the production and the profits have steadily increased from the time when this practice was commenced, say ten or eleven years. Upon other farms a quite opposite course is pursued. The purchase of manure is still quite large, but it is wholly indirect. All the hay, straw, turnips and grain (except wheat, or perhaps oats,) is consumed on the farm, and this is supplemented by quantities of rich cattle food purchased with the expectation that only a part of the cost will be recovered in the sale of meat, but the balance and a profit in the rich and abundant supply of excreta from the cattle, by means of which fertility is sustained and increased. A much more common practice is to divide the purchase money devoted to fertilizers between cattle food and artificial manures, the proportion which is bought of each varying with the character of the land, the crops grown, and the views of the farmer as to the comparative profit of the two methods.

Now, the lesson which it seems we may learn from their experience is, not to copy blindly any of these methods of English farmers, because our circumstances are unlike theirs; but *to adopt the* *principle upon which they are based*, viz: to devote *as much* to the permanent enrichment of our farms *as can be profitably done*, rather than to struggle along with the least expenditure on which a subsistence can be realized; and having adopted the principle let us adapt our method of carrying it into practice to our own circumstances.

The remark of the writer of the communication quoted, that English farmers are becoming commercial men, is a suggestive one. It is true in fact, for they buy and sell as really as our traders do, and to a large extent they live upon the profits of their transactions; while with us the rule is, that the farmer employs his farm as something by means of which he secures fair wages for the labor bestowed, while he might add to these wages a profit upon drains put in where needed and worth more than they would cost, upon manures bought, upon Indian corn, or shorts, or cotton seed, or linseed cake purchased, (perhaps this year primarily to to eke out a scanty crop of hay and prevent loss by sacrificing his stock at ruinous prices,) upon irrigation, if he has an opportunity by this method to combat droughts, (and more have such opportunities if they would but look for them than is commonly supposed,) and in many other ways.

Another idea advanced in the paper which was read by the member from Franklin, is an important one, viz: that the best method of applying farm-yard manure is, not to plow it in, but to mingle it with the surface soil. Happily a great improvement in this respect has taken place generally throughout the State. Where twenty loads were plowed under, six, eight, or more inches deep, thirty years ago, probably not more than one or two are now buried so deeply. It was formerly thought, that as the manure decomposed, its fertilizing influences would rise; now it is generally understood that the tendency is to sink; and although most fertilizing constituents, as phosphate, potash, and many others, are undoubtedly arrested and kept within moderate distance of the surface, there is reason to believe from the elaborate experiments most carefully conducted by Messrs. Lawes and Gilbert, that this is not so fully the case with nitrogen, but that in the form of nitrates there is, not very rarely, more or less of loss by sinking into the subsoil. Ammonia is held by the soil, but it is probable that nitrates, if not taken up by the growing crops, are not similarly absorbed and held. The existence of nitrates in the waters of drainage has been shown in repeated instances. It has long been known, that the whole amount of nitrogen applied in manure to land was not recovered in the crops grown, and it has been supposed that it might be exhaled by the foliage of plants, but recent investigations show a much greater probability that the loss is by being washed into the subsoil. It may be one way in which clover serves so valuable a purpose as it is known to do, by sending its roots deeply into the subsoil and foraging there successfully for nitrogen, which other crops are unable to obtain from the same source.

Mr. Chamberlain. I was yesterday cautioned by a member of this Board, who has left, against buying lime that is burned with coal. He says it is offered largely in barrels and in bulk. If in the barrels, the pretence is that the stone was imperfect, and the lime being dark colored is not salable, when the fact is, that the lime is worthless for building purposes. I am apprehensive that some of this lime has found its way into our county, or may do so, and I want to know whether the caution is well-timed.

Secretary Goodale. I have neither experience or knowledge of refuse lime burned with coal, but have heard of "lime ashes," as they are called, that come from Rockland, being used with good results. I supposed they burnt wood, and in that case you would get more or less wood ashes with it. If it is burned with coal, you get no potash, but I cannot see how lime can be harmed by having a little coal with it. The coal is quite inert, it does not decompose, and has no effect upon the soil. Anthracite coal ashes are nearly inert; there would be very little gained or lost by putting either upon the land. Coal ashes may have a little effect in improving the texture of the soil. I have known them put upon light soils and upon heavy soils. They improved one somewhat by lightening it, and the other by making it more cohesive; but I would advise no man to buy coal ashes, nor to cart them far.

So far as the lime is concerned, it would undoubtedly pay to apply it where lime is necessary. We could use a great deal more lime than we do, especially upon heavy clays, not with the expectation of immediate marked effect, but producing a permanent improvement in the physical condition of the soil. I should not be afraid to use Rockland lime burned with coal, but I would advise no man to go into anything of that kind extensively at first. As was said in regard to superphosphates and fish pomace, if you can get an article upon which you can rely year after year as being of uniform quality, try it fairly, and be governed in future operations by the results. It will be safe to use next year if it has been successful this year; of course, taking into account the variations of the seasons. Very much depends upon the seasons; no manure can assist plants unless there be moisture enough accompanying to render it available to the plants; they cannot live on dry fodder alone, however rich, any more than an animal can live without drink.

A much more probable explanation of the badness of some lime sold is, that it was made from dolomite, or magnesian limestone. Dolomite, containing only fifty to sixty per cent. carbonate of lime and forty per cent. or upwards of carbonate of magnesia, occurs in considerable quantities in the towns near Rockland, and sometimes is mixed with the true limestone (which contains not more than one per cent. of magnesia) in such a way that it is very difficult to separate them. Now, although magnesia is a constituent of plants, and just as necessary for their growth and health as phosphoric acid, or any other constituent, yet our soils generally contain enough for useful purposes; and it has been found that lime burnt from dolomite produces injurious effects when applied to the land. I am not aware that any fully satisfactory explanation of the way in which the magnesia causes the alleged mischief has been reached, although several very plausible suppositions have been offered, but the fact seems to be beyond question, at least in many instances; and this, to my mind, furnishes a more satisfactory explanation than to ascribe injurious effects to the coal with which the lime is burnt.

Mr. Brackett. I would inquire of the member from Knox, who lives in the lime region, what he knows about the application of lime ashes?

Mr. Hawes. Few lime ashes have been used in my vicinity. I know one man who has composted them with whatever refuse matter he could get around his premises, using the compost as top dressing, and he told me he never failed, unless in times of uncommon drouth, of getting two good crops of hay. The lime in years past was burned without grates. They would be five or six days burning a kiln, and a good deal of fine lime got mixed with the ashes. Nearly all lime is now burned with grates, and within two years about half coal has been used in the manufacture. What Mr. Chamberlain refers to is bad lime. Heretofore there has been a good deal of poor lime sent into the market, which injured the reputation of the place. This season much refuse lime has been thrown away. They are now trying to re-establish a reputation by putting nothing upon the market but good lime. I infer from Mr. Chamberlain's remarks that it is palmed off upon our farmers. My opinion is that what would be poor lime for mortar would be poor lime for dressing.

Mr. Brackett. What is the price of lime ashes at the kiln?

Mr. Hawes. They have never made much account of them in my vicinity. I was told by a man whom I saw with a load of forty bushels perhaps, that he paid five dollars for the load. They are mostly shipped to Connecticut and New York.

Mr. Chamberlain. To my apprehension, the necessity of a proper supply of phosphates *in the soil* has not been sufficiently brought out in our discussions. Both the Secretary and Prof. Fernald have alluded to this need, and to some of the evils arising from the lack of it, but not so fully as to satisfy me. The evil is of greater magnitude, and extends farther and wider than is generally apprehended.

Many farmers are aware that their cattle, especially cows, are in want of something which they do not get in their food; and that on offering them ground bone they eat it with avidity, and in most cases are at least temporarily relieved from the difficulty. The trouble is a bone weakness arising from a deficiency of phosphates in the food given to the stock upon the farm, and the deficiency is due to the fact that land which has long been pastured is wanting in the phosphates; nor does it take a great while for the phosphates in the soil to become exhausted. We have learned also, that the cattle of farmers who have used phosphates, or bone fertilizers upon their lands in sufficient quantities, do not suffer in this way. I would be glad to have the facts and the remedy more fully dwelt upou.

To illustrate I will say, I have been in the habit of using phosphates probably longer than any one else in my section of the State. It is now eighteen years since I purchased and applied them. For the first I sent to New York. I have always had some cattle about me, and those which I have raised have never suffered from the want of bone-making material. When I put ground bone where they can get it, the cows which have been reared upon my land will rarely touch it; but if I hire an animal pastured, when that animal returns she goes almost daily, for months, to the pail of bone, which I keep as I do salt, where the cattle can get it. After having animals off my farm for five or six months, they always come back hungry for bone. I bought an animal from Mr. Percival last winter which was raised on his farm, and he came to me with that same appetite for bone. He has been kept in the barn ever since I owned him, and he has eaten a large amount of bone; and the same was the case with a heifer that I hired pastured last year.

SEC. GOODALE. The matter which has been alluded to is certainly one of great importance. It is an undoubted fact, that in all those sections that have been pastured long without receiving proper returns, there is a deficiency of phosphoric acid, and one indication of that deficiency is, the development, to a greater or less extent, of what is known as the "bone disease." There is a lack in the food of the animals of sufficient phosphate to make bone. Bone consists of cells, animal matter, filled with minute particles of phosphate of lime, compacted together into a solid mass, as hard as a phosphatic rock and twenty times tougher. That mineral matter can be received by the animal only from its food, and the food can obtain it only from the earth. It is an earthy matter; it cannot possibly come from the air or from water. When it is not in the earth a scantier herbage is yielded, and containing a scanty supply of phosphate. It is becoming a very serious matter, and it will grow more serious unless something is done to remedy the evil. Nor is it confined to Maine. There are districts in New Hampshire, and in other States, where all the cows suffer more or less from this cause, and the amount of phosphatic fertilizers used in consequence is very large. It is said that in one town upwards of $20,000 were expended in a single year. The amount used in many of our farming towns, although much less than this, is steadily increasing, and very much in proportion as this need comes to be recognized.

The fact related in respect to the animal from Mr. Percival's herd reminds me of a conversation some years ago, in which, if my recollection serves me, Mr. Percival said that in a comparative trial of superphosphate and fish manure, the latter gave as good or better pecuniary results than the former. It occurred to me then, that possibly the increased product from the fish cost an abstraction from the soil which he had not counted in. It may be that we get now some additional light on the subject from another quarter. What did the fish do? It furnished largely of ammonia and but little phosphate. The effect of ammoniacal manure is to stimulate production; the fish enabled the plants to take from the soil what was in it; and as he furnished no phosphate, or an insufficient amount, it seems possible that his animals obtained less than they needed in their herbage, and afterwards indicated the want in the way stated. An indication which is pretty reliable with regard to the extent that phosphates have been taken from the soil in this State, is furnished by the demand for bone-meal for feeding purposes. I am told by dealers in Portland, Augusta, and other leading towns, that the call for bone-meal for cattle feed has increased at the rate of fifty or a hundred per cent. annually. Some say it has doubled every year for five years past. Now, while as a temporary expedient it may be well to use bone for food, (for if your animal is suffering in that way you want to relieve it as soon as possible,) just think how shiftless a method this is of doing it, when, instead of feeding the animal, you might feed the plants and double your crop. The herbage will not only be increased largely, but it will contain an abundance of phosphate; so you get, not as immediate relief, perhaps, but a permanent benefit in larger and more nutritious crops. Thus the crops show a profit, and you have healthy stock at the same time.

I suppose many of you know that I am connected with the manufacture of superphosphate, and I do not always say so much with regard to its use as I might otherwise, for the reason that my motive is liable to be, as it has been in some instances, misconstrued. The facts are these: About a dozen years ago, several farmers in the State having had ill success in purchasing manure, asked me where they could get what was reliable. I could not inform them; and finding that the amount used was larger than I had supposed, and likely to increase, I advised the erection of works to make it. I had no more thought then of taking hold personally than I have now of directing operations in the tannery over the way. When they learned how much of an undertaking it was, and how much machinery and power and capital were required, the plan was rejected. But after a few years more of unsatisfactory experience with the manures in market, they came again with a proposal to go ahead, provided I would engage, for a reasonable compensation, to see that materials of the best quality were put together in the best proportions--in other words, to act as its chemist. I thought it would be for the interests of farmers throughout the State that a really good article be made here; I did not think of any incidental ill effects, and so we agreed, and ever since I have given advice and direction, and they pay me so much every year for it, be the sales little or much, no more this year than when the amount manufactured was a quarter, or an eighth as much as now. As the years have run by, an article has been made, regarding the quality of which I have nothing to say, farther than to allude to what I suppose to be admitted by all, viz: that since its introduction other manures brought into the State for sale have doubled or trebled in efficacy beyond what they exhibited previously; so that the agriculture of the State has, at least, reaped an indirect benefit. But in regard to the policy of feeding phosphatic fertilizers to faint and hungry soils, instead of putting the same directly into the stomachs of sick and lame animals, I may say that it is so palpably and self-evidently the correct one, that it must carry conviction to all who give it fair consideration.

On motion of Mr. Thing, the subject of Re-seeding Grass Land was resumed; and Mr. Robinson offered the following:

Resolved, That where grass seed failed this year on lands where it failed last year, it is expedient to re-seed this season, without grain and without manuring; remarking that he offered the resolution simply for discussion, in order to bring out the views of practical men as to what can be done to best advantage in the present emergency. Much land in my neighborhood seeded last year, failed, especially sandy soils, with a southern exposure. The roots dried up or the grass was feeble, and the grass-hoppers destroyed it; at any rate, there was no grass. Part was plowed again this year, and another portion was left to see what it would come to; but for the most part only weeds grew, with here and there a sprinkling of clover. The manure of our farmers is limited, and if they must go forward and plow up additional lands to procure grass, they must apply manure, and they will have none to apply to those that have twice failed. Now, the question is, How are we to re-seed these lands? Shall we sow broadcast, and harrow in without manure, or what are we to do? I recollect a year ago last spring sowing a piece with oats and grass seed. The land was in fine condition, and I anticipated a good crop of hay. The grasshoppers took the oats quite early, and left the land in such condition that the grass seed was able to grow, and it grew pretty well so that I got a good crop of hay. But where the grain grew with more vigor, the grasses were feebler and either dried up or somehow perished. A portion of that land

I plowed again, applied superphosphate, and sowed oats. The grasshoppers took the oats this year, and there is no grass. Now, what am I to do? On the other portion of the land there was a large crop of sorrel, and the man who mowed it, a Bluenose from the Provinces, told me that the sorrel next year would turn to white clover, that it always did so in the Provinces, and I need give myself no uneasiness about it. Now for the result; I examined that land the other day, and lo and behold! white clover is appearing all over it. I suppose the sorrel did not turn into white clover, but how it came there I don't know; it is really a matter of some interest and curiosity. The man was right as to the result, however it came about.

Col. Swett. I have found both red and white clover to appear and grow vigorously after ashes had been applied to run-out mowing land. I suppose the seed was there before the ashes, and that the ashes furnished such food as enabled it to grow.

Sec. Goodale. The view is held by some, and many facts favor it, that sorrel serves a useful purpose in nature's economy by liberating potash from the insoluble combinations in which it exists in the soil, and that it does this by a vital force of its own, (using as a tool the oxalic acid which it manufactures for itself, doubtless by rearranging and combining in peculiar proportions elements which exist in air and water only; nothing being taken from the soil for the purpose,) and that so much potash as is thus liberated and brought into a soluble state, upon the decay of the plants is given up in a condition in which other plants can appropriate it for their needs, while the same plants would be utterly powerless to feed upon potash in its insoluble combinations.

If this be so, it is but analogous to many similar operations which certainly do go on in nature's laboratory. If you will look back to the early history of vegetation, not written in books but in soils and rocks, and study the conversion of rocks into soils, you will be satisfied that plants have played an important part in the disintegration of rocks and their conversion into fertile soils. Look to-day at the numerous lichens (commonly miscalled mosses) growing upon rocks; they get their living from a bare rock by the aid of their own life and air and moisture, and when they have fulfilled their mission and part with life and go to decay, a little vegetable matter is added to the soil, and a little mineral matter also, which these lichens have liberated from the rock and worked up into their own structures. Perhaps you may have seen, as I have, hyacinths growing in glasses filled with water, with roots six or eight inches long by the sides of the glass. When grown in vessels of soft glass, by carefully observing you may sometimes see a line on the surface of the glass corroded sufficiently to be visible to close observation, just where one of these roots lies. The glass contains potash and silica fused together, in a state quite secure from being dissolved out by water, either hot or cold; yet that feeble looking, slender root succeeds in appropriating a little of the potash, or of the silica, or of both, to the needs of the plant. There can be little doubt that all plants have a function of this sort to perform and do perform it; they do not live wholly to themselves, nor die wholly to themselves, but do something for those to come after them, as we ought to do. If we could read and would profit by all the "sermons in stones" which lie around us, we would be wiser than we are.

I see nothing at all improbable in the idea that sorrel does good work as a forerunner of clover. But some observations made this year lead me to believe that sorrel does not like, and cannot endure to have potash crammed into its little mouths, however much it may be inclined to forage for it in its own way. Wishing to test the German potash salts, which have been before spoken of, I procured some of two sorts, one containing eighty per cent. of chloride, and the other about thirty per cent. of sulphate of potash. I had a sandy plain on which clover had been sown a year ago last spring, but the drought caused a feeble growth, and the plants which appeared to be alive in March were found dead in April, and I immediately sowed clover again. Upon a strip across the lot, fifty feet in width, I applied one of these salts, at the rate of about four hundred pounds to the acre; then leaving an interval of fifty feet, I put the other on another strip of same width. During the present dry summer, sorrel grew profusely upon the whole piece, except upon the two fifty feet strips to which the potash salts had been applied; upon these scarcely a plant of sorrel could be seen, but instead of it came up a profuse growth of rag-weed, (sometimes called Roman Wormwood, and by botanists *Ambrosia artemisiafolia,*) which was scarcely to be found on any other part of the field. The contrast between the green of the rag-weed and the brown of the sorrel a month or two ago was very striking.

Mr. Thing. Last spring I sowed a piece of land for one of my neighbors, a man seventy-five years old, putting on twenty pounds of clover to the acre. This spring I visited him, and he told me he had no grass there. I asked him what he was going to do. Said he, "I am not worried about it, there will be a stout growth of clover there next year, for this year there is a thick crop of sorrel." If I live till next year I can tell you whether his prediction is verified or not. But he is just as confident of it as we are that we shall get our dinner to day.

MR. HERSEY. I can testify to the growing of clover on sorrel land. If you do not get a good catch of clover, and sorrel grows plentifully, it is very likely to come next year. The old gentleman is right.

PRES. ALLEN. I would remark, that nature uniformly provides for a rotation of crops. Our forest trees change from hard to soft wood, and the reverse. The same process takes place in smaller plants as well as in those of large growth. There are certain constituents in the soil which go to make up the food of a plant, or which are necessary for its existence. These being exhausted, that plant gives place to another having different requirements. Now, if it is generally conceded that white clover succeeds sorrel, I should say that the solution of that fact lay in this general principle, that the sorrel prepared the way for clover, either by taking away that which hindered the growth of the clover, or by adding what would assist its growth. But how came the seed there? White clover is indigenous to our soil; it was found growing here without being introduced. The vitality of seeds is remarkable. If you dig a well and throw out the soil, you will find that seeds were in it, because weeds or strange plants will spring up from it. The seeds have been buried so deep as to be below the power of vegetating influences, but when brought near the surface they begin to grow. So if you drain a pond, the soil is found to be full of seeds that have retained their vitality, even in water. Clover seed will remain a long time in the soil without losing their vitality. My father, when he first prepared the soil in his front yard, near fifty years, ago, sowed red clover, and had an abundant crop; herdsgrass and other grasses afterwards came up, but the growth gradually degenerated until only common June grass was to be seen. After forty or fifty years, an application of gypsum was made, and soon the whole yard blossomed with red clover. The seed had been there all that time.

SEC. GOODALE. The appearance and growth of particular plants in certain localities depends greatly upon the character of the soil. If we knew all about plants we could tell by the growth what the character of the soil and its capabilities were. There are abundant and good reasons for the appearance of certain plants at different places and times. It is a very common thing for a farmer, when he proposes to buy a piece of land, to look at the growth upon it; if he finds large trees of rock maple, or yellow birch, he concludes that it is good, strong soil, and that he can have a substantial, rich farm. But he rarely follows out that idea into all the minutiæ into which it might be carried. Every plant growing on the surface of the earth has its own story to tell with regard to the soil beneath it, if we only knew how to read that lesson. This may help us to a glimpse of the depth and extent of our ignorance; help us to know how little we know.

Mr. Thing. I have been asked the question, this fall, many times, "What shall I do with my stubble land?" "How shall I get it into grass? Shall I plow and re-seed as soon as the grain is off, or shall I wait until fall and sow on the stubble? or wait until spring, and then plow and re-seed?" I told them to wait until I went to the meeting of the Board, for I hoped to learn then. In our discussions we have gone all round the subject, but we have hardly come to the point. Mr. Percival told me that he had a large tract in the situation of many of our fields; there is no grass upon it. He intended, just before winter, to sow grass seed as he would in the spring, without plowing; he thought that the snows and frosts of winter and spring would work that seed into the ground so that it would grow, and would stand the drought of next summer, unless it was very severe, at least, that it would be more likely to stand than if it germinated this fall, because not so likely to be thrown out by the frosts of spring.

Mr. Hersey. A good practical farmer told me, not long ago, that he had been in the habit of sowing grass on his mowing land for a number of years, and he found very good results. He sowed in the spring, on the snow, just before it went off. He said, you must sow clover chaff; that the naked seed would not hold moisture enough unless it was covered in the ground; but if you sowed in the chaff it would germinate and grow. Herdsgrass, he said, was different; that would root into the ground without being covered. My own experience agrees with this, and I would advise all farmers to sow clover in the chaff.

The Chairman. Last spring I sowed two acres, and no grass came. This spring I sowed again, and no grass has come. I was told that white clover would come in by and by, but as yet it is only barn-grass, and as fine a crop as you ever saw.

Mr. Farrington. I cannot tell others what to do, but only what I have done. There was a piece of about six acres on the college farm, which year before last I am told was planted with potatoes, and heavily manured. It was a clayey loam, rather heavy and wet. A year ago last spring, (as I am told,) it was sown with barley and grass seed. Last spring it was stubble, and only stubble. We plowed it, not early, but as soon as it was fit, and harrowed it very fine. I sowed one bushel of oats to the acre, thinking that a few oats, while they would exhaust the land comparatively little, would shade the young grass and help protect it; but the drought was so severe that although the grass appeared, it disappeared, and when the oats were cut there was barn-grass coming up just as has been stated. Finding that the barn-grass was likely to go to seed, I ran a Nishwitz' harrow over it, pulverized the surface thoroughly, and then sowed herdsgrass and clover. That was three weeks ago. There is other stubble land on the farm in the same condition. I thought it a good opportunity for experiment, to leave a part and sow grass early in spring. There may be an advantage by sowing late in the fall, but that I had not thought of, and am glad of the suggestion, I do not see why it is not a good one.

Mr. Chamberlain. I will inquire if they had any Alsike clover in their hay on the college farm?

Mr. Farrington. We did. There is a patch of perhaps a quarter of an acre, in a very exposed situation, yet there was a fair crop of Alsike upon it. I remembered, also, reading in the report of a year or two ago, that a small spot in a corner of a large field was sown with Alsike, but I knew nothing more where it was; but while mowing we came upon it; the rest of the field was herdsgrass, and the best we had, bearing nearly a ton to the acre. I noticed the clover this fall, and, for the season, there is a very fair second crop. There is no living clover on the farm except on those two spots.

Col. Swett. Most of the farmers in my section have followed the plan adopted by the last speaker. There has been a large amount of grass seed sown this fall on fields that were seeded last spring. The calls for grass seed has been so great that herdsgrass rose from four to seven dollars a bushel. There is a grass with us called witch grass, which farmers have protested against in years past, but if it had not been for that we should have had scarcely any hay this year. Our farmers know that I have a good deal of it on my farm, and I have had calls for the seed. When I have a good crop of witch grass I have good hay. It is first rate if mowed in season.

SEC. GOODALE. How much to the acre?

COL. SWETT. I have cut three tons to the acre. There may have been a little herdsgrass and clover, but three-quarters of it was witch grass.

MR. HERSEY. Will it produce year after year, at this rate?

COL. SWETT. Witch grass will run out, like other grasses. I have top-dressed it and brought it right up again, the same as other grass. I would not pay a cent less for a farm if it was covered with witch grass. It never winter kills.

MR. THING. One thought may be worth mention with regard to sowing just before winter sets in. In cases where parts of a field only are bare, a man of good judgment could save seed by sowing only where it was needed; whereas, if he plowed he would have to sow the whole.

MR. GILBERT. I would inquire of the member from Kennebec, how much grass seed he recommends to the acre?

MR. THING. The same rule will not apply to all lands. To succeed as a farmer, a man must have judgment, and observe accurately. Some lands want seeds in certain proportions; other lands want other seeds, or the same in different proportions. Mine is a gravelly loam, on a hard subsoil, but easy to work. I can state from the observation and experience of twenty-five years, that it wants fifteen pounds of clover, eight quarts of herdsgrass, and a bushel of blue grass, or what some call red-top. The beauty of blue grass is, that it will not winter-kill, and it will wait longer to be cut, if need be, than other grasses, without taking harm, and it makes a better sward.

MR. FARRINGTON. Last spring I passed a field of clover that I have seen for several years, and the owner asked me if I knew the secret of it. I told him no, but wonld thank him to tell me. Said he, "It is twenty-five pounds of seed to the acre."

COL. SWETT. I believe in that doctrine. I have a deep, fine loam, on a hard subsoil. I suspect I have not put on half seed enough.

MR. ROBINSON. I sow thirty pounds of clover seed (when I can get it) and twelve quarts of herds-grass, to the acre.

Sec. Goodale. I wish some one would tell me what becomes of all the grass seed that goes on to the ground or under the ground. Did you ever try to ascertain how many seeds there are in a pound of clover, or in a quart of herds-grass, and now many plants are needed on a square foot, and calculate how many quarts or pounds would furnish the proper number if all the seeds grew? My impression is, that either a large proportion of the seed we buy is worthless, or from some cause or other, or combination of causes, and probably more from too deep covering than any other one cause, it never germinates. My attention was attracted to this subject by an experience of the present season.

A few years ago I came into possession of a piece of land which, although within a mile or two of upwards of ten thousand inhabitants, had never been cultivated, so far as I could learn. It was part of what had been used as a pasture, or rather cattle had access to it. It was nearly destitute of grass, and covered with small bushes, such as sheep laurel, hardhack, and the like, here and there rich enough to bear an alder bush, and knolly. It required a heavy team to cut and turn the mat of roots and reveal the character of the soil. It showed white sand and gray sand, with streaks of vegetable matter enough to color dark, and the whole moist withal. It was plowed in beds in the fall of 1869. Next year it was repeatedly harrowed with a Nishwitz cultivator, and the roots as far as might be thrown in small heaps and burnt. The labor cost about thirty dollars per acre, and as it was so poor I thought it only fair to apply the same value in manure, which I did, partly of leached ashes and partly Cumberland superphosphate, which were harrowed in the last of July. Early in August three acres were sown with two bushels of red-top and a peck of herds-grass, and the land was rolled, no other effort being made to cover the seed, and with the intention of sowing clover in addition in late autumn or early in spring.

After the rains came, the seed came up finely, and it looked like a velvety lawn. On close examination there was found on a large part of it several times as many plants as ought to grow on the surface they occupied. When the ground closed the promise could be better only by having fewer plants; they were altogether too crowded. It wintered perfectly well, and the spring growth was rapid, insomuch that toward the middle of June it began to lodge, and before July five stout loads from the three acres were in the barn, which at the market price two months later would have sold for nearly enough to pay for both labor and manure. It was evident that the crop would have been much heavier if there were fewer plants, so that they could have room to develop more fully and stand up long enough to blossom.

But what caused surprise was that it was all herds-grass. The most diligent search resulted in finding only one single plant of red-top developed enough to be recognized, and yet less than three quarts of timothy seed was applied to the acre. The wonder was whence all those long straight heads of herds-grass sprang. After pondering a while I hunted up Messrs. Lawson's table giving the weight of grass seeds per bushel, the number of seeds in an ounce, and other items of interest with regard to more than twenty varieties. Red clover was put down as weighing 64 pounds to the bushel, timothy 44 pounds, and red-top 12 pounds; also that one ounce of average red clover would count out 16,000 seeds, an ounce of herds-grass 74,000, and an ounce of red-top 425,000. These seemed large numbers, so I weighed out a small amount of clover and herds-grass in the delicate balance used in the laboratory, and counted, and calculated from the result the numbor in an ounce of each, and I made upwards of 20,000 of red clover and 72,000 of herds-grass. I did not attempt counting red-top seeds and let that pass.

Next, I calculated the number of seeds to the square foot which one peck, or eleven pounds of herds-grass would give, provided it were evenly distributed over three acres, and found it nearly one hundred, say between ninety-five and one hundred, and I found that two bushels, or twenty-four pounds, of red-top on the same area should give upwards of 1,200 seeds to every square foot—that it would seem should be quite enough, in fact, more than could develop properly, even with allowance for poor seed and losses from incidental causes.

With regard to fall seeding, I may say, that the practice is gaining in popularity, and I believe the best results follow early sowing, say in August; most of the failures occurring where sowing is deferred too late for the plants to reach a stage where they can winter safely. If it could not be done by the middle of September I would prefer delaying until spring, or so late in autumn that the seed would not start until spring. This method seems to promise well, but I have had no personal experience in relation to it.

Being lately in the eastern part of New Hampshire, I noticed a great many fields which had evidently been seeded this fall; and upon inquiry, I was told that such had come to be the almost universal practice, and was greatly preferred to spring sowing.

MR. CHAMBERLAIN. I believe I can answer the question raised by Mr. Goodale, where the seed goes to. Farmers generally sow their grass seed with their wheat and oats, and harrow it in, and a large proportion goes so far below the surface that it does not vegetate. I think that half or three-quarters of the seed usually sown never germinates, or, at any rate, not until the ground is again worked, and the seed brought to a proper nearness to the surface. My practice is, to finish harrowing before I carry my grass seed to the field; then sow and put on the roller, and if the land is moist, in a few days all the seed germinates. I believe that four pounds of Alsike contains seed enough to sow an acre as thick as the plants ought to stand. Three quarts of herdsgrass, put on in the same manner, is sufficient. I believe that twelve quarts, sowed as I sow it, would come up so thick that it would not head at all.

MR. BODGE. My farm is a gravelly, moist soil, and for the last twenty years, I have invariably put on a peck of herds-grass and twelve pounds of clover to the acre, and I have had little trouble, even when there has been such drought as this year and last year, in getting a good catch one year, and a good burden of grass the next year.

MR. HERSEY. When I cleared my farm, some twenty years ago, there was a sort of basin on it; it was hard-wood land, very moist, and I sowed it with herds-grass, only. I thought I would put on enough to get a stout crop, and I put on so much that it never headed out, or very few spears headed, and it remained so for years, until I plowed it up. I am satisfied, from experience, that you can sow herds-grass so thick that it will never head out.

Adjourned.

The AFTERNOON SESSION commenced soon after two o'clock, and Col. SWETT read the following paper on

CLEAN CULTURE.

I look upon agriculture as lying at the foundation of wealth. If a man makes a thousand dollars gain by dealing in stock, the world is none the richer; nothing has been actually added to property by such transactions. Wealth consists in the accummulation of the earnings of labor, and necessarily comes only by gradual and toilsome steps.

The idea has been sown broadcast that farming in Maine does not pay. We are ready to admit that a good deal of the farming in the State, as it is carried on, is a small and unprofitable business, but if we examine we shall find that it is owing to the way in which it is conducted. Instead of clean and well cultivated fields, we too often see abundant evidence of neglect, and plenty of reasons for lack of profit.

Grass is admitted to be the king of crops, at least in this State, therefore we should expect to see the proper methods adopted to put the land in the best condition to produce grass, but instead of this, we often find a border of from four to ten feet around the fields, covered with bushes and weeds spreading their noxious seeds over the land; we find boulders and stones left on the field interfering with the harvesting of the hay; and who wonders at hearing men who farm in this way complain that their business is unprofitable?

There is great complaint about pastures, that they do not produce near so much as they did fifty years ago. It is undoubtedly true that much pasture land has been steadily deteriorating, by over stocking, and by leaving in the yards at night the manure made from the food eaten in the pasture by day, which causes a continuous drain upon the land of those ingredients which are required to produce a vigorous growth of grass; this, however, is an evil to be remedied by other means than clean culture, which is the subject of my present remarks.

But there is a very large portion of the pastures of the State which would be greatly benefited by clean culture. Many pastures are covered to the extent of from one quarter to two thirds with bushes and weeds to the exclusion of grass. This state of things is due in part to the fact, that fifty years ago, much land was turned to pasture before it was more than two thirds cleared, and it had never had much seed sown on it, except the foul or mixed seed of grasses and weeds collected under the barn. Mother earth never lies idle; if we do not give her useful work to do she will bring forth thorns and thistles. Now what shall be done in such cases? I see but one course, and that is to declare war, and to fight it out with axe and bush-scythe; cut close to the ground, pile them on the knolls, burn them off, harrow thoroughly, sow a good coat of grass seed of various kinds, and see that the sprouts and weeds are kept down until the grass gets secure possession.

It is not good policy to plow pasture lands. It is very difficult after plowing to get a close turf, well filled with a variety of grasses, such as we desire in a pasture, and such as can be had by top-dressing occasionally and keeping weeds and bushes subdued.

Clean culture is of especial importance in reference to fields to be laid down to grass. They should be cleared of stones and stumps and everything which prevents the convenient use of the mower and tedder, for in these times it does not pay to get hay by hand. And the land should be as free as possible from weeds and weed seeds when it is laid down to grass.

This brings me to speak of clean culture of hoed and grain crops, for there is a field for great improvement. In traveling over the country we see too many acres where corn and potatoes and other crops have been planted, but where you can hardly tell which way the rows run, by reason of the great growth of weeds. It seems that the importance and the *economy of early and frequent hoeing* cannot be well understood where such a state of things exists. There certainly can be no profit expected from farming where clean culture is not practiced, nor where attempts to practice it are put off until the weeds get a large growth. The injunction of the parable, to let the tares grow together with the wheat, *was never intended to be carried out in farm practice, nor in garden practice.* If weeds be left until large, it costs a great deal more labor to destroy them, and the crops are much less benefited by the labor than if cleaning be done early. I have known it to cost less to hoe a piece of corn four times, and do it well, than to hoe another part of the same field twice after the weeds got more growth. Then the advantage of a frequent stirring of the soil during such a drought as we have experienced the past season, is very great; in connection with entire freedom from weeds, this has in many instances resulted in saving crops which would otherwise have dried up and proved total failures. In any season we can count upon an increase in amount of yield and an improvement in quality.

We apply manure to our lands in order to furnish food for the crops we desire to grow. We invest money and labor for this purpose, and also the use of our lands. Now if we neglect to keep down the weeds, and permit them to absorb the moisture out the soil and rob it of the fertilizers which we have obtained and applied with so much labor and expense, why should not farming be an unprofitable business? If weeds are allowed to grow, it is safe to calculate that they will take the manure at the very times when your plants need it most, either for their growth or for their perfection. Therefore we assert that Clean Culture is indispensible to success.

A few years ago, some experiments and careful observations were made in England to test the value of clean culture.

1. Seven acres of light soil were sown with wheat. One acre was left without weeding, and produced eighteen bushels; on the other six every weed was removed, and the produce averaged twenty-two bushels per acre.

2. A six acre field was sown with barley. The produce of one acre unweeded was thirteen bushels, of the weeded twenty-eight bushels per acre.

3. Six acres were sown with oats. One acre, unmanured and unweeded, yielded seventeen bushels; five acres manured and weeded produced thirty-seven bushels per acre; and besides this gain there was the great advantage of having the land clean for the next crop. It will be borne in mind that the custom there is to sow in drills, which makes weeding much easier than when sown broadcast.

Now let us estimate the loss by growth of weeds in Maine—calling the loss 25 per cent.

There were grown, according to the census returns, of

Wheat	278,793 bushels,	at $1.50	per bushel	$418,189	50
Rye	34,115	" 1.00	"	34,115	00
Indian corn	1,089,888	" 1.00	"	1,089,888	00
Oats	2,361,354	" 50	"	1,180,677	00
Barley	658,816	" 80	"	526,952	80
Buckwheat	466,635	" 75	"	249,980	25
Potatoes	7,771,009	" 50	"	3,885,504	50
Total				$7,385,307	50

Now deduct one-quarter as loss by reason of weeds, and we see that it amounts to the enormous sum of upwards of one million and eight hundred thousand dollars. What class of farmers is it which pay this tax yearly? It is not those who keep their land clean, and who cultivate no more than can be properly taken care of; those who do this, say that *farming does pay*, and they prove it by their works. The class which pays the greater part of this tremendous tax are those who let bushes and brakes overrun their pastures, who mow three or four acres to get the hay which ought to grow on one, who plow or run over from ten to thirty acres when they would get more profit from three or five acres, if properly manured, thoroughly cultivated and kept perfectly clear from weeds. Some may say, that it is easier to lecture than it is to practice; this I admit, at the same time if I lecture, I desire to lay down the true principles of farming—those which will be of greatest benefit if carried into practice.

All cultivators have found by experience that it is more natural for the soil to produce thorns and thistles than to produce plants useful for man; they were the first crop promised to Adam, and they have grown without cultivation ever since, even upon lands exhausted for all useful growth.

As a matter of fact, we find in the western part of our State, at least, that the land is stocked with innumerable foul seeds on every acre, and that they seem to be on the increase. When I was a small boy, and hoed corn and potatoes, there were fewer weeds to contend with than now, and the most I had to do was to properly shape the hills.

In 1672 there were only thirty-two weeds which were understood to have been introduced from Europe; and it is now stated on good authority that the number has increased to two hundred and fourteen. Clean culture involves more labor now than if these had been destroyed as soon as they made their appearance. There is work to be done, and it can be done, and it must done, or the evil will increase to still greater magnitude. To those who persist in growing tares instead of wheat, I have no word of encouragement to say; if they continue the practice, and stick to the doctrine that "farming won't pay," they will have to take up the lamentation of him who would not plow by reason of the cold, and beg in harvest and have nothing.

Sometimes we see fields, which having become exhausted by long cropping are thrown out of cultivation, in the hope that they will recover strength. Great improvement may be reasonably expected in such a case if the surface be kept stirred, and the weeds subdued; but it is a vain hope if weeds be allowed to grow, for no crop exhausts more than a crop of weeds; it is but exchanging one crop for a worse one, since the land becomes more foul; it gets no rest and gains no strength.

So important has this subject become in the view of some, that the Irish Royal Agricultural Society *Resolved*, "That a very great injury arises by the growth of weeds along the public roads where seeds are allowed to ripen, and are spread over the adjoining land;" and it was proposed to make it imperative upon road contractors to cut down and remove all weeds, especially thistles, dock and rag-weed, before the first of June.

The wisdom of a long continued war of extermination is apparent to all who understand the loss involved by the growth of weeds, the length of time during which weed seeds retain their vitality, and the necessity of abolishing the roadside, the fence corner and all the other *nurseries* which furnish large annual supplies of new seeds. No truce should be allowed in this war, for every thistle or dock can keep an acre full stocked.

Let us look at a more pleasant picture. We have dwelt long upon the dark side, but there is a bright side as well. There is a class of farmers in our State (I wish it was more numerous) who believe in clean culture, and practice it. If you visit their homes, what first meets your eye are neat, convenient, comfortable farm buildings, with surroundings entirely free from weeds and rubbish of all sorts. Go into the barn or tool-house and you will find a place for everything and everything in its place. In the fruit and kitchen garden you find plenty of vegetables and fruit for his family, of early sorts and late sorts, but no weeds; in the corn and potato fields you find luxuriant growth and large promise of crops, but no weeds; in the wheat fields long heads of golden grain bending with their own weight, and no weeds; the mowing fields are found free from rocks and stumps and weeds, there is from one to three tons per acre growing, with no worthless plants to injure its quality and no obstacles to hinder its harvest; in his pastures you find a thick mat of the different grasses, and the oxen and cows chewing their cud contentedly in the shade on the brow of the hill. Call again after harvest and you find the barn full of hay and fodder, the corn-house full of large, long ears, the cellar full of turnips and beets and potatoes and pork and beef. Follow him into the dairy and see the rich, melting cheeses, and the golden butter, and are you not ready to exclaim, "The farmer's life is the life for me?"

Hon. T. Fuller of Lincoln. The subject of clean cultivation is a very important one. The great fault of our farming is, that we have too much land under cultivation. We have been clearing a great deal for the sake of selling the lumber, and we try to do something with the whole of it, when our means are insufficient to deal properly with so much. Under these circumstances clean culture is impossible. One acre, well tilled is worth more than four overrun with weeds, and I hope the paper read, and the discussions here, will call attention to the subject and work a reform.

Mr. Hersey. As I have passed to and fro in town I have noticed one of Mr. Fuller's fields, as green as any in June. I would inquire what crop he has there?

Mr. Fuller. It is witch-grass. I plowed that field early in spring, manured it well from the barnyard, put on Cumberland superphosphate, and planted it with a determination to eradicate the witch-grass if possible. It was very dry in the spring, and the corn did not start quick, nor come up well, consequently I could not hoe early, but the witch-grass did not stop for anything. I hoed that corn thoroughly, three times. There were about three acres in the piece, and when I got across it the other side would be green with witch-grass. Where the corn did not come up I planted yellow-eyed beans. I have a pretty good crop of beans, and about half a crop of corn. After the hard frost the other night, we cut up the corn and stacked it. Then I told my men to pull the beans and throw them, roots up, on the hill; which they did three days ago. We have had rain since, and this morning when I went out I could see no beans at all, but the a most beautiful growth of witch-grass, and it was a query in my mind whether I had better let it be, or put in my cattle to eat it off. I finally concluded I would get the beans and corn off, and then put my team on and give it the greatest plowing and harrowing that ever a field had in this town. What the result will be I do not know, but I am determined to spend a good deal of time and labor on it this fall. If any one can help me to get rid of the witch-grass, I shall be very glad. It has been said that there is a gentleman here who likes it. I would like to have him tell me its good qualities. I admit that it will stand the drouth.

Col. Swett. My sympathy is largely awakened when I find a man in trouble, and am always willing and ready to help. I shall have to relate something of my experience.

Nineteen years ago, I bought a farm in Paris. The farm I lived on previously was clear of witch-grass, but I had seen it on the Androscoggin river. I bought the farm in winter, covered with snow. When the snow was gone I found all the plowed land full of witch-grass, and I felt sick of my trade. But in the spring I went at it. I planted and sowed, and raised a crop of witch-grass —a good one. My corn was pretty good, better than I expected; my potatoes were good, but pretty well riddled; the witch-grass roots went through them. I laid that land down to grass and got a stout crop. I talked with men on the Androscoggin, and they told me not to plow until ready to plant, and to plow deep, and it would not plague me much with a hoed crop; and the next year to seed it down. I adopted their mode. My soil was pretty free from stone, and when I got ready I put the plow in a foot deep, turned the witch-grass down, put on my manure and harrowed it in, and the witch-grass did not plague me any that year. The next year I plowed in the fall, sowed grain, and seeded it down. After six or eight years I could honestly say that I liked it. It was no plague, managed in that way. I cut, this summer, an average crop of hay, bad as the season was.

I admit that witch-grass is a plague, where you want to plow year after year. I have killed it out of some pieces. Put in your plow and set the sod on edge as much as you can, and let the frost go through it. The next spring put on the harrow, and you will find that seven-eighths of the roots have been killed. I would not do it upon a piece of land now.

Mr. Fuller. I am much obliged to the gentleman for the encouragement his remarks have give me. I think my farm worth five hundred dollars more than I did an hour ago. I will try his method with this piece as I have others where there is plenty remaining to show its good qualities. I think now I will keep the farm a few years longer; but I would like to sell off a thousand tons or so of the roots.

Mr. Thing. The question was asked in the Farmer's Club last winter, how to get rid of witch-grass, and I answered without hesitation, and I say now, if you have got it fairly in your soil, every cent of money or moment of time you spend in trying to get rid of it, will be thrown away. Set it up on edge, or do what you will, kill seven-eighths of it, or almost eight-eighths, and you will have enough left. The little one will become a thousand mighty spry. If there is anything to be dreaded on a farm it is witch-grass; anything else can be got rid of.

Mr. Gilman. I have known some who had pieces of land as badly infested as that of Mr. Fuller, who kept it under control, so that when they wanted hay they had it, with all the benefits referred to by my friend from Oxford, and when they wanted the land for crops, the witch-grass did no injury. The rule with those who have met with this success is, not to plow until the last thing before the land freezes. If you can, put on a fine tooth harrow and tear the sod all to pieces. If you cannot do that, or if the winter does not come on soon, plow again before planting, so that it will not have time to come up before you plant, and then plant corn.

COL. SWETT. If you want to get rid of it very much, pasture your land, and you will kill it.

MR. HERSEY. With hogs?

COL. SWETT. No, sir; with cattle.

MR. FULLER. Will pasturing with sheep kill it?

COL. SWETT. I think it will, sir.

MR. FULLER. I had two acres where I let my sheep run for two years. They lay at night on a sandy knoll, and the witch-grass would grow an inch every night, and the sheep would eat it off every day. Then I turned it into mowing, and the grass came up a foot or a foot and a half high, and was so thick that it excluded the light, had no color, and rotted at the bottom at the time I mowed it.

MR. GILMAN. I was never troubled with it except in a small patch, and as soon as I found it there I turned the piece to pasture. That was eight years ago, but the witch-grass is there now.

MR. HERSEY. I have a piece in mind, which has been pretty thick with witch-grass, where hogs have been turned in. It has been used as a garden for a year or two, and I have been told that the hogs completely cleaned the witch-grass out.

SEC. GOODALE. Several persons with whom I have conversed, have told me that they have eradicated witch-grass by the use of French's cultivator. One was used at the college farm last year, and I understand it was very effectual. It is a good deal like the ordinary cultivator in its frame, but in place of the usual iron shares there is something more like a tooth of an ordinary spike harrow, except that it is longer, and bent forward in such a way that after effectually pulverizing to the depth it goes, it just lifts out what we call the roots of the witch-grass. These that we call roots are properly underground stems, furnished with buds. The roots proper are the little feeding fibres which start out from the stems. The stems, as we know, are very tough and sharp-pointed, so that they will pierce through a potatoe or through a board that is partly decayed. While it is true that a very small amount of these underground stems will serve to seed a large extent, yet by following up the use of the implement to which I referred, some farmers have succeeded in eradicating it, and especially when followed by a crop that shades the ground well, like corn or Swedish turnips. There seems to be something in the rutabaga which is antagonistic to it. I have seen rutabagas raised on ground that was rich and full of witch-grass, and the witch-grass entirely disappeared. This was in a dry season, however; in wet seasons this plan has not worked so well.

Mr. Chamberlain. I deem myself unfortunate in the possession of some land infested with witch-grass. I found, in putting in the plow the last two years, that there were patches of witch-grass, and I bought an implement known as Perry's Scarifier. Last year I had part of this field in potatoes. I tried to carry out the idea of clean cultivation, and succeeded very well. There were no weeds after harvest, except an occasional spear of witch-grass. The remainder of the field was in fodder-corn, planted for fall feed. I put the scarifier upon the ground after harvest, with the design of working it over two or three times, and to repeat the process this spring, so as to thoroughly eradicate the witch-grass if I could. I had not much time last fall, and only went over the field once. This spring I commenced pretty early, and went over it in one direction, holding the implement down the strength of the draft of one horse. The next opportunity I went over it in the opposite direction, and so repeated the operation, and I have nearly succeeded. The field is mostly in corn this year. On one side there is a piece of rutabagas, very thick. I examined that very closely since I hoed it the last time, and I think you could not find a spear of witch-grass. There is a very little where the corn was. I do not think I have succeeded, by buying the implement, in fully getting rid of witch-grass. I did not expect to; I consider it a great pest. I had occasion, in June, two years ago, to go on to farms, at intervals, all the way along from my place in Piscataquis to the Connecticut river, and I found everybody in the same trouble as Mr. Fuller. I am glad there are some, like our friend Swett, who are philosophers enough to be reconciled to their lot. If they were not, they might as well make up their minds to abandon New England, for there is scarcely a farm between here and the Connecticut river where it is not. I was surprised to see to what an extent it had increased and multiplied, until it had possession everywhere. It is a great pest, but one which must be endured.

The subject was then laid on the table.

PRES. ALLEN. Mr. Chairman—The officers of the State College desire, through you, to return their grateful acknowledgments to the citizens of Lincoln for their kind hospitality extended to its members during the sessions of this Board.

On motion of Mr. Gilbert, a resolution was passed, tendering to the citizens of Lincoln the thanks of the members of the Board for the kind reception, attentions and favors received from them; which was appropriately responded to by Messrs. Hersey and Robinson of Lincoln.

THE PRESIDENT. I find some resolutions before me which I am happy to present here; and you will allow me to say, that from a personal acquaintance of twenty-five years, I know of what I speak.

Resolved, That the thanks of the people of Maine, and of the friends of progressive agriculture everywhere, are due to Calvin Chamberlain, of Foxcroft, retiring member of this Board, for his earnest, unremitting and gratuitous labors, in advancing the material prosperity and social welfare of the people of our State during the fifteen years he has been a member of this Board.

Resolved, That in parting with Mr. Chamberlain, the members of the Board can express no better wish than that the remainder of his days may be as pleasant to himself as his labors have been useful to others.

SEC. GOODALE. I second the resolutions with exceeding heartiness. I feel that not only so much as they express is due to Mr. Chamberlain but a great deal more, and more than I am capable of saying. I am well aware—perhaps better than some others—of the extent of the labors which he has performed, and the great amount of time, energy and perseverance expended in his researches, and which are likely to bear fruit for many years to come.

MR. SIMPSON of Bangor, MR. ADAMS of Franklin, MR. GILBERT of Androscoggin, COL. SWETT of Oxford, and MR. HERSEY of Lincoln, spoke briefly in support of the resolutions; bearing testimony, in the heartiest manner, to the faithfulness and efficiency of Mr. Chamberlain's labors, and expressing fervent hopes for his future health and prosperity.

The resolutions were then unanimously adopted by a rising vote.

MR. CHAMBERLAIN. Brothers and members of the Board of Agriculture, you have taken me by surprise by these too flattering expressions of your kindness. It is true that our official relations terminate at the end of the present calendar year, but this circumstance need not be taken as indicating that we separate at that time. I hope, so long as I have life and strength, and remain a citizen of the State, which I hope to do until the end of my career, that I shall maintain the same relation to you, and to the citizens of the State generally, that I have had the pleasure of maintaining for the last fifteen years. I hope that my interest in the cause in which we have been engaged, so pleasantly and so happily, since we have been associated together, will not cease.

I will not attempt any further expression of thanks in reply to the resolutions, but I would like, in the quiet of my home, to attempt to express with my pen something that I feel on this occasion.

The President then made some parting remarks, and the Board adjourned *sine die.*

ON STASSFURT POTASH-SALTS AS FERTILIZERS.*

BY PROF. CH. A. GOESSMANN, PH. D.

In a paper read before the Massachusetts State Board of Agriculture, and published in their Annual Report of 1869, I took occasion to refer to the importance of the Stassfurt surface salts, and to call attention to their extensive use as fertilizers in Germany. Neither our manufacturers of artificial fertilizers, nor our farming communities, appear as yet to realize the great benefits which will result from their well considered application. As a new and important source of potash compounds—like the Stassfurt surface salts—ought to engage the attention of every intelligent agriculturist in the country, I believe that a short description of the locality where these compounds are obtained, and what the commercial brands, "Muriate of potash," "Kainite," etc., represent, may prove of interest to some of your readers.

These salts, which have been lately introduced into agriculture and the industrial arts of Europe, are mined at Stassfurt, Prussia. The celebrated Stassfurt salt mines have been worked since 1857; the saline mass has been pierced more than one thousand feet, without reaching its lowest termination; it extends over an area of more than twenty-five *German* miles in length; the salts were struck at a depth of from 480 to 812 feet. The most interesting feature of this immense salt deposit, consists in the fact, that its upper portion contains a very large admixture of the sulphates of potassa and magnesia, and of the chlorides of potassium and magnesium, besides a series of less valuable compounds. These various salts occur frequently in an isolated, well-characterized form by themselves, or they are found in combination with each other, producing new and distinct minerals. Thus for instance, mineralogists and chemists recognize *Sylvine*—chloride of potassium in its isolated form; *Polyhalite*—containing the sulphates of lime, of magnesia and of potassa (28.9 per cent. of potassa); *Kianite*—containing the sulphates of magnesia and of potassa (36.34 per cent.); besides chloride of magnesium (E. Reichhardt); *Schönite*—containing the sulphates of magnesia and potassa (43.18 per cent.);

* From the American Chemist, July, 1871.

Carnallite—containing the chlorides of magnesium and potassium (26.76 per cent.). Most of these minerals contain also a certain amount of water in a chemical combination, whilst some of them, as the Polyhalite and the Kainite, are decomposed by merely dissolving them in water. The mineral Kainite was first noticed by C. Zincken, in 1865, in the Leopolds-shaft at Leopolds-hall near Stassfurt, and was first described by him as a compact, grayish green, transparent mass; its composition has been differently stated; according to Rammelsberg, this mineral contained all its potassium as chloride of potassium (12–13 per cent.); Reichhardt's view as above given, is at present more generally accepted. The Kainite of commerce is an artificial product obtained in the manufacture of the highly-concentrated potash compounds; evaporated and calcined mother-liquors, in most instances, furnish its constituents. The larger portion of these various potassa compounds, however, are found in more or less compact masses, distributed in a certain order throughout the successive upper layers of the rock-salt deposit, each one of the latter being particularly characterized by the presence of one or more of the compounds previously referred to. The entire deposit viewed from a chemical standpoint, has been quite properly divided by F. Bischof and others, into four different layers. The lowest layer thus far worked, which contains the best quality of rock-salt, with numerous thin seams of sulphate of lime (Anhydrite) is about 600 to 700 feet thick. The succeeding layer, 200 feet in thickness, still consists principally of rock-salt; it is mainly characterized by the fact, that the seams of sulphate of lime observed in the lowest layer, are gradually replaced by those of the sulphates of lime, magnesia and potassa; the sulphates of lime, magnesia and potassa, produce here the Polyhalite, whilst the sulphates of potassa and magnesia, with some chloride of magnesium in smaller quantity, furnish in its upper portion, the material which compose the mineral Kainite; these two compounds represent from 5.5 to 10 per cent. of the second layer. The third layer is about 180 feet thick; its average composition is stated to be 65.0 per cent. of chloride of sodium from 16 to 17 per cent. of sulphate of magnesia, (Kieserite) from 3 to 4 per cent. of chloride of potassium, and from 7 to 8 per cent. of chloride of magnesium, Kieserite and Carnallite are here the most prominent native admixtures of the chloride of sodium, whilst the Sylvine and Schönite noticed in this stratum, are looked upon as secondary products, due to the action of water. The fourth, or upper layer, is 135 feet thick, and consists of 25 per cent. of chloride of sodium; from 15 to 16 per cent. of sulphate of magnesia; from 14 to 15 per cent. of chloride of potassium, and and from 22 to 23 per cent. of chloride of magnesium, etc.; the Carnallite amounts frequently to 55 per cent. of this entire layer. It will be noticed that more than 500 feet thickness of the upper portion of the saline formation at Stassfurt, contains a considerable quantity of compounds more valuable than rock-salt. The four layers as a general rule, pass gradually into each other; they are thus quite naturally varying in their composition, even within their proper limits, a circumstance which has at an earlier state in the history of the mines, greatly interfered with the general satisfaction concerning the great value of their crude products for fertilizing purposes. For some years after the opening of the mines, no particular attention was paid to the crude surface salts: they were treated as worthless refuse material. The celebrated chemist, H. Rose, of Berlin, Prussia, was the first who recognized their value as a new source of potash compounds. He succeeded in directing the attention of his government to this fact. The latter, in 1860, made arrangements to sell the materials at a low figure for experimental purposes. Agriculturists first began to test their value as fertilizers, and chemical manufacturers, encouraged by a system of premiums, soon followed with examinations in regard to their fitness for commercial concentrated potash compounds. Whilst the former felt somewhat discouraged in their experiments, on account of the varying composition of the crude products of the mines, and in frequent instances, the serious influence of the chloride of magnesium on staple farm crops, the manufacturers of potash compounds for general industrial purposes met with encouraging success. Several important causes operated decidedly in their favor; the chloride of potassium brought a high price, from 4½ to 5½ cts. per pound. The available resources for potash manufacture were slowly but surely declining in the face of an increasing demand, and the opening of a second shaft at Leopolds-hall, a short distance from Stassfurt, had demonstrated almost beyond doubt, that the layer of Carnallite alone, promised a yield of not less than six million tons of chloride of potassium. The manufacture of that compound soon became the leading feature of the new industray. An extensive manufacture of nitre was started by Dr. Grüneberg, in 1861, the first factory for the separation of potash salts from Carnallite; there are at present from 12 to 14 large factories engaged in the production of the same article.

The process adopted by Dr. Grüneberg and others is that of fractional solution, and aims at a product containing from 80 to 82 per cent. of chloride of potassium, the product containing, besides this, from 18 to 20 per cent. of chloride of sodium. This strength has been found convenient for the manufacturers of nitre, for 80 pounds of chloride of potassium will produce, if decomposed with Chili saltpetre, including unavoidable losses, one hundred pounds of nitre. The production of the latter from Chili saltpetre by means of Stassfurt chloride of potassium, was added some 4 to 5 years ago, to the chemical industry of the New England States; one party in Boston purchased, lately, not less than one thousand tons of the chloride of potassium from Stassfurt.

The rapid increase of factories soon caused a general decline in the prices of their productions. In 1863 one hundred pounds of chloride of potassium (80 per ct.) were sold at 49 francs ($7.75,) in 1865 it was offered at $3.60, a price lower than cost at that time; the present cost is stated to be 15 fr. ($2.90.) Although the manufacturers of alum, Prussiate of Potash, flint glass, etc., had become steady consumers, the markets were overstocked, causing a disastrous local, commercial crisis; a number of factories closed operations. The Government, at this point, for the purpose of relieving the young industry, wisely offered premiums for valuable suggestions to create new channels of consumption. To produce sulphate of potassa, and subsequently carbonate of potassa, after Leblanc's mode of soda manufacture from the products of the mines without the aid of *additional* quantities of sulphuric acid, was one of the principal questions proposed for investigation. The peculiar location of Stassfurt, causing too high prices of freight for the transportation of iron pyrites and coal, rendered an economical manufacture of sulphuric acid in the vicinity of Stassfurt impossible; it is to this circumstance that we have to ascribe the failure of its being the centre of the soda, etc., industry in Germany. Dr. Grüneberg (Voster & Grüneberg, of Stassfurt, and of Kalb, near Deutz, opposite Cologne,) it appears was again among the first persons who succeeded in offering the best solution of the problem. His process consists in treating the pulverized sulphates of magnesia and potassa, either native or artificial Schönite, with a concentrated solution of chloride of potassium, in consequence of which all the sulphuric acid present generally unites with the potassa present, forming sulphate of potassa and chloride of magnesium, i.e. Carnallite. The sulphate of potassa originates thus indirectly from the Kainite and Kieserite by the reaction of native Sylvine or the chloride of potassium previously obtained from the decomposed Carnallite; it is subsequently more or less purified by a recrystallization, and sold either as such, or first changed into carbonate of potassa by Leblanc's process. The carbonate of potassa produced from the Stassfurt salts, is on account of its superior quality, highly valued, for instance, in the manufacture of the best English flint glass, etc. The growing importance of the Stassfurt potash industry, may be some what inferred from the fact that its production of chloride of potassium alone, amounts at present to from 25,000 to 30,000 tons per year, and at the same time, that the entire amount of potash obtained from the chief vegetable source, woodash, has been reported at the Paris Universal Exhibition of 1867 to be but 30,000 tons; about 13,000 tons of woodash is stated to be the annual contribution of the United States and British America; a great decline when compared with earlier years. The want of potash fertilizers which is felt more and more every day, for the successful cultivation of extensive root crops, particularly sugar beets, tobacco, hops, potatoes, almost every description of grain and many of our fruits, as grapes, etc., has of late induced a number of manufactories at Stassfurt and elsewhere to meet the wants of agriculture with suitable and cheap potash compounds. Learning from the past, they prepared them upon the following plan: cheapness of the potash contained in the fertilizer, definite composition of the products as far as their percentage of potash is concerned, and to as great an extent as possible exclusion of the injurious, or at least, in many instances, very objectionable, chloride of magnesium. The fertilizers manufactured on that plan contain the potassium either as chloride, or as sulphate; the latter form is decidedly preferred. The sulphate of potassa is frequently accompanied by sulphate of magnesia, an addition which, in some instances, may prove quite advantageous. The peculiar position of magnesia compounds as special fertilizing agents, is now undergoing in Europe, a closer investigation; the unusual proportion of magnesia in all our grains, points towards an important function in the growth of plants. William Grange, Esq., of Baltimore, Md., one of the first who engaged in the importation of Stassfurt potassa fertilizers, kindly furnished me, at my request, more than a year ago, with a series of samples, which have been subjected to an examination with a view to experiments upon the college farm. I obtained the following analytical results from some of them; I give them, with their commercial names:

No. I. Muriate of potash represented 90 per cent.; found 89.0 per cent.

No. II. Concentrated potash-salt contained 42 per cent. of sulphate of potassa.

No. III. Refined sulphate of potash and magnesia; it contained:

Sulphate of potassa,	43.3 per cent.
Sulphate of magnesia,	33.1 per cent.
Sulphate of lime,	2.2 per cent.

No. IV. Calcined ground crude sulphate of potash contained:

Sulphate of potassa,	19.9 per cent.
Sulphate of magnesia,	17.5 per cent.
Basic chloride of magnesium,	4.6 per cent.
Sulphate of lime,	4.2 per cent.

No. V. *Commercial Kainit* represented:

Sulphate of potassa,	28 to 32 per cent.
Sulphate of magnesia,	14 to 20 " "
Chloride of magnesia,	4 to 5 " "
Sulphate of lime,	10 to 12 " "
Chloride of sodium,	35 to 40 " "

All these samples contain chloride of sodium. Most of them, in consequence of calcination, contained also more or less basic chloride of magnesium; the less they contain of the latter, the more desirable. Most of them are obtained in the course of the manufacture of the higher grades of potash compounds, for general industrial purposes. The commercial Kainite results from the working of the mineral Kainite, for purposes just alluded to.

The market price of these salts is quite naturally based on their percentage of potassa; an inadequate supply during the past season, has kept them more unsettled and fluctuating than proper management would seem to warrant. The following figures will convey some idea of the quotations during the present spring: muriate of potash 80 per cent. $2\frac{5}{8}$ to $2\frac{3}{4}$ cts. gold, per pound, or about $58 to $60 per ton of 2000 pounds; sulphate of potassa 90 per cent. $5\frac{1}{4}$ cts. currency per pound, or $105 to $106 per ton; Kainite at $30 to $35 per ton; in some instances sulphate of potassa, of from 50 to 52 per cent. has been sold as high as $90 per ton, and Kainite at $40 to $45 per ton. Stassfurt manufacturers offered in 1870, in case at least 5 tons were purchased, sulphate of potassa, 70 to 75 per cent. at $62 to $64 (gold) per ton; muriate of potash, 75 to 80 per cent. at $35 to $36 (gold) per ton; concentrated potash 30 per cent. of sulphate potassa at $12 to $13 (gold) per ton; crude sulphate of potash 18 to 20 per cent. at $6 to $7 (gold) per ton. Comparing the Stassfurt and our own market prices, we notice that we pay about twice the original cost to dealers in our markets; a healthy competition will regulate the trade.

The results obtained from an intelligent use of these and similar potash fertilizers, are highly satisfactory; their consumption increased in 1865 to 50,000 tons; they have gained ground as special fertilizers year by year, in Germany, France and England; with us it cannot be otherwise, for common potash is too expensive for farmer's use, and even wood ash of good quality commands in most localities, a price almost beyond the means of a farmer engaged in the ordinary pursuit of his business; those engaged in special farming, frequently cannot obtain at any price the desirable amount. As the tendency of progress in agricultural pursuits points decidedly towards cultivation of special crops, the importance of an ample and cheap supply of a special fertilizer, like potassa, cannot be over-estimated. I do not propose to enter at present upon a detailed exposition of their particular advantages concerning our most important farm-crops, as noticed in Europe, but confine myself to a few general remarks concerning the best ways of applying them. They are used as special manures in connection with stable manure, and are rarely applied in larger quantities than about 200 pounds of the higher grades, and 300 to 400 pounds of the lower grades per acre; they are never used in their isolated states; in case they have to be applied as top-dressing, for instance upon meadows, etc., they have to be mixed with at least three to four times their volume of soil, compost, etc.; they are usually applied together with guano, superphosphate of lime, ground bones, &c., or are incorporated in the barnyard manure in the course of its accumulations in suitable water-tight cisterns, etc. The best results regarding the same crops, have been noticed upon a loamy soil, less favorable ones upon a stiff and wet clayey or marshy soil, or upon sandy soil without a retentive subsoil. The lessons derived from a careful investigation of the Stassfurt salts, have stimulated inquiries as to the chemical conditions of other salt deposits; the recent discovery of an unusually large proportion (50 per cent.) of chloride of potassium within the surface salts of the salt mines of Kalsuz, in Galicia, by B. Marguliks, is the first fruit of these well-directed exertions. May a similar spirit animate the managers of our valuable salt deposits, and there will be no reason why we may not be enabled to record, sooner or later, the potash fertilizers among the products of home industry.

MASS. AGRICULTURAL COLLEGE, Amherst, Mass., 1871.

CROP REPORTS AND FORECASTS.

A proposition has lately been presented by Commodore M. F. Maury for a system of meteorological observations, co-operative researches, crop reports and forecasts, upon a magnificent scale, which, if carried out, can hardly fail to prove of immense service to the whole country, and especially to its agricultural interests.

The following resolution, sketching an outline of his comprehensive project, was first presented at the meeting of the Memphis Agricultural and Mechanical Society, October 17, 1871. It received a hearty adoption. It was subsequently adopted, with great enthusiasm and unanimity, by the National Congress of Agriculturists which met lately at Nashville.

The resolution, and the remarks in support of it, by Commodore Maury, have been forwarded to agricultural associations, with an invitation to put forth such influence as they may possess, whether as Boards of Agriculture, Societies, or individually, toward its being carried into effect.

Whatever may be thought of Commodore Maury's war record, or of his estimate of the practical value (or lack of it) of the scientific labors of the Secretary of the Smithsonian Institute, or of his estimate of the value of his own labors, it is generally admitted that he has contributed to increase of knowledge, and in much larger measure to the application of science to useful ends, and has fairly earned the gratitude of the world as a public benefactor.

"*Resolved,* That the President of this society be, and is hereby instructed to petition, in behalf of the farmers of Tennessee, the the United States Government, throughout the State Department and the Executive, in favor of the establishment, by international co-operation, of a general and systematic plan of Meteorological Observations and Crop Reports, and to request the Government, in furtherance of this object, to invite the other nations to meet, in the persons of their leading Meteorologists, at an early day in conference, *a la* that of Brussels in 1853: 1st. For the purpose of connecting with the plan now proposed the system that was then devised for the sea; 2d. For the purpose of arranging details;

and 3d. For the purpose, also, of providing a general system of Telegraphic Meteorology and Crop Reports, 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; and the President of this Society is required, also, to request that the United States Government will co-operate in this system of research, by causing the plan that may be agreed upon in conference to be carried out in this country, and to be adopted on board of the national cruisers."

Commodore Maury then spoke as follows:

The farmer sows in faith. But whether he shall reap in plenty, or glean in scarceness, depends, as you know, upon the season.

I am not fond enough to suppose, nor do I mean to convey to you the idea, that the conference to which these resolutions point is to devise any system of physical research which will enable Meteorologists to regulate the seasons. But I do mean to convey the impression to your mind—because the conviction is strong upon my own—that, if the object of these resolutions be carried out, the result will be far more beneficial than any which could possibly flow from human power over the seasons.

Let us illustrate this, so that we may make it plain as we go: Some farmers here present grow wheat. Let us take such an one for illustration, and follow him from seed-time to market; he has been up early and late; he has worked hard; his grain is harvested and housed; it is all ready for sale; he wants a little money, and goes to the town to inquire the price of wheat of the men who want to buy.

Now, in doing this, he is reversing the general order of business at once. Usually, the buyer asks the price of his wares. But with regard to all of the chief agricultural staples, the producer knows so little about the yield in competing States and countries, that he is compelled to go and ask the buyers about it, and request them to fix the price. What would you think of your neighbor, who, wishing to sell a horse, should go to the man who wants to buy, and ask him to fix the value and set the price? Yet, this is exactly what you do with your cotton and grain, rice, sugar and tobacco, and all of your staple productions. To relieve you from this, and put you on a footing with the factor in knowledge as to the yield of the crop everywhere, is exactly what these resolutions aim to do.

But let us follow our grain-grower to town, and see what occurs. The factor tells him wheat is low. "How is that?" he asks; "the season has been very unfavorable, and nobody in my part of the country has made half a crop; grain is scarce, and ought to be high." "Oh," the reply may be, "the crop in the Northern States—in Ohio, Minnesota, and other valley States—has been very large. Corn is so cheap there that they are using it for fuel. It will be brought down here by rail and water fast enough, and the local scarcity will soon be rectified." "But mine is Tennessee wheat. It is almost as flinty as the maccaroni wheat of California, and bears sea transportation nearly as well. I don't want to sell it here; I want it shipped to England. How much will you allow on it?" "If I do that," the factor may rejoin, "you must be prepared to allow a very large margin, for there has been a tremendous crop in the valley of the Danube and the basin of the Black sea, which, you know, are said to be the granaries of Europe."

Thus, you see, prices are regulated, not by the yield in Tennessee or Minnesota, but by the yield in all parts of the world, both at home and abroad, whence wheat is sent to market to compete with that which is sent forward from here.

But our farmer pushes his inquiries, and learns that the factor gets his information, as to the large crop in Europe, from estimates of the grain dealers in New York and London, who in turn base their calculations upon such information as they have been able to gather here and there.

Now, I cannot keep it too prominently before you, that the object of these resolutions is to give you, as well as the merchant, as accurate and familiar information as to the yield of the crops in every part of the United States, in England, the basin of the Black sea, Egypt and the Danube, as you have of it in your own neighborhood.

Like mistakes, as to yield, happen with corn and tobacco, sugar, rice, hemp, and all the agricultural staples of commerce. They are of annual occurrence. How should it be otherwise, seeing the information is so one-sided. It is collected by the buyer—of course in his own interest, for by it he sets his prices. This information ought to be collected by the Government, and be in the interest of truth and science, and therefore impartial.

Upon such information as they have been able to "pick up" from the Black sea and elsewhere, it is surprising to see how accurate these estimates are made and prices fixed. Though they are often wide of the mark, as all of you know to your cost—for it not unfrequently happens, that by fall and winter, when the crop has nearly all gone forward and left the hands of producers, the discovery is made that the wheat crop, both in the Upper Mississippi valley and in the Black sea country, has fallen far short of the estimates. Then prices go up. Sometimes the rise is as much as a dollar a bushel, and, as a rule, the rise comes too late to do you any good. The middle-men usually get the benefit of the rise, at the expense of the producer on one hand, and of the consumer on the other.

The relation between buyer and seller are antagonistic, in so far as one wants to buy low, and the other to sell high. For the lack of just such a system of co-operation and research as I propose, it continually happens that the producer, who knows nothing as to the commercial wants of the world for his staple, has to sell at prices that are based upon estimates which dealers, not producers, form as to the extent of the crop—not in one land, but in all lands from which commerce draws her supplies.

Did it ever occur to you to inquire how the data are obtained for these estimates, by which, year after year, you dispose of the hard-earned fruits of your labor, of your sweat, and your toil? Why, my friends, they come from sources the most feeble and inadequate. As an example, let me quote from the city articles of the "London Times," which reached me as I was preparing this address. That paper, you know, devotes daily nearly half a broadside to matters of finance, trade and commerce, and the number before me contains a long letter from a Mark Lane correspondent "on the present position of the grain trade, and the prospects of the approaching harvests in England." This dealer looks to me like a merchant who wants to buy, and would therefore like to see prices a little lower. At any rate, he states that the bulk of grain and flour on hand was then about ten million bushels, and prices ruled high; that there was a fleet of four hundred and eleven grain-laden ships then at sea and all bound for England; that the maize market was in a feverish state, owing to the uncertainty as to the extent of supplies from this country; and then, with the assistance of the "Harvest Journal," he attempts to forecast the English crop of 1871. The "Harvest Journal" forecasts from such information as it can pick up from farmers; and Mr. Kaines Jackson, the "Times" correspondent, supplements it with his own observations, made during "a tramp of ten miles" in the country. Now mind you: here is not an expert, not a farmer, but a city merchant who, from interested motives, perhaps, but at any rate from observations wholly insufficient, undertaking to forecast the wheat crop of all England, and publishing his predictions where they are liable to influence prices even here.

Now, suppose that you were to see a man, "*after a tramp of ten miles* in the country," from Memphis, pretending to forecast the corn crop of Tennessee and Kentucky—for these two States are not much larger than England—what would you think of his accuracy? Would you like to depend upon such figures for the price you are to get?

Well, let us look at the cockney's ear-marks for a crop. He argues in favor of a good crop from the stiffness of the stem, the shortness of the straw, and the compactness of the ear and color, in connection with what he had heard a farmer say the day before who had two stacks of different harvests, one a large, the other relatively a small stack—the latter produced one hundred and seventy-five—the other only seventy quarters.

From such sources of information as this, forecasts are made concerning all the staple crops upon which the husbandman expends his labor; upon such forecasts prices are fixed, and the producers have to take what they can get; and upon such sources of information you now depend for the price you are to get for all your crops that are standing in the fields or gathered in your barns. This is good for the speculators, many of whom annually make far more out of your crops than you do yourselves.

This letter—not because we know anything of Kaines Jackson, the writer, or of the newspaper called the "Harvest Journal," but because Sampson, who writes the money articles for the "Times," takes it up, indorses it, and publishes it in that journal—is read, and its purport retailed upon all the corn exchanges of the country, and prices influenced accordingly.

Now mark: these estimates were made in the beginning of August, when American wheat was just beginning to go forward, and when it had to encounter the cargoes of four hundred and eleven grain-laden ships already on their way to a market stocked with ten million bushels of wheat, and backed by buyers' estimate of a most abundant harvest. Of course, prices ruled low, and now, when many of you have sold, what has become of that abundant English harvest? Mr. Lewes, one of the great authorities there, now comes out with an estimate, showing that the present crop in England will fall short of English consumption at least eleven and a half millions of quarters, which, at sixty shillings, is worth upwards of $170,000,000.

An English paper, while confessing that this short crop is to tell fearfully upon the social history of the year—for a short harvest always lowers the marriage rate there, and checks increase of population—finds consolation in the reflection that John Bull's garners will surely be replenished from abroad. "Corn," it says, "will come to us from the prairies of Illinois and Iowa; from Russian steppes and Tartar river banks; from Baltic and Black sea granaries; from San Francisco, and places more distant still."

How are crops in those distant places? We know not; still, the price American grain is to fetch in England is to be governed by the yield in those countries.

We know already that the crop in France is short. Now, suppose American grain-growers had been possessed of Lewes' information two months ago—and these resolutions, had they been in operation, would have given it—what would it have been worth to the country? Something more than twenty cents* on every bushel of wheat that has been sold between July and October.

Under the system now proposed, we may expect the promise and the yield of every staple crop throughout the world to be forecast as accurately as an observant farmer can do it for his own neighborhood. Some will over-estimate, while others will under-estimate, but that will be like the personal equation among astronomers, which *savans* will know how to eliminate so as to get at accurate results. If you admit that true estimates may be made for one neighborhood, why not for all? It only remains to bring them together, and the appliances of the age furnishes the ready means for doing that.

Now, remember that Agriculture is the great source and fountain of prosperity, wealth and power of this country and the world; that, weighed with it, mining and manufactures, fishing, seafaring, navigation and commerce, are but straws in the balance. Calculate and see what vast sums of money your Government is and has been expending for generations, in the shape of duties and

* The statistics of the Corn Exchange, of New York, shows that, from the first to the middle of August, the price of wheat ranged from $1.30 to $1.32 per sixty pounds for No. 2, and from $1.33 to $1.35 for No. 1; and on the 26th of September, No. 2 brought $1.50 to $1.51, No. 1 then being worth $1.55. It is now (October 12th) quoted at $1.60 to $1.72.

tariffs and protection, direct and indirect, for the benefit and encouragement of those industries, and how little for yours. You don't ask as much for this great interest as is given annually for fishing bounties from the Treasury alone.

Surely, considering the progress that has been and is now making in physical research and scientific discovery, it is not much out of the way to ask the Government so to direct these discoveries and researches, and so to encourage them, that you, too, in your husbandry may have the benefit of them.

The cost will be trifling; the machinery for carrying out this plan is already provided in most of the States of Christendom, and it only requires to be geared together and put in operation. In this country, you have the Agricultural Bureau and the Signal Office; then there are the log-books of your men-of-war and merchant-men—those "famous abstract logs" which were turned to such good account in the "wind and current charts." There is also, or was, the system of army meteorological observations, from which there have been derived results of exceeding value in the shape of Blodgett's Climatology of the United States. Also, you have in several States, colleges, and other public institutions, in which various systems of meteorological observations were carried on; and, besides these, there is the Smithsonian system; each making the observations and collecting the information required by this plan, but each acting for the most part as independently of the other as though there was nothing common between them.

Besides all this, there is stretched out over the world—a fact which is of the utmost importance to the system—a net-work of telegraphic wires, without the use of which this plan would lack its most precious fruits. The length of these wires at present is nearly a million of miles, and it is increasing at a rate one hundred thousand miles a year. Moreover, in all countries there are meteorologists with their systems and plans for observing and discussing the movements of the atmosphere; and most nations have their Agricultural Bureaus and other offices, where information is sought and disseminated touching the soil, crops and cultivation. And all that is needed is to bring these meteorologists, offices, implements and means together in a spirit of friendly concert and co-operation to this, and the greatest boon that Agriculture has received since the continent gave it Indian corn, the potato and tobacco, will be conferred upon those who earn bread in the sweat of their brow.

What, gentlemen, do these resolutions propose that you should ask? Simply that the Government will use its friendly influence —not its money, but its good offices—with other nations for the advancement of science and the especial benefit of all those, everywhere, who till the earth.

In 1853, I obtained leave to invite the powers of Europe to send their men of science and leading meteorologists to meet in conference at Brussels, that we might there counsel together, devise a uniform system of meteorological co-operation and research at sea. The invitation was promptly accepted, the conference met, a plan was agreed upon, and immediately ships under all flags were, without the cost of a cent, converted into floating observatories; they were to be found day and night in all parts of the navigable world, observing and recording the phenomena of sea and air according to the plan that we had in conference devised. Other nations established bureaus to engage in the work of discussion and to co-operate with us. What was the result? Why, a harvest as rich as the ooze at the bottom of the sea. The voyage from this country to Brazil was shortened twenty days; to some other countries it was shortened thirty days; to others forty, fifty, and even sixty days. Navigation was rendered more safe, the dangers of the sea were lessened, and millions, not only of dollars, but of pounds sterling, saved to commerce annually in the shortening of voyages and the saving of time; and the commerce of the world is for all ages, and without let or hindrance, to enjoy these benefits and blessings. Nor is this all. A new department of science, named by Humboldt, "the Physical Geography of the Sea," grew out of these researches. They led to the discovery of the Telegraphic Plateau, which led to the laying of the Atlantic cable. With it, also, I introduced a system of deep-sea soundings, which has excited such a lively interest in the minds of philosophers throughout Europe, touching the physics of the sea, that nation after nation there has, since I left the Observatory at Washington, taken up the broken threads of my researches, and carried them on separately, and with such success that now European meteorologists tell us that, under the impulse given by the Brussels conference, their science has made more progress than it had done in all time before.

I proposed, then, to include in that system the land also; and to do for Agriculture then what I was doing for commerce and what, by these resolutions, we seek to accomplish now. The

Royal Society, of London, advised against it. Through deference to their opinion, I abandoned the land portion of the enterprise. It was postponed—not given up—at the Brussels conference; and that it was postponed has been with me the source of a standing regret ever since, for I afterward learned that the leading meteorologist of Europe and all the governments, with the single exception, perhaps, of little Bavaria, were with me. Thus, at an expense not exceeding $1,000—if I accurately remember—I got together the conference of meteorologists at Brussels, and brought under one comprehensive and co-operative plan of physical research more than two-thirds of the known regions of the earth's surface. Surely your government, backed by all the moral weight and influence of the country, can bring the remainder under this system, and by so doing confer upon Agriculture, Commerce and the Industries of the country a boon such as they have never received—no, not since your fathers knocked off poling up the Mississippi.

But to return to the present plan of collecting that sort of information by which the price of your crop is determined—in order that you may fully understand the defect of the present system, and fairly comprehend the benefits that are to be expected from the plan proposed, let us see how the data are now collected for forecasting the crops in this country. One or more houses in New York will issue circular letters from time to time, telling of the promise and forecasting the yield of the crop. This is done from data the most scant, but from the best that is to be had. Some rely on the merchants in the inland towns and cities for their information; some on newspaper reports, and some will send agents to ride over a few plantations—take a "tramp of ten miles." From data thus collected the crops are forecast.

As a rule, these firms aim at accuracy. But we cannot forget that there is the principle of antagonism between the factors who buy and forward, and the farmers who grow and sell the crop; and I fancy that generally—not always, but frequently—the crop, as it begins to come forward, is over-estimated; and, as a rule, these errors are not detected until the crop has left the hands of the producer and entered the channels of commerce. The discovery is then too late to do any good.

Perhaps I can bring this home more closely to an assemblage like this, if I draw my statistics from cotton; though facts would be as telling to those engaged in other specialties, if I were to draw them from corn, tobacco, sugar, coffee, fruits and wine, hemp, rice or any other great Agricultural staples of commerce.

Let us see some of the over-estimates that have been made in cotton during the last generation.

Here is a table I got from one of the first authorities on this subject in the land—Maury Brothers, New York.

The cotton crop, after it had all gone forward and had been delivered for shipment, was found to fall below the estimate in the following named years, as follows, viz:

The real crop of 1827 fell below the estimated crop 25 per cent.; of 1838, $24\frac{1}{2}$ per cent.; of 1840, 25 per cent.; of 1843, 15 per cent.; of 1846, $15\frac{3}{4}$ per cent.; of 1849, $23\frac{1}{4}$ per cent.; of 1856, 18 per cent.; and 1860, $21\frac{3}{4}$ per cent. Average, $21\frac{3}{4}$ per cent.

These are not all the erroneous estimates that occurred during this period of thirty-four years. They are only extreme cases; but they show that, on the average, every fourth crop is over-estimated to the extent of more than one-fifth.

In other words—I wish you cotton growers to mark this fact, because, through lack of what these resolutions seek to accomplish for you—you lost during those thirty-four years one entire crop and three-fourths of another—that is, you gave it away—for in the above-named eight years you sold each crop on the assumption that it was one-fifth larger than it really was, and, therefore, you got for it one-fifth less than it really was worth.

This, I believe, is the way you gentlemen would put the case. It may not be quite the true way, but it will answer for the purpose of illustration, and serve to show—though it may give figures too large—that the sum total which you lose through erroneous forecasts, amounts annually, on the average, to millions of dollars. Illustration, with example, will make this clear: A crop, while coming forward is, let us suppose, estimated at four millions of bales, and the word is passed across the ocean and circulated in all the cotton marts of the world that the American crop is enormous, and prices are pitched accordingly. You sell suppose at sixteen cents, but by the time most of you have sold at these figures, and before much of the crop has gone into consumption, though much of it has gone forward, it is discovered that the crop is but 3,000,000 bales, and up goes the price to twenty cents. Now, if you had bad the means of correct estimates, and if the crop had been correctly forecast at three million, you would have sold, perhaps, for nineteen or twenty cents, instead of for sixteen cents.

The fluctuations in commerce, the loss to producers and the expense entailed upon consumers, are far greater and more grievous than those who have not studied this subject are aware of. It extends to all your articles of export. I estimate that the cotton planters alone of the South have, from such fluctuations during the last six years only, lost the lion's share of $375,000,000. That is, in consequence of erroneous estimates and the lack of such accurate crop statistics as we now seek, the planters have received for their last six crops many millions of dollars less than they would have received had they known, before selling, the actual amount of the crops as accurately as it was known after they were sold.

Our total cotton production since the war, is, in round numbers, sixteen millions of bales, and the fluctuations in price, owing chiefly to the lack of correct information as to yield, have amounted to upwards of $375,000,000. Supposing planters to have sold on the average only half the crop of each year, at the lowest figures—then, according to this way of putting the question, they have lost on the crop of 1865, $96.000,000; on the crop of 1866, $44,-000,000; of 1867, $67,000,000; of 1868, $30,000,000; of 1869, $68,000,000; and on the crop of 1870, $70,000,000; total, $375,-000,000, or an average of $62,500,000 per crop. It is useless for me to go back to refresh your minds upon this subject; you remember that last January cotton went down to twelve and thirteen cents, and at that price many of you parted with your crops; and that before the present crop began to come forward, prices ranged from nineteen to twenty cents; you remember that, likewise, in the winter of a year or two previous, when you were parting with your cotton, it went down to nine and ten cents, and then, after it had gotten fairly out of your hands, it went up to twenty-seven cents, and in some instances as high as thirty cents per pound.

Now, I maintain that had this system of observation, which I now propose, and which I advocated before the war, been in operation, this system of fluctuation could not have occurred, and farmers would have received millions more for that single crop than they did. The cotton growers of Egypt, India and Brazil would have shared with you likewise in these benefits.

The crops may be regarded, in one sense, as a meteorological expression of the weather from seed-time to harvest; for that there is a physical relation between the weather and the crops is obvious to all. Who shall say that one of the results of this combined system of observation and research will not be the development of that relation, and the expanding of it into a philosophical lasso, which shall be a rule to the husbandman even in the casting of his crops?

Like fluctuations, as I have already said, take place with your other staples. I can give you those for wheat in London for the last eight years—not the extremes of high and low prices, as in cotton, but the yearly average—therefore, the fluctuations will not appear so great; the average price per imperial quarter (eight bushels) was 44s. 9d. for 1863; 40s. 2d. for 1864; 41s. 10d. for 1865; 49s. 11d. for 1866. But the statistician says, that in October of this year (1866,) when the quality and quantity of the yield were *approximately* known—that is, when the grain had mostly left the hands of the growers—the price went up to 62s. 1d., and continued to rise until it aggregated 64s. 6d. for 1867; 63s. 9d. for 1868; 48s. 2d. for 1869; 46s. 11d. for 1870. All your staples will vary in price according to the crop, but accurate information, such as is now proposed, as to the promise and yield, will, with the aid of steam and the telegraph to satisfy demands, tend mightily to forbid speculation, by preventing fluctuation and maintaining uniformity in prices.

I wrote and lectured upon this subject before the war, and I promised that if you would give me a lock of cotton—an ounce or two—from every bale, I would undertake with that, as a fund, to defray all the necessary expenses for forecasting the weather and the crops for you, and to render to Agriculture and the industries of the land, services far more signal and valuable than those which commerce and navigation were then reaping from the wind and current charts, and my researches touching the physics of the sea. Nay, I went further, and promised to give back your ounce of cotton if you would lend me influence with your Representatives in Congress in favor of an act just to permit me to do for the land what I was doing for the sea. I simply sought leave to extend my observations over the country so as to comprehend its industries, and bring continents as well as oceans within my field of research.

I would, I have always thought, have carried the day then, and won this great boon for science and for you, but for the miserable jealousy of certain persons and so-called friends of science in Washington. To defeat this measure, it was represented that the Smithsonian Institute had it already in hand. Why, therefore, urged its Secretary, subject the country to needless expense? That was fourteen or fifteen years ago. I now ask what the Smithsonian

Institute, with all the boasts of its Secretary, has done in this matter, or what good has it ever rendered you, or the industries of the country, in any way?

For my part, I have ever regarded that Institution as a hindrance to science, an obstruction to physical research, and a misfortune to the country. To this day, it stands in the way of a National Academy of sciences, which being governed and managed by the scientific men of the nation, would be the exponent of their views and truly represent American science.

This institute does not, never did, and never can, represent the science of this country. It is a close corporation, in the management of which the scientific men of the country have no more voice than they have in the Pacific railway. It is not a member in the great republic of science, as the scientific institutions of the world are. It is outside of them all. It is an autocracy, with a man at its head called Secretary, to manage it, who, burning with envyings and jealousies, moves about the public places there in Washington, whispering in the ears of Congressmen and high officials, malevolently, against every one who dares to bring before the government a proposition for the advancement of science without first having consulted the Secretary of the Smithsonian Institute. I warn you, the Secretary of the Smithsonian Institution will, in all probability, oppose this scheme. He is more likely to oppose it secretly in committee rooms, as he did before, than openly. Forewarned is forearmed.

The machinery for putting the plan in operation is—so far as this country is concerned—all ready; all it wants is the gearing up. You have your Signal Office, where weather reports are continually received by telegraph, and whence telegraphic forecasts are issued daily; and though this work is so new to the officers engaged in it, their progress so far is in the right direction. You have also the Agricultural Bureau, in the service of which reports embodying many of the facts and observations required are already made, or might be without any additional expense. Many of the data which these two officers seek to obtain stand somewhat in the relation of cause and effect to each other; as, for instance, a dry season and bad crops. Your fields have the same area and soils this year that they had last. Why is not their yield the same? Simply because the seasons were different. Do you mean to say that amid all the mind, means and appliances of the age, the relations between the weather and the crops are past finding out?

If I could, with just such a system of research for the sea, sit down in my office and tell the navigator how he would find the winds any season of the year, in any part of the ocean through which he wished to sail, am I promising too much when I tell you that by the plan I now propose the relation between the weather and the crops is in this age as capable of scientific development as were the relations between sea voyages and the winds twenty-five years ago?

The new system of observation may be so arranged that the two offices may co-operate, each giving the other what it lacks to make its own observations and data complete.

The Agricultural are not the only interests to be benefitted by forecasting the weather and the crops, and that the money articles that are issued daily from the financial centers of the world and the great emporium of commerce, abundantly show. Hence, in the city articles of the London "Times" and other journals, are such expressions as these: "The weather for the last few days has been unfavorable to the crops; consols and securities generally have been drooping; or, the weather is glorious for all growing crops; securities are looking up; even Nottingham laces and stockings feel its influences, and are active."

So the relations between the weather and the crops in England affect the public securities not only there, but all over the world. Touch the weather and you touch the crops; touch the crops and you touch consols; touch them and you touch the value of all leading articles in trade and the credit and securities of every State, city and corporation in this country that has paper on the stock boards of Europe or America. Merchants, bankers and brokers, all who invest in stocks or deal in public securities, and most of those who buy and sell have an interest in this matter, and they, as well as planters and farmers, are concerned in these resolutions.

I have drawn my illustrations chiefly from cotton. But the grain-growers have a larger interest at stake in this matter than even the cotton planters, and so have all who are engaged in the cultivation of staples of whatever kind in any part of the world. Proper co-operation having been established between the Signal Office and Agricultural Bureau in Washington, let us see what else is required to carry the plan into effect in this country.

There would be not much more to do in the meteorological way; for observers are already in the field, some of whom send their observations daily by telegraph, and others at stated periods by mail.

These should all go to the central office for discussion in connection with the crop reports.

I believe the Agricultural Bureau has already in its employ agents in the various States to collect agricultural information. Its organization for receiving monthly or bi-monthly reports as to the staple crop of the various sections may, for aught I know, be complete, for I am not informed as to the details of that office. I am under the impression, however, that there is in this Bureau abundant room for improvement as well in organization as in the conduct and management; for its utterances as to yield of crops do not, in commercial circles, seem to be received even with as much confidence as are the private circulars of many produce dealers.

The conference would deal with these defects and give efficiency to both.

The meteorological office, though the more recently established, is the more deserving of commendation. Its forecasts of the weather are instructive, but they are too vague as yet to be of much practical value. Here is a fair sample of its predictions, called "weather probabilities," as any of you may see in the daily papers. I took this from the first paper that I happened to lay my hand on with its paragraph of "weather probabilities:"

"WASHINGTON, August 11.—Clear and warm weather will probably be experienced on Saturday from Missouri to Lake Huron and westward. A low barometer, with cloudy weather, will probably continue from Louisiana to West Virginia and eastward. A low barometer, with cloudy weather and local storms, will probably extend during the afternoon over New York and New England."

There is nothing in these "probabilities" that you can utilize. There is no reason why, with the means and appliances under the control of that office, you should not reasonably expect to have timely warning at least of certain great changes in the atmosphere that you can profit by. After a while, the information, as knowledge and experience increase, may be more specific; but as they are, these "probabilties" are so vague that shipmasters and farmers who felt a lively interest in them at first are beginning to ask each other, "*Cui bono?*"

Nevertheless, considering this office is new, it has made a good beginning. But the time is coming—and this plan will hasten it—when the probabilities should become "certainties," and be more specific and practical, for how can such vague things as I have quoted be utilized? Of what use can it be to any living soul to know that a low barometer, with cloudy weather and "local" storms will probably extend to-morrow afternoon over New York and New England? Now, if it had said what counties and parts of New York and New England these "*local storms*" would reach and give some idea of their character and severity—whether wind, rain or hail—we should have something that might be of practical account. But let us suppose, for the sake of illustration and by way of showing the main features of the plan, that the proper meteorological stations have been occupied, and that the observers and co-operators report upon the crops as well as upon the weather; and that at first, and in a tentative way, a special crop reporter be assigned to every district of ten thousand square miles in the States. It should be his business to travel over his beat continually, and put himself into communication with intelligent farmers in all parts of it, and through them together with his own observations, to keep the central office posted by regular reports, say monthly at first, as to the state and promise of each one of the staple crops of his district. At the same time the meteorological observers in the district would send forward their observations and reports in detail for the same period, also by mail; while the daily telegraph observers keep up their daily reports, both as to weather and crops.

This would give five crop reporters for Alabama, five for Tennessee, four for Kentucky and four for Ohio, and so on in this country. In Europe—twelve for Great Britain, nineteen for France, one for Holland, one for Belgium, and so on.

These reporters would have their attention at first going off, so as not to be lost in a wilderness of data, directed chiefly: in Alabama to cotton and corn; in Tennessee to corn, wheat and tobacco; in Kentucky to corn, wheat and hemp; and in Ohio to corn and wheat; and in each State and county to its chief staples only. So far the plan is simple enough, and may be carried out easily for this country by itself.

But it now requires to bring other nations into the plan, and to include within it the system for the sea, which has been so rich in results, but which I could not carry out to full harvest, through lack of co-operation on the land.

The atmosphere covers the land as well as the sea, and we can never fairly unmask those agents which govern its movements unless we trace them from the sea to the shore, and from the land to the water; watching, observing and studying their action and behavior from the beginning to the end of the storm. The atmospherical machinery is a whole, and it must be studied as a whole, else we can no more comprehend it movements than we can expect a child to understand the mechanism of a watch by simply hearing it tick, and looking at the hands as they move round the dial.

The reward which the grain-grower of the West is to earn for his labor, depends almost as much upon the yield in England and Europe, in Egypt, California and Chili as it does in the neighboring States of the Atlantic. Therefore, we want to invite all these States to unite with us and enter upon a system of international research equally beneficial to them and to us, and profitable to the world. The same with the cotton of India, Brazil, Egypt and Peru; the rice of the Carolinas and the East; the sugar of Louisiana, Cuba, Central America, Brazil and other parts; the coffee of Brazil, Java and the East Indies; the hemp of Kentucky and Russia; the Indian corn of America, Italy, Austria and other Black Sea countries, which in late years have been competing so stoutly with ours in the English and European markets, and so on; aiming to secure the friendly co-operation of all States and nations that are concerned in the production of any of the chief staples of Agriculture, and so make the system universal.

How to go to work about this, and how to interest all people in a common plan requires consultation, good-will and co-operation among all nations. This we must seek through their wise men and meteorologists; and to get them in conference for that purpose, with their government at their back, is wherein your kindly aid and friendly offices with the administration are solicited.

As for the collateral advantages that are to flow from this system of research, they are doubtless many and great. They cannot be estimated or specified in advance, but they will probably equal, if they do not exceed in value, the direct. See what has come from the part of this system that has been tried at sea. Among the first fruits of the system of deep-sea soundings, which formed a part of my plan touching the physics of the sea, was the discovery of a plateau or raised surface across the bed of the Atlantic. I called it the "Telegraphic Plateau," because it is just such a bed, as at that time, was required for the telegraphic wire to rest upon; for until then so little was known about the depths of the ocean, that capitalists were afraid to venture.

Now, see how in these scientific researches one thing leads to another, and how, step by step, as we penetrate the secrets of nature, we ascend a sort of "Jacob's ladder," and gain acquaintance with the very ministers, and learn to use them too, that do the bidding of the Almighty.

The discovery of the plateau led to the laying of the Atlantic telegraph. It would not work; was faulty and broke. Men of science were employed to investigate, and in their work they established the correctness of an important discovery; laid the foundation for accurate electric measurements, and pointed out means and appliances with the aid of which philosophers have resurrected up the lost cable and are pushing their researches into the very subtleties of ether.

Compute now the value of marine telegraphs. Tell, if you can, their worth to governments, to you, and to every interest in the round world. Go back to the beginning, whether on one hand to the frog in the Florentine kitchen, or on the other to the deep-sea soundings in the Atlantic, with Brooks' apparatus—a cannon ball and a bit of twine—and you will see that from small beginnings you have results here far greater in disparity and far more disproportionate between value of seed and of fruit, than that between the acorn and the oak, in your "thick-ribbed men-of-war."

There is in this wide world, no field so grand, more rich with promise, and more ready for laborers, than that to which these resolutions point.

You remember how comets and eclipses used to alarm mankind. Why do they not create dread and consternation now? Simply because the science of astronomy has improved, and we are able to see that these things, when they occur, occur as much in the order of nature as do the changes of the moon and the rising of the sun, and we can foretell their coming.

Now, our ignorance about the movements of the atmosphere and the laws which govern it, is greater than was our ignorance two hundred years ago about the laws which rule the heavenly host. That you may be impressed with the grossness of this ignorance, only think of the "signs" many farmers have for the weather, and how empty they are.

The atmosphere must be observed by observers stationed in all parts of the world, and acting in concert, before we can hope to understand its movements and comprehend the laws which govern them. Until some such system of observation is established, we may hope in vain for our children's children to see the science of meteorology assume the dignity or claim the accuracy that belonged to astronomy in the days even of our great grandfathers.

I appeal to you, therefore, not only as husbandmen, for your own sake, but as philosophers, philanthropists and friends of science, also, to lend me your assistance in this scheme. I make this appeal with the more confidence, because, chief among the objects of the mechanical branch of this society, is the advancement of the physical and material sciences. Europe is ripe for it. There has just been held there a grand International Congress for the advancement of cosmographic, geognostic, geographical and commercial knowledge. A correspondent writes: "Your resolutions for an agricultural and meteorological conference—international—were received with cheers, and by unanimous vote ordered to be printed with proceedings." It is now for you to help put this ball in motion here.

FOOT AND MOUTH DISEASE.

In the report of 1870, mention was made of the introduction of this disease from Europe into Canada and thence into some of the United States, and of its threatened spread among us. The following report relates its subsequent, unexplained and wonderful disappearance; a providence the farmers of Maine may well be thankful for.

To the Honorable Governor and Council of Maine:

In accordance with the provisions of the law, the Commissioners on Contagious Diseases in Cattle, submit the following report:

During the summer of 1870 the ailment known as the Foot and Mouth Disease, was introduced into Canada from Europe. This disease had been long known in Great Britain and on the Continent, and it had been proved to be contagious beyond any other. While it was not usually fatal, its effects upon many which recovered were so serious in reducing the flesh and inducing lameness, and in other ways, that it was much dreaded. Nor had any measures which had been adopted in Europe proved effectual for its suppression, insomuch that during its late prevalence in England several thousands of "centres of infection" were reported by the authorities. Consequently its introduction hither was an event to be carefully guarded against, and regulations to this end had been promulgated by the United States authorities. For some time after its introduction into Canada it was confined to the herds which it first entered, and its existence there was unknown to the public; but during autumn, through the agency of one or more animals, the disease reached the stock-yards of Albany, N. Y., whence its dissemination was rapid, insomuch that by the end of December it prevailed to considerable extent in most of the New England States as well as in New York. It was then rapidly spreading, and the danger of its introduction into Maine was imminent. On the 11th of January, 1871, the Governor and Council appointed the undersigned commissioners under the act relative to Contagious Diseases in Cattle. We proceeded forthwith to prepare and issue a circular, which was forwarded to the municipal authorities of cities and towns throughout the State, cautioning the public relative to the disease and giving directions in regard to its treatment, and the measures to be adopted for its suppression, should it appear. On the 22d of February, the danger apparently increasing, an order was issued prohibiting the introduction of cattle and sheep from beyond the State until the same had been quarantined for a term not less than ten (10) days, and a permit issued by one of the Commissioners or by one authorized by them.

On the 6th of March, Mr. N. L. Marshall was appointed Ass't Commissioner. He at once proceeded to adopt measures for enforcing the order in respect to animals coming from Canada, (by rail,) including, also, the necessary structures for quarantine purposes. The chairman directed respecting the quarantine arrangements at South Berwick Junction, for cattle coming from the west. The above named order remained in force, without change, until, on the 22d of June it was so far modified that on and after July 1st, permits would be granted, on proper conditions, for cattle and sheep to be brought in for immediate slaughter, without quarantine detention.

The Commissioners have reason to believe, that the measures adopted prevented the introduction of the disease into the State, no case having been known to have occurred, although some were reported within a few miles of its border.

Promptly upon its appearance in the New England States, energetic and untiring efforts were made to resist the progress of the disease, and to suppress it where prevailing. These were measurably successful from the first, and ere long the Commissioners in the several States were able to report the disease as rapidly declining. At the same time great apprehension was felt, that, as warm weather approached and spring work was entered upon, necessitating travel on infected roads, and the moving of manure from diseased animals, this might break out with renewed force.

Happily these fears were not realized. The disease continued to abate until it finally disappeared, and for some months, no cases have been known to have occurred in the country.

How much of this result is due to the active, energetic and skilful labors of the authorities in other States, and how much to known or unknown natural agencies, independent of their control, it is not easy to determine, and may never be known.

The writer has long indulged the belief, based in part upon the comparative ease with which Pleuro-Pneumonia, (a malignant contagious disease of foreign origin), has been checked or exterminated when introduced into the United States from abroad, and the fact, that some cattle diseases which are prevalent in Europe are unknown here, together with other reliable facts not needful now to detail, that the climatic and other natural conditions existing among us are less favorable to the extension of cattle diseases of European origin than those which prevail on the eastern side of Atlantic.

However this may be, the people of Maine, those who eat meat as well as those who keep cattle, have great reason to rejoice and be thankful for the exemption we have thus far experienced; and the more so when we learn how unlike is our experience to that of English farmers during the same period; the latest reports thence being that foot and mouth disease is largely upon the increase; that the cattle plague (Rinderpest,) is not extinct, and that Pleuro Pneumonia still prevails to a very serious extent. If the foot and mouth disease had visited our herds and flocks, and ravaged as it has abroad, the falling off of the grass crop, and the depredations of grasshoppers which we have experienced the past season, would have been quite thrown into the shade by the greater evil.

Respectfully submitted.

S. L. GOODALE,
For the Commisisoners.

The past season cannot be called a favorable one for agricultural pursuits in Maine. In fact, we have now had two successive years which have been remarkably unpropitious to the growth of the great staple crop of the State—grass. The season of 1870 was very dry; the hay crop was considerably below an average, and the continued severity of the drought after hay harvest, in many cases entirely destroyed young grass plants, and almost universally enfeebled, to a great degree, those longer established. To a very unusual extent the expected blanket of protecting snow was lacking during the ensuing winter.

Under such circumstances the season of 1871 opened; and had it been all which could be desired in itself, no reasonable expectation could have been entertained of a large hay crop. But it was far from propitious. June, the grass-growing month, was very dry, and so was July until near its close. Besides this, upon large breadths in various parts of the State, grasshoppers appeared earlier than ever before known, and in numbers beyond all precedent, in some cases devouring not only grain and grass but every green thing. Destruction like this was not general nor uniform; in fact there was great unevenness of results even within comparatively limited localities; yet the drought and grasshoppers together wrought such general diminution of products that farmers have been compelled to purchase corn or other food for farm stock to an extent unparalleled in all previous experience. Details relative to these facts have been so fully presented in the foregoing pages as to render unnecessary any repetition of them here. Nor do I propose to dwell at length upon the lessons of the year, which have been so ably presented by Mr. Chamberlain and others, and yet, perhaps, somewhat may be profitably added.

Over some of the causes which have led to these results man has little control. It is, however, equally true that much which has contributed to the leanness of the crops of the two past years might have been different had wise forethought and judicious practice been exercised in former years, in place of the short-sighted and exhaustive methods which have prevailed. It is undoubtedly true that a large proportion of our lands have been allowed to run down too far to yield good crops, and can yield tolerable ones only in seasons which are unusually favorable, the hay crop especially being upon land in such poverty very largely dependent upon an abundance of rain. Such lands require a season so wet as to furnish almost the equivalent of irrigation to produce tolerably. For this condition of our agriculture there is no sudden remedy, and none at all which does not require more outlay than farmers here have been accustomed to, including a better culture and a more liberal use of seeds and of fertilizers.

More manure must be used. Where or how to get it is a serious question. The answer is, first, in saving and using all the fertilizing materials which are within home resources. On many, perhaps on a large majority of farms more or less has gone to waste; the liquid excreta from cattle has not been fully absorbed and retained, the privy, the sink-spout and the swine-pen have not been made to do so good nor so large service as they might; the drafts upon the muck-bed and upon forest mould and leaves, have not been large enough. These and all lesser sources of fertilization should be employed to the full limit of economy; and after all, more must be had, and we must buy. Then the question arises, where and what to buy. No one answer will suit alike all cases. Experience in England and on the continent of Europe may help us to some light. It has been shown that, upon some farms, chiefly clay, or clayey loam soils, good grazing lands, and near a good meat market, the preferable way is to buy it in the form of cattle food; get all the direct return from the purchase money which can be had by judicious feeding, and the balance in manure. Maine farmers have, the present winter, been trying this experiment (not altogether from choice) to a much greater extent than ever before. They will next season be able to judge of its expediency better than ever before. It may prove a profitable lesson and worth all its incidental as well as its direct cost.

Upon other soils, chiefly lighter and hungrier naturally, yet so easy of working as to be among the most profitable when properly enriched, the preferable method has been found to be the direct application of commercial fertilizers. As a general rule, these have greatly improved in quality over what were in market ten or twenty years ago. Frauds are not wholly a thing of the past, and may continue so long as dishonest people have to do with their manufacture and sale; but by purchasing of those who have earned an established reputation by fair dealing there is as little danger as in buying any other kind of commodities in market. The profit attending their use will depend much, in any case, upon the skill and judgment with which they are used, (just as in the case of cattle food,) and also upon the season.

A large item of expense to Maine farmers lies in the purchase of grass seed. I do not condemn the expenditure nor say that we can better grow it than buy it, as a general rule. But I do say without hesitation or qualification, that every dollar expended for clover seed can be retained, and a positive gain besides can be had by growing it. Land does not suffer by the growth *nor by the seeding* of clover. Unlike the grasses proper, both its growth and its seeding may be made a most efficient auxiliary to the renovation of our run-down grass lands and grain fields, (see page 167, also Report for 1869, page 456, *et seq.*, for details and proofs,) nor need the farmer be at the trouble of hulling and fitting the seed for market, for it has been found that clover seed sown in the chaff, on the surface, (nature's method,) serves a better purpose than if hulled and harrowed in.

The past season may yet prove one of the most productive ever known. Blessings sometimes come in disguise, their true character remaining unrecognized for a considerable period. I do not now refer to drought as an evil having compensations in its very nature—that by its physical effects a degree of subsequent fertility is attained which would not be without it; the reference is rather to its influence in awakening thought and arousing to study and investigation upon vital points in farm policy and practice—about ways and means of fertilization—about the best methods of preparing lands for grass—of seeding, usually, and renewing under exceptional conditions such as now prevail—about substitutes for hay as winter forage—roots, corn fodder, or whatever else, and how to grow, cure or store it; about how to use winter stores to best advantage—involving the whole subject of FEEDING, both in its physiological aspects and in its practical methods. These, and questions akin to these, stand out before the farmer of to-day with a boldness like the handwriting upon the wall in olden time. They do more than invite investigation and study, they demand it; and if it be given, in full and worthy measure, the harvest will be worth more than any ten grass crops ever cut in the State.

S. L. GOODALE,
Secretary Board of Agriculture.

JANUARY, 1872.

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