

MAINE STATE LEGISLATURE

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Public Documents of Maine:

BEING THE

ANNUAL REPORTS

OF VARIOUS

PUBLIC OFFICERS AND INSTITUTIONS

FOR THE YEARS

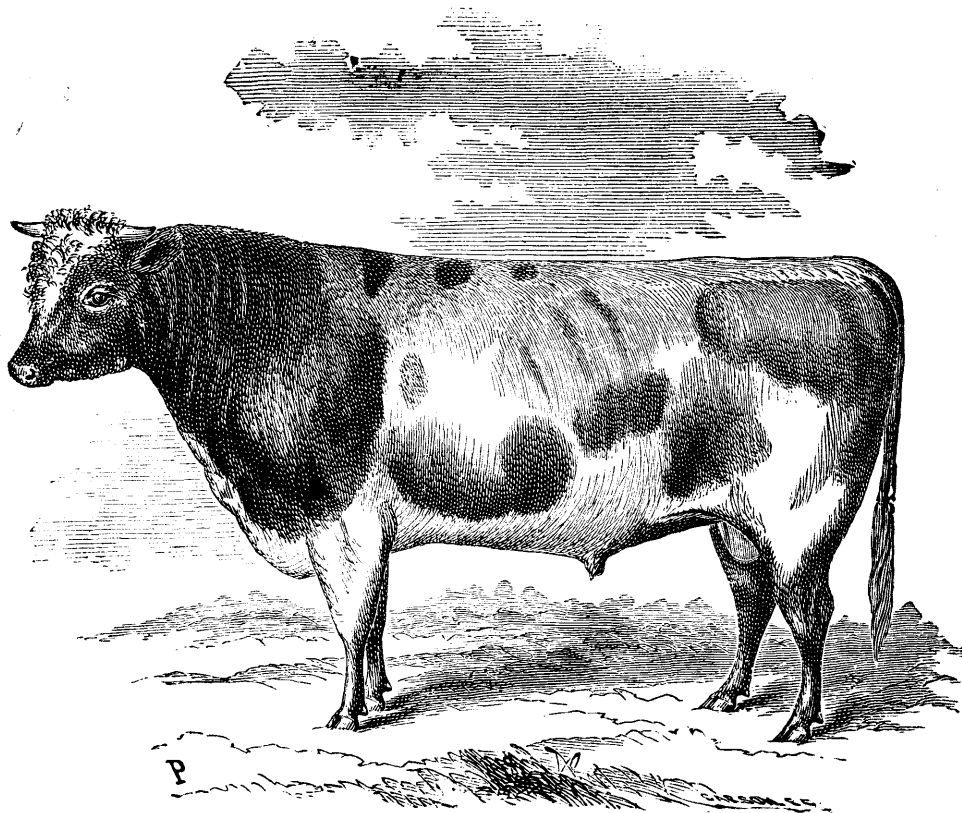
1870-71.



AUGUSTA:

SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.

1871.



Ayshire Bull "GENTLE JACK," the property of H. L. Stewart & Son, Middle Haddam, Conn

FIFTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Maine Board of Agriculture,

FOR THE YEAR

1870.

AUGUSTA:

SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.

1871.



BOARD OF AGRICULTURE.

SAMUEL WASSON, PRESIDENT.
 D. H. THING, VICE PRESIDENT.
 S. L. GOODALE, SECRETARY.

APPOINTED BY GOVERNOR AND COUNCIL.

Name.	P. O. Address.	Term Expires Dec. 31
M. C. Fernald.....	Orono.....	1870
George L. Goodale.....	Brunswick.....	1870
C. E. Hamlin.....	Waterville.....	1871
C. F. Brackett.....	Brunswick	1872
S. F. Peckham.....	Orono.....	1872

CHOSEN BY THE STATE SOCIETY.

Calvin Chamberlain	Foxcroft	1871
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CHOSEN BY COUNTY SOCIETIES.

Name.	County.	P. O. Address.	
Samuel Wasson.....	Hancock	Ellsworth	1870
Elijah B. Stackpole.....	Penobscot.....	Kenduskeag	1870
Jere R. Norton.....	Franklin	Avon.....	1870
Luther Chamberlain.....	Piscataquis	Atkinson	1870
Moses L. Wilder.....	Washington.....	Pembroke	1870
Isaac Hobbs.....	Knox	South Hope.....	1870
J. V. Putnam.....	Aroostook.....	Houlton	1870
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 Sweet.....	Oxford.....	South Paris.....	1872
L. L. Lucas	Somerset.....	St. Albans.....	1872
Ira C. Doe.....	York.....	Saco	1872
W. P. Walker.....	Sagadahoc	Topsham.....	1872



REPORT.

To the Senate and House of Representatives :

The winter public session of the Board of Agriculture under the law of last year was held at Lisbon Hall, in the city of Lewiston, January 18th to 21st inclusive. The attendance of farmers, both from the immediate vicinity and from various parts of the State, was much larger than at the autumn meeting previously held in Bangor, and a most gratifying degree of interest was manifested.

Organization having been effected together with the usual preliminary business, the public exercises were opened by an address from D. H. Thing, Esq., member from Kennebec county, on

AGRICULTURAL ORGANIZATIONS AND INDUSTRIAL FAIRS.—THEIR INFLUENCE UPON THE VARIOUS INTERESTS OF THE STATE.

“As iron sharpeneth iron so man sharpeneth the countenance of his friend,” is an adage as true to-day as when uttered by divine inspiration three thousand years gone by.

To suppose that we can profitably live in the world and neither do good to, or get good from, our fellow creatures around us, is equivalent to supposing that Adam might have continued to dwell in, and profitably cultivate the garden of Eden without Eve to associate with him. If it be true that in those circumstances he would not have fallen, may it not be equally true that he never would have attained to a social and intellectual elevation high enough to have harmed him seriously if he had. But it is not my intention to go into any other investigations at this time than those strictly relevant to the subject under consideration. It is for our purpose, sufficient to know that Adam in his farming operations was associated with Eve; that they tilled the soil together, and as their farm became suddenly enlarged, and in consequence of their transgression of law the weeds and briars increased, just as they do in our day, both morally and literally,

they put on more help and continued to overcome and subdue all obstacles, thus early demonstrating that what could not be done by individual effort might be accomplished by united action.

Very soon we read of the first exhibition, when the young men came to exhibit and offer the best of their flocks and fruits. We are also pained to find that in this early history of agricultural exhibitions there were heartburnings and dissatisfaction on account of the awards, thus proving that in this respect at least, if we have not improved upon our ancient predecessors, we have not degenerated. At the same time it furnishes a precedent for the grumblers of our day, which is a far better excuse for them than the grievances, real or fancied, of which they often complain. But to come more directly to the point, it is idle and foolish to attempt, solitary and alone, to accomplish any very great results in the way of aiding or improving our fellow-men.

The history of the world from the creation of man to the present time is full of instruction upon this point. All the great results which have been achieved by representative men in every age and throughout the world, in religion, philosophy, education, political economy or any of the industrial pursuits, have been achieved by these same representative men by uniting their minds and intellects together; thus giving to their enterprise, character, strength and aggressive power, which enable them to command respect and admiration from those very men, who, had they acted individually, would have sneeringly called them fanatics. All the bitter feelings of oppression, humiliation and degradation, which in 1775 existed in the hearts of the people of the colonies which now compose these United States, might have continued till now, with the same, yea, with ten-fold more bitterness, and we to-day, have been under the huge paw of the British lion, had not those patriots, in whose hearts was swelling the germ of that liberty and freedom which we now enjoy in full fruition, combined together, and by their glorious "Declaration" of the faith which was in them and the patriotic principles which governed them, assumed a tangible organization, which enabled them to put forth a united and concerted effort, which, being clad in the double armor of earnestness and justice, was invincible.

So too, all the way along through the history of the industrial world, we find that leading men in every age have associated themselves together, for the purpose of aiding each other and the community at large in more successfully prosecuting their various

vocations. The most eminent geniuses and learned writers of every age, from Hesiod of three thousand years ago to our own great Jefferson and Webster of yesterday, and Victor Hugo of to-day, have not deemed it beneath their dignity or derogatory to their mission, to write of lowing herds and bleating flocks, of purple grapes and golden grains, and Dean Swift or somebody else has told us, and every writer since has reiterated it, that "he who makes two blades of grass grow where but one grew before is a benefactor to mankind."

When a large number of individuals combine together for the purpose of accomplishing a certain object, there are just as many minds at work and just as many intellects laboring for the same object as there are individuals in the association, and among persevering, progressive men, there is always a noble contention or rather emulation to excel, which is continually spurring them on to greater exertions. Again, it is essential in order to make the greatest improvement, that these associations come together and compare notes and products, that they may know who excels in any calling or department, or in regard to any particular animal or article, and how they do it; whether by chance or by intelligent experiment. If by the latter, we wish to know the exact "conditions" of the same, as we thereby avail ourselves of the experience and observation of others and come directly to the point we wish to gain. Suppose for instance, Mrs. A. or Mrs. B. presents for exhibition the best lot of butter or cheese, we wish to know the breed of cows, their distinguishing points or characteristics, what their feed has been, how they have been cared for, how the cost of keeping tallies with the income, and all about the manner of making the article and its preservation since. If a crop, we wish to know something of the soil, manure, cost, value, manner of cultivation and what is of still more importance, whether its cultivation has improved or impoverished the soil; if a manufactured article or implement, we wish to know its materials, cost and value and in what its value consists; if an animal, we wish to know the breed, how it has been kept, its peculiar points of excellence and wherein it is more valuable than other breeds, together with such facts concerning the same as have come under the observation of the owner or exhibitor.

In this way each member of the association may become possessed of the most valuable knowledge in the possession of all, so that while one gains knowledge and information on one point

he may impart that which may be equally valuable on others, thus practically carrying out the doctrine of reciprocity, where the reciprocity is not all on one side.

That we may reap the greatest benefit from thus meeting together it is not only necessary that we be present ourselves, but also our better halves and our children, that all may thereby obey the injunction of the apostle to "look not alone on our own things but also on the things of others;" and that we may thereby "provoke each other to good works." This meeting to compare notes and products is what is known in common parlance as the "Show and Fair," of which let us say a few words.

At the fair we expect to see the best of the herds and flocks, the finest specimens of our grains and fruits, the formidable rows of jars, tubs and boxes of golden butter, (golden in more senses than one at modern prices) the luscious melting cheese, the preserves, jellies, jams and syrups, boots, shoes, valises, trunks, robes, blankets, whips, harnesses and carriages of surpassing excellence and finest workmanship, the most useful agricultural and mechanical implements too numerous to particularize; all those beautiful, useful, labor-saving, comfort-bestowing inventions for the thrifty housewife, from a "Universal Wringer" (which will wring anything but tears, never those unless tears of pity for our mothers who did not have them) to a patent clothes-pin, and from a pie-fork to a carpet sweeper. We also expect to see the handiwork of the wives and daughters of the farmers, mechanics, merchants, lawyers and ministers, in all their varieties and gradations; counterpanes, comfortables, blankets, shawls, hose, socks, mittens, yarns, clouds, hoods, scarfs, tidies, rugs, carpets, ottoman covers, embroidery, beadwork, drawing, painting, and what is far better than all the rest, the fair authors themselves, in Grecian bends, suggestive of the leaning tower of Pisa, waterfalls rivaling anything to be found in the famed valley of the Yo Semite, loves of bonnets of microscopic proportions, the whole surmounted by a chignon towering as Mont Blanc, from which will be suspended the curl of the period. But the laugh may not all be on one side, for if we should see these fair ones of which I have been speaking, under the escort of juvenile Beau Brummels, their hair parted in the middle, legs encased in pants which are only to be drawn on by liberal oiling, and coats suggestive of one of Barnum's bob-tailed Shanghais, we should be compelled to believe that the world had made even greater progress than I assumed when I commenced.

But, says one, you have forgotten the principal feature. Oh! my good friend, what is that? Why, it is a horse trot. No, Mr. President, I have not forgotten it, for it has been the great "bug-bear" in my way ever since I first contemplated writing this essay, and at first I decided to ignore it entirely, leaving it for wiser heads and more influential minds than mine to assail or defend; but I find it so intimately connected with a successful fair, at least so far as financial success is concerned, that I have been unable to get by it without a few moments consideration.

There was a time when there was but one agricultural society in a county, and the State allowed them three hundred dollars, when competition was limited in comparison to what it now is, when all members of the society paid a dollar annually, and the show and fair was holden on some public grounds, so that an exhibition could be successfully conducted on its own merits. Now we must have an exhibition hall, a track for our own private society's exhibition of horses, enclosed with a suitable fence, must pay a much larger amount in premiums, a much larger sum for printing, must have a board of officers whose services are worth paying for, and at the same time the counties are so divided by the increased number of societies, that few of them get more than one hundred or a hundred and fifty dollars. Under these circumstances the trustees of the societies had either to abandon the enterprise and confess themselves euchered, or at once, like McClellan on the Potomac, change their base and devise some untried means by which to raise the wind, and in selecting a horse-race as the means by which to accomplish that result they not only raised the wind financially, but they raised at the same time a huge breeze about their own ears, which they now find it difficult to allay. It is not my purpose to discuss the question whether it is desirable to get along without a trot, for I consider it a fixed and permanent feature of agricultural exhibitions, and with this admission it becomes our duty to control and direct it in such a manner as to get the desired benefit from it, with the least possible harm either to ourselves, the societies, the cause of agriculture, or the morals of the community.

To do this it is necessary that we give the public distinctly to understand that the primary, and indeed, the only reason for offering premiums on speed horses, as such, is to obtain funds with which to pay other premiums. There is a large class in the community who certainly pay their money *as* freely, if not *more* freely,

for seeing a horse trot than for anything else, and if, as is often the case, we thus bring together a class of roughs which nothing but a horse trot or some other kindred excitement will bring together, they certainly put their time and money to as good use as usual, and themselves for the time being into good company.

Now so long as the raising of horses is legitimate business, so long as fast horses bring in money, as everything is conducted fairly and honestly, and the operation produces the desired results, I am not willing to abandon the enterprise until I see something which promises better, or at least as well, which I am free to confess is now beyond the reach of my limited vision.

At one time the attraction depended upon to get the people out, was an equestrian performance or exhibition by the ladies, but this failed as soon as the question of "woman's rights" began fairly to dawn upon us, for among other rights which pertain to ladies was found to be the right to attract no more attention than the gentlemen, if they voluntarily placed themselves in the same position.

Foot races were tried in many exhibitions but were a failure, but a "pure agricultural horse trot" has succeeded every time, for as Josh Billings has truthfully remarked, it is "just what the people hanker arter."

It is well known to every observing man that the people will have some excitement, and it is for us who contribute in some measure to public recreation to decide whether we will give them something not in itself harmful, and conduct it so that no harm shall grow out of it, or leave them to seek their amusement where the inevitable result will be such "communications" as the Bible tells us "corrupt good manners."

A few years since it was a disgrace for a respectable man to enter a bowling-alley, and why? Because the name was always associated with a grog shop. When I was a boy a bowling-alley could hardly have been found without a bar connected with it. Now we find them just as properly conducted as any other physical exercise, and in connection with the first theological institutions and young men's Christian Associations; so of horse trotting, much of the prejudice which exists in the minds of the people is the result of early impressions of what such practice was and is, when conducted essentially as a horse race. If ladies and gentlemen will visit the fair of the old Kennebec Society they will find the trotting conducted with as much propriety and de-

corum as any part of the show. I conceive the odium which newspaper correspondents and reporters attempt to cast upon trotting at our fairs to be a principal cause which goes to make such fairs unpopular with that class of persons which we desire above all others to reach; I mean the sober, quiet, hard-working farmers and mechanics of Maine.

Not long since I was pained to see in one of my weekly papers, something, as nearly as I am able to recollect, like the following: "It may be all right to offer fifty or one hundred dollars for the fastest trotting horse and only ten for the best acre of wheat, but we can't see it." This gives the impression that we think the trot of five or ten times the importance of the wheat, *which is not true*. Instead of this kind of talk (which is nothing more or less than "buncombe") I would have something like the following: Men and women, young men and maidens of old York, Cumberland or Kennebec, as the case may be, please give us your attention one moment; we are to have a cattle show and fair, and we mean to have a good time; we have offered premiums on almost everything you raise on your farms or manufacture in your houses or shops, and the last afternoon we have advertised a horse trot, which will bring in money enough to pay them all. And beside all this we are to have the Hon., Rev., Gen. or Gov. so and so, who is supposed to be able to tell us just what we wish above everything else to know, to give us an address on the occasion. So come on with your noble Herefords and Shorthorns, so suggestive of sirloins and porter-house steaks; your Jerseys, which are in momentary danger of melting away and leaving (I was about to say) not so much as a grease spot, but they are bound to leave that any way; your Eaton, Morrill and Knox horses; your Cotswold, Southdown and Spanish sheep; your Chester, Suffolk and Prince Albert pigs; your hens, turkeys, geese and ducks, and the thousand and one articles of utility, ornament and luxury from your field, shop, cellar, pantry and parlor; and let us take the whole thing into our own hands and give to it such a character as we wish it to bear. Please make a note of this ladies and gentlemen, an agricultural society, farmers' club or any other society, bears just such a character as the individuals composing it choose to give to it, so don't find fault because everything is not just as it should be, but take hold of the matter yourselves, and by earnest effort and untiring perseverance compel that respect which such effort, when well directed, always deserves.

But I must hasten on to the latter part of my subject, lest I weary your patience: "The influence of Agricultural Societies and Industrial Fairs upon the various interests of the State."

Perhaps we might turn aside for a few moments to consider the influence they ought to have. We would have all, and particularly that numerous class of our people who earn their bread by the labor of their hands, remember that the pioneers in these matters, the fathers, protectors and supporters of agricultural societies and fairs, were men who honestly sought for the best good of the industrial classes, and who earnestly desired to place within the reach of those who were to succeed them in the active duties of life, those means by which they might render their circumstances and situation more pleasant and their labor more profitable than had been their own. Well do I remember to-day the faces of some of those noble old leaders in this enterprise. First and foremost, were Parson Thurston, Dr. Holmes, the Woods and others of Winthrop, Col. Greene of Winslow, Pierce of Monmouth, Hon. John Otis and J. W. Haines of Hallowell, Dr. Baldwin and Major Thing of Mt. Vernon, Esquire Fogg, Col. Bean, Capt. Haines and others of Readfield, Hon. J. H. Underwood of Fayette, Wardsworth of Livermore, and many others whose names I am unable at this moment to recall. These men had no selfish schemes to carry out, or personal ambition to gratify, but they labored for the good of those who were to come after them. When they commenced the work in Winthrop there was no agricultural society in Maine, they had neither experience nor precedent to guide them and there was no money to work with save what they drew from their own pockets, and that did not find its way there so easily as money does now-a-days. But, stirred by benevolence and philanthropy, they began the work, and small as was their beginning and untoward as were their circumstances, it marked the beginning of a new and most important era, not only in agriculture and mechanics, but also in the professions, literature and politics of our State; for no man of whatever profession or occupation can succeed for any length of time in any community unless he is in sympathy with the people.

The same class of self-sacrificing men have ever since, even up to this day, had the management of this matter, and have freely given to it their time, thought and money. When individuals criticise or find fault with the manner in which our societies and fairs are conducted, let them remember that the earnest study and

anxious thought of the best friends of the working men and women of Maine have for the last forty years been given to this subject, that they have given to it their hours of sleep and of labor, and have sacrificed to it their private feelings and opinions; that they have been willing to become "all things, to all men," that they might thereby do good to some, and then ask themselves if these men are not more likely than themselves to have hit upon the arrangements most likely to produce the desired results.

With these few remarks let us view the whole thing, as we find it, and endeavor for a few moments to discuss the real, visible influence of these associations, past and present, on the various industrial interests of the State. And here let me ask, if intelligent, discriminating, persevering men and associations of men, have for the last ten, twenty or forty years, been attempting to bring about a certain result, and that result has been accomplished, is it not right that those men or those associations should have the credit of the same, allowing them to be creditable?

Suppose for our first example we take our neat cattle. But how am I to illustrate this point so that the young men and boys in this audience, upon whom soon will devolve the cares and responsibilities which now rest upon us, can realize and understand the improvement which has been made in this direction. I was raised on the main thoroughfare from the valley of upper Kennebec and Sandy rivers, one of the best grazing regions of New England, to Portland. Thirty and forty years ago droves of cattle of from one to three hundred head, and sometimes four or five hundred, passed frequently in the fall on their way to Portland, for barreling, and I wish each of you could understand just how they would compare with the bullocks of our day.

Why, sir, the most prominent feature about them was their horns, and the least so, their hind quarters, for beside their hind legs and hip bones, there was but just enough upon which to hang a tail. I wish these young men could see such a drove as Howes and Crosswell, Major Crompton or my friend from Aroostook, drove from that country in those days, and alongside of them a drove of oxen of our day. And from whence came those noble broad-backed Shorthorns with their fifteen hundred pounds of luscious, juicy oxhood, or the proud symmetrical Hereford, whose aristocratic bearing proclaims his royal birth?

Let us take one example which will illustrate the manner in which this has been brought about all over the northern and

western States. Forty years since the bull "Turk," by imported Jupiter, out of a thoroughbred cow, was brought into Readfield by Robert Cornforth, I think, and passed at two years old on to the farm of Major Thing, in Mt. Vernon, where he was kept three years, and then passed to the farm of Ariel Tinkham, Esq., of Anson, in which vicinity he was kept some six or seven years longer. His descendants are now to be seen and readily recognized in all that region. Some fifteen years since in passing through that vicinity I was struck with the familiar appearance of their stock, especially on one farm, where there were kept about fifty head. On inquiry, I learned they were descended from the animal above named. It is but just to state that one of the calves of "Young Denton" had been previously taken into that vicinity and had thus paved the way for still greater improvement, but this rather strengthens than weakens my argument, for "Young Denton" was brought into the State, as probably all know, by Dr. Holmes, to whom the agriculture of county of Kennebec is indebted more than to any other man. These animals were imported with the approbation of the very men I have named and through their influence. Since then there have been brought into this section of the State several valuable animals by Col. Greene, some of the justly celebrated "Henry Clay" stock from Kentucky, by Hon. John Otis and Col. Morgan; several valuable animals by Hon. Warren Percival, Jesse Wadsworth, Whittier and others, all shorthorns.

Of the Herefords we first recollect the "Albany," by J. W. Haines, from which, it has been said, descended more good working oxen than from any other animal ever brought into Maine. Since then we have had several fine full bloods by the Underwoods, Burleigh and others.

I might in truth make similar statements in relation to the horses, sheep and swine of our State, but time forbids, and besides, it is unnecessary, for what I have said of cattle will readily suggest what might be said of other stock. The point I wish to make is this, that these results have been brought about, mainly, and indeed I may say wholly, through the influence, encouragement and assistance of the several agricultural societies. Just in proportion to the prosperity and influence of agricultural societies in any section of the State, has been the improvement in the domestic animals of that locality.

Perhaps some good farmer will say here, "My farm is as well

conducted, my crops are as good, I have as good cattle, horses, sheep and swine, as my neighbors, and I have never spent my money or bothered my brains in conducting agricultural societies or spent my time at farmers' clubs." Very true, and equally true, that in a very great majority of such cases the idea of doing a really benevolent, unselfish act in any direction or for any cause, has never penetrated the outside coating of your gizzard. To such men I desire to suggest a certain text of scripture, which speaks of entering into "other men's labors," and also the oft-repeated quotation of the celebrated Roman orator, after the assassination of Cæsar, "Here comes his body mourned by Mark Anthony, who, though he had no hand in his death, yet shall he receive the benefit of his dying."

Probably the most striking improvement has been made in agricultural tools and implements, but the very thought of it suggests a whole lecture, so I will pass it by, knowing that such of you as have dug up your ground with one of Joss. Ladd's plows, mowed your grass with one of Elder William's homemade scythes, pitched your hay with a fork made by the village blacksmith, hauled it on a "sloven," and cleaned out your tie-ups with a shod shovel, can realize something of the improvement of which I am speaking.

Another good of agricultural shows and fairs is the influence they have on the manufacture of agricultural and mechanical tools and implements, and textile fabrics. For example, a few years since the North Vassalboro' Manufacturing Company exhibited goods at the World's Fair in Europe, for which they received a first prize, and what is the result? Why, the fact that they have received a gold medal at London or Paris calls the attention of people to their goods, exhibitions are being held all over the State, other companies exhibit their fabrics along side of Vassalboro', and each is obliged to produce about as good a sample as the other or be driven from the market, and every consumer of Maine cloths to-day gets better goods in consequence of that one prize. Again, suppose I go to my friend Whitman the manufacturer of implements and machinery at Winthrop for any thing I may want in his line about my house, barn, shop or farm, what then? Why, he looks at me and says within himself, "There has been a fair at Portland, another at Readfield, and others all over the State; my goods have been shown there beside those of Barrett, Hussey, Holbrook, Dunham and other manufacturers, this

man has been there, and it is no use for me to offer him an article that is not just as good as anybody else can offer."

So of edge tools and all the manufacturers of steel and iron. The Dunn Edge Tool Company cannot afford to let the Douglass Company make a better axe than themselves, and Hubbard & Blake must produce as good a scythe as Phillips, Messer & Colby.

So of the thoroughbred horse or bull. The people have been to the fair and have seen the best, and Mr. Percival must show as good a Shorthorn as Mr. Dow, and Mr. Underwood as fine a Hereford as Mr. Burleigh, or they must at once come down from the proud position they now occupy. So you see, when an article or animal is offered as first-class, it needs no warranty, for in this day of so general diffusion of useful knowledge, no one but a fool would throw away his reputation by offering anything else.

Again, no one will deny but that the agricultural societies are the parents of the agricultural papers which are so plentifully scattered through the land, and if so, who can compute, or imagine even, what they have done for the intelligence of the people, not only in regard to agriculture and mechanics, but in the general knowledge of the world, for a weekly paper is a sort of encyclopedia of useful knowledge, political, religious, industrial and general, and every school boy or girl to-day may be, and the most of them are as well informed and as much interested in the researches of Dr. Hayes in the frozen north, and Dr. Livingstone on the burning sands of Africa, of the rebellion in Cuba and the revolution in Spain, the Suez canal and the Pacific railroad, as were their grandfathers with the road to Hallowell or Wiscasset.

There is a story told of a lady formerly living in this county, which illustrates the scanty diffusion of the knowledge of passing events of that day. Soon after the treaty of Ghent, this lady went to spend the afternoon with Mrs. Chapman. Esquire Chapman, who was one of the leading men of his day, told her that a British minister was expected over right away. The old lady laid down her knitting-work, raised her spectacles above her eyes and exclaimed, "Of all things! well there, if he preaches at Whittier's Mills, me and my old man must go and hear him." To-day any school boy will tell you Mr. Thornton is not a preacher.

I trust what I have said may suggest to your minds something of the importance of this part of my subject, and other gentlemen present may take up and discuss the points which I have omitted. One thought more: The lecture of Prof. Goodale on the "Con-

ditions of Successful Experimenting," delivered at our last session, suggested to my mind a solution of the difficulties we so often meet with in our experience as practical farmers and gardeners. In experimenting, the "conditions," in some particular, not being observed by us, are not complied with, and we fail to attain the result reached by somebody else and forthwith conclude that somebody else is either a knave or a fool. Again, in experimenting many people adopt a theory of their own and experiment to prove it. Everything which does not go to prove it is thrown aside as unsatisfactory, and everything which tends in any degree to corroborate it is accepted, and magnified into positive proof, and every experiment such a man tries only serves to confirm him more and more in error if he adopted a wrong theory in the beginning. It is unpleasant and vexatious to read of somebody's very successful experiment as published in the *Farmer* or some other of the agricultural papers, and after we have expended care, thought and money on a similar trial, to find ourselves sadly disappointed, or, what is worse, "sold," and it makes no difference practically whether somebody else sells us or whether we sell ourselves.

It was wisely suggested by the honorable gentleman from Naples, Mr. Perley, that perhaps we had better not publish our experiments, because of the danger of others being led astray by not regarding all the conditions observed by us.

In this dilemma what are we to do? If we make any decided improvement we must experiment, and to do this and fail three times in four is uphill business. I am happy to know that this contingency has been provided for by this same system of industrial associations of which we have been speaking. I refer to the College of Agriculture and Mechanic Arts, the permanent fund for which was furnished from the public domain. By the wisdom and liberality of our State legislature this college and the farm connected with it are in successful operation; the former under the care of an earnest, efficient and laborious President, aided by able Professors and Lecturers, and the farm is managed by a scientific and practical farmer. This farm consists of about three hundred acres and embraces many varieties of soil. Upon it are to be tried complete and circumstantial experiments in floriculture, horticulture, agriculture, including the cultivation of all the crops grown in our State, together with scientific lectures on, and practical experiments in draining. In these trials we shall have

full notes of the character, previous treatment and present condition of the soil, the preparation of the seed, the mode and expense of cultivation, its daily or weekly progress, the parasites which harm it, the changes of the thermometer and barometer, the deficiency or surplus of rain, the character and effect of drainage, together with such other incidents or accidents as may be observed. New seeds, plants, trees, fertilizers, tools and implements are to be tried, good ones proved and humbugs exposed. Here too is to be demonstrated the great fact that agriculture affords an ample field for the development of all the powers of the most cultivated minds, and also the value of science and intelligence when applied to practical labor upon the farm. These experiments are to be published in the agricultural reports and will be available to all the farmers and gardeners of the State. All that will be necessary for a farmer to do, to avail himself of the knowledge thus gained, will be to take an inventory of his resources of cash, soil, climate, patience, pluck and backbone, and then after carefully studying these several experiments, decide what course will be most for his interest to pursue, and he can go forward with a well defined and intelligent purpose, feeling reasonably sure of success.

This is but one of the good results which are sure to follow the successful operation of this institution, which we believe is to be the nucleus around which will gather, and in harmony with which will be prosecuted, all the various industrial interests of our State, and which is to prove still more clearly the great fact that there is necessarily no antagonism or conflict of interest between the several branches of productive labor, but only that wholesome emulation as to who shall best fill the position in which Providence has called him to exercise his physical and mental abilities.

This institution I look upon as not only a necessity and a real economy, but as a finality, for I believe it is destined to rise and expand and send forth its streams of scientific and practical knowledge, till its influence shall be felt and its good work appreciated throughout the whole length and breadth of our beloved commonwealth, from Kittery to Madawaska, and from the head waters of the Magalloway to Passamaquoddy bay. And long after we shall have closed our earthly labors and been laid to rest in the bosom of mother earth, it shall continue to open up to those who shall come after us, sources of knowledge and improvement, which, if

we shall then be cognizant of what is transpiring here will cause us to rejoice that we were permitted to bear some humble part in providing the means by which such results shall have been accomplished.

The PRESIDENT. The subject of the lecture is before you. There is a little time remaining before the hour of adjournment, and it is hoped that gentlemen present will take up the subject and continue the discussion.

Mr. NORTON of Avon. After the interesting address to which we have listened from the member from Kennebec, it would seem to be hardly necessary that any further argument should be presented in favor of agricultural societies; but when we so often hear it said that they are of no benefit, and that the small amount paid by the State is wasted, I think we should try to examine carefully the facts of the case. If we look back a few years, we shall see that we were merely plodding on in the tracks of our fathers; that our corn did not average more than twenty or thirty bushels to the acre; that our grass crops were not over three-quarters of a ton to the acre; and that our cattle were mostly unimproved breeds. I remember the time when, if oxen girthed six feet and a half, they were thought to be good, no matter how much like a case-knife they might be. Nearly all the work on the road and on the farm was then done by oxen. Few farmers owned horses and carriages, the ploughs were of the old-fashioned style, and most of the other farm implements were of the same description. These things are now entirely different. We have fine breeds of cattle, and most of our farmers are raising seven feet oxen and upwards, and also are stocking their farms with horses. The horse has almost entirely taken the place of the ox on the road. Our farm implements are very much improved. Sheds and barn cellars for the protection of manure are very much more common. Commercial manures are coming into use, and a much larger amount of manure is made on the farm by composting. Our hay crop is improved, and all our other crops are also improved. We are getting more to the acre than we did twenty or thirty years ago. We see also a marked improvement in the farm buildings. They are neatly painted and better furnished than formerly. Farmers' families are better clothed and better educated than they were a quarter of a century ago. Agricultural books and newspapers are far more abundant than they were then.

The result of all this is, that there is a better rotation of crops, more thorough culture, a more plentiful use of grass seeds and fertilizers, more stock, and better care taken of the stock than there was at that time. Our lands are being cleared from stones and other obstructions, and the consequence is, that we are reaping better profits from our agricultural operations. If any one will look candidly at the matter, he must be convinced that agricultural societies, with the aid that has been given them by the State, have been of great benefit.

The PRESIDENT. I notice here a gentleman who has been closely identified with the agricultural organizations of the State and also with the Board of Agriculture,—one whose wisdom, we all know, is measured by his years. I allude to Mr. Robert Martin of Auburn.

HON. ROBERT MARTIN of Auburn. I did not expect to say a word when I came in here, and when I look around and see so many young men, and others whose heads are not so frosty as mine, I feel that I can hardly expect to say anything that will interest them. I came here to be instructed, and I should be very glad to be allowed to keep my seat.

I came in only late, but I understood the subject to be agricultural organizations. That has been, in times past, a subject which has exercised my mind considerably, but can I possibly, with my advanced years, say one word in addition to what has been said this morning? I fear not. Whatever I shall say will be a repetition, nothing more.

But, Mr. President and gentlemen, all the interests with which we are acquainted have been assailed precisely as the agricultural societies are assailed. There have been men, and intelligent men, who have spoken lightly even of the religion of Jesus Christ. They have said it could not prosper, that it was not worth following, that to devote time and money to its protection and dissemination was idle and useless. Shall we wonder, then, if the agricultural societies are assailed? Shall we tremble in the least? Not at all. Go ahead young men! See what has been already accomplished! My friend, Mr. Norton, has told us something of the condition of the farmer in years gone by. No schools—no chance for study—no chance for improvement. When I was young, the boys were glad to find even an old newspaper, and glad to carry it home, because it was something to read. There were few school-houses then, and little chance to learn anything.

All that has been changed. You now have schools, you have agricultural papers, you have all the means for obtaining information. These young men should be educated, and they should take this burden upon their shoulders, and say to the world, so far as they can, "These interests *shall* prosper; they *shall* go ahead, for the great advantage that is to be derived from them, in every way."

My friend has spoken of the value of oxen. Forty or fifty years ago, I was buying young stock in the fall, and sending them to Brighton, in droves. Not long since, to convince my sons of the great change that has taken place, I took down those old books, showing the prices paid for cattle at that time. When we got up to \$6.00 for a yearling, we thought it was a big price, and we told the young men, "You must be careful and look sharp." \$4.00 and \$4.50 was the usual price for yearlings, \$6.00 and \$9.00 for nice two-year olds; I say "nice" for that time, not now. A nice two-year old would then buy a barrel of flour. The farmer thought if he sold a two-year old heifer for enough to buy a barrel of flour, he was doing a pretty good business, and was perfectly satisfied. How is it now? I ask the gentlemen in the State of Maine who are telling about "hard times," and saying, "we can't live," how is it? Take your nice two-year old heifers, and they sell for forty or fifty dollars. How many barrels of flour can you buy for the price of that nice heifer? Yearlings are sold now for from twenty-five to thirty dollars. Why? Because they are much bigger than a two-year old was forty years ago.

That is one instance of improvement, and there has been equal improvement in many other directions; and shall we not attribute it to what has been done and said, the combination of thought and action, mind acting upon mind? Here is my friend Goodale; he is young compared with me, but he has been a father to us in these things, through the reports which he has sent out to us. If he were not here, I would say more than I dare to now. I tell you if we would carry these books right to the doors of all those who disbelieve, and prevail upon them to read and study them, they would come out converted children. We have right here in Androscoggin, many who whine out, "we can't! we can't!" No man ever did or ever will do anything on this earth who cries out morning, noon and night, "I can't." Say "*I can* and *I will*," and you will be pretty sure to accomplish what you undertake. Shall we succeed? Certainly we shall.

Mr. H. B. WILLIAMS of China. I have been thinking much of one subject while the lecturer presented the matter of horse trots. We all know that on the last day of our shows, a horse trot usually takes place, and that we receive more money on that day, than on all the others. That is a fact, and worthy of our consideration. At the same time have we not carried the horse trotting to an extreme?

A great many farmers in our section have become dissatisfied on this account, and kept their stock and the products of their farms away from the exhibitions. I think this matter one well worthy of our consideration at this time, and that we ought to inquire whether it be not possible to devise some methods that shall be satisfactory to the people, by placing restrictions upon these trots. We have in our society some smart business men, who have done a good deal towards organizing it, getting it in running order, keeping up its reputation, and all that. But they are really horse men, and they insist upon great premiums on horses. I think there is no consistency in offering \$50.00 for the fastest trotting horse, \$25.00 for the second, and \$10.00 or \$5.00, as the case may be, for the best pair of draft horses, and fifty cents for the best rug. To me it seems absurd.

Mr. MARTIN. That is a subject I have thought of a great deal. I have had something to do with these societies, and I have found, that if we have the show, we must have the picture, and we must have such pictures as the people want to see. For myself, I care but little about horse trotting upon the grounds, but, Mr. President and gentlemen, old as I am, I admire to sit behind a horse that does not take anybody's dust. Is there a man on this floor who does not? If there is, I wish he would rise, just to gratify me. Not a solitary man! I tell you, there is not a man or a woman either, who does not like it.

Now can we make our fairs go without we have the pictures that are called for? I think not, and any man who has occupied the position of a trustee of an agricultural society must have come to the conclusion that we must have these trots, in order, as my friend, Mr. Thing, says, to bring in the funds.

I will give my experience in regard to these horsemen, and I will ask the gentlemen present if their experience has been different from mine. I do not think very much of their way of life, but, gentlemen, I never had, as an officer of the society, a disrespectful word from one of those men. All they asked was, "What do

you require?" and they would obey to the letter. Have you not found it so? Who does any better than obey to the letter? Then are we responsible for the character of these men outside? Not at all, in my opinion. We want the fast horse. You like, every one of you, to see a good horse trot; the ladies like to see a horse trot; the young and the aged all like it. Well, that is all right. We all, I repeat, admire to see a fine horse.

Now, I ask again, how are we going to get along without the horse trots? Here is a large portion of the community who call for it, and we are all pleased with it. My friend, Mr. Thing, wants us to regulate it. So do I. He must do it in his place; you must do it in your places. Every one must see that there is order, and good order. I do not apprehend that our morals are going to suffer. I do not feel afraid of it. I hope it will not be the case; if I thought it would, I would oppose them; but I cannot see it myself.

The lecturer alluded to the ladies riding. I never liked that. I should not want my wife or daughter to ride on the grounds. If they wanted to, I should not oppose it; but I was very glad when that practice was abolished. But it is utterly impossible, at the present day, as men are constituted, to get along without having the fast horse at our agricultural exhibitions. Can we make the show go without it? No sir, or it will go slow and very feeble. Then let us have the fast horses, but be careful to regulate the matter, and when the horse jockey comes up, treat him as a gentleman, while he behaves himself, and make him behave as a gentleman, on that fair ground, if he never did before, and never expects to again.

Gov. BROWN of Mass. I should like to ask Mr. Martin one question. The objection is sometimes made to trotting or racing horses on the track, that it is an act of cruelty to the animal. It never struck me so, but as Mr. Martin seems to have had a good deal of experience in this matter, and to have given it considerable observation also, I should like to ask whether, in his judgment, the horses are really injured by a fair trot on the track?

Mr. MARTIN. I do not think it hurts the horse, *if he is taken care of after the trot*, any more than it hurts the master. You can drive a horse for an hour, but if then you stop and hitch him to a post while you go in to drink, and neglect him, you can spoil the animal.

Mr. WILLIAMS. I would not be understood as wishing to rule

the trotting horse off the ground. But I repeat, that we have seen this practice carried to an undue extent, I think; with us, especially.

The gentleman last up seems to consider it the duty of the officers of the several societies to regulate this matter, and perhaps they ought to do so; but I understand it to be the duty of the Board of Agriculture to regulate the societies. Doubtless it was the delinquency of the societies in regard to the premiums for wheat that induced the Board to take action in relation to that matter. They noticed, also, that there was a lack in regard to the formation of Farmers' Clubs, and they took that matter in hand, and the result is doing good in our section of the State. I do not know that the time has arrived when legislation is necessary upon this matter of horse trots, but I have been thinking whether or no the Board, at some time or other, would not have this duty to perform.

Secretary GOODALE. The gentleman labors under a misapprehension as to the province of the Board of Agriculture. It has no authority to "regulate" the societies in the way to which he alludes. It is competent for the Board to direct for what purposes and objects a portion, not exceeding one-half, of the State bounty shall be expended, and this authority has sometimes been exercised, as in the cases to which he has alluded, but in regard to operations of societies farther than this, the Board can only offer suggestions and recommendations, which the societies can accept and act upon or not, as they please.

Mr. BODGE of Jefferson. As raising horses is one branch of farming, I consider it a benefit to the farmer, sometimes, to go to a horse trot and see the style of the different horses, so that, if he is going to raise a colt, he will know where to look for a sire. It is important to have a good-gaited, stylish horse. If we go to a trot, we can see the style and learn the speed of the horses, and by that means secure the service of a sire for our breeding mares that will probably produce a similar animal. We need a good horse as well as a good yoke of oxen or a good cow. Every farmer wishes to have a good horse or a good span of horses, and if we can see the style and gait of stud horses, I consider it an advantage to the farming community.

Mr. WHITTIER of Vienna. I recollect attending, when a boy, the first agricultural exhibition ever held in the State, and since then I have watched with some interest the progress of agricultural

societies in the State. We now have State, County and National Societies. I have had the privilege of attending one fair in New York, one in Ohio, and also a United States Fair, and I have marked everywhere the advantage of these exhibitions.

It occurred to me, while our friend Martin was speaking, that while we had the ornamental, it would be well if we could add something of the useful. I think prizes should be given for brood mares kept for breeding purposes. In England prizes are given to the racers, and English writers say they have no other way of testing the quality of the best horses except by a race, and that is true. Have we any other test for our brood mares or our stallions, than by their actual performances? In England, large prizes have been given to racers for years, perhaps for centuries. In that way, they test the power of their horses. Twenty-two hundred horses go on to the English turf in a year, and the qualities of those horses are tested at the county and national races. That horse which has the strength of limb, soundness of wind and power of endurance to win, is the horse for breeding. So when Mr. Alexander of Kentucky, went to England to procure a horse to improve the American stock, what horse did he select? He selected "Scythian." And what was "Scythian?" Although but five years old, he had won \$27,000 on the English turf. His sire was "Orlando," who was sired by "Touchstone." That was the guide he had, and the only guide he had. His ancestors had desirable qualities, and the horse himself had these qualities, and he was purchased at a very large price and brought to Kentucky.

Again, let me remark that I regard the horse interest as an important one in Maine. The farmer can breed horses, and if he can produce good horses, it is an advantage to him. We raise them to make money, and we find that men in the cities will pay well for a good horse. We know they will go pretty deep into their pockets for a first-class horse.

So far, therefore, as the agricultural interests of the State are concerned, it is well to improve the race of horses. What has Vermont done by united action and effort? She succeeded in raising the "Morgan," and secured for that breed a world-wide reputation. What did she do with the "Black Hawk?" She has given that a reputation almost as wide.

It is already admitted that Maine horses are superior in bottom to any other horses in the United States, from some cause. The

test in the army showed that. We might confer a general good by shutting out the horse jockey from our fairs, and still have all the pleasing part and the useful part of a horse trot. Why should the jockey be allowed to go to Boston or New York and get some worn-out trotter and come to our exhibitions and compete for the prizes? I would have these prizes go to the horses in our own vicinity kept for breeding purposes—brood mares and stallions.

I would not disparage our agricultural societies, or intimate that they have not made the best arrangements they could under the circumstances; but I was noticing the returns to the Secretary of the Board of Agriculture, and I could not help observing the disparity in some of the premiums offered and awarded by our societies, although they may have done the best they could under the circumstances. The amount of premiums paid for trotting horses by my own society, for instance, is \$185, while for stallions, only \$11 was awarded; perhaps a little larger amount was offered, but only \$11 was awarded, to offset \$185 awarded for trotting horses. For breeding mares \$5 was awarded. Something more was offered, but no great amount. Working oxen, \$25; bulls and bull calves, only \$16 awarded. We had some excellent animals and a goodly number of them exhibited. But see the limited amount awarded, compared with the amount paid for trotting horses. I admit that we received twice as much money at the gate the last day as we should have received, had we not had a horse trot, but if we turn right about and give the money to the horses that are trotted, where is the advantage? Is not that a point worth considering?

Our society was organized in 1868, and our first fair occurred a year ago last fall. We offered liberal premiums for trotting horses. I will say, however, that the entries were not filled for the largest premiums offered, and we got up some special trots,—the best we could. In one case, a horse was entered clandestinely, from beyond the limits of the society; he was smuggled in unknown to me. He was an old horse called "Sleepy David," that had been up and down the river, and had trotted at Bath, and here, there and everywhere, and always swept the stakes in his class. They put him on the track, and he swept the stakes—drew every dollar offered in that class. When we came to settle, we were compelled to rule that horse out, thus creating a great deal of dissatisfaction with the owners of the horse and their friends, although the result proved we were right. But, as Mr. Martin has said, these horse-

men, as a rule, appear gentlemanly ; but they have axes to grind. There is policy in war, and it is for their interest to use the officers of the society well, and to keep up a respectable appearance, at least, in order to meet with the greatest success.

Mr. THING of Mt. Vernon. I don't object to gentlemen's pulling other folks' houses down over their heads if they will put up another one just as good, or better. If they will tell us how to run an agricultural fair without the horse trot, I should be willing to see the horse trot abolished, but I know no other way. We must have it, in order to get the money to pay our premiums. Before we can do anything else, we have got to go back to the children, and educate them, if such a thing is possible, (I don't believe it is,) so that they won't want to see a horse trot, and will give more *not* to see one than to see one. If you can advertise that a certain horse is *not* to trot, and the people will come and pay their fifteen, twenty-five or fifty cents because there is *not* to be a trot, you will get the money, and then you will be all right. But as long as they will pay their money to see a trot, and will not pay it for anything else, we are driven to it. I put it on that ground solely. I have no objection, personally, to a trot. I don't believe it hurts the horse. I don't believe it hurts the morals of the community. I believe it has helped the morals of that class of people who are denominated "fast," for they have learned, at these exhibitions, that their avocation or profession (if they please to call it so) can be prosecuted in as gentlemanly and courteous a manner as any other.

Hon. RUFUS PRINCE of Turner. I am no fast horseman, and when I became one of the officers of the Androscoggin Agricultural Society, some fifteen years since, I made up my mind that I would try to do away with trots at our fairs, and run the society without them ; but I became satisfied that it could not be done. We must have the fast horse, or we cannot get the money. Can we run a society without money ? Certainly not. I believe the horse trot is a necessity, and the question is, are our exhibitions, as a whole, an advantage ? We all say they are. There is no question at all but that they are an advantage to the agricultural community. Now, if they are an advantage to the farmer, are they conducted in the best manner they can be ? Can we conduct them without the fast horse ? I am satisfied, after some fifteen years' experience, that we cannot. As the last speaker has said, we must have the fast horse to get the men and women in. I

recollect attending the New England Fair last fall, and I was on the ground one day with two ladies, who cared nothing about the horse trot—didn't want to see it, they said. I urged them to go. I said, "You had better see it. There are to be some nice horses there; some that you read about every day in the newspapers." Finally, they went. There was an old gentleman in the company, and before the trot was over, he said to the ladies, "I think we had better go home. Suppose we go, and leave Mr. Prince to see the rest." One of the ladies turned to her sister, and said, "I think I should like to see it out," and they concluded to let the old gentleman go, and stay themselves and see the trotting. Nether of them had ever seen a horse trot before in her life, and they were both greatly interested. As the gentleman from Mt. Vernon says, you have got to educate the people before you can do away with these trots, and that, I don't believe you can do. You have got to make them over.

Mr. WILLIAMS. I do not wish to be understood as desiring to do away with the horse trot. I like to see a horse trot as well as any other man. But I was noticing the disparity between the premiums offered by our society, (and I presume our record is similar to that of other societies,) and questioning the propriety of it; that was all. I do not believe we can dispense with horse trots at our fairs. They are desirable, if properly conducted. There is the point.

Mr. LUCAS of Somerset. I am glad that this question has come up for discussion. It was discussed at the last meeting of our society, and it will be taken up again at the next meeting, a week from Saturday. At our last show we had a premium of \$50 for trotting horses. The result was, that we really got but a small amount of money. The idea is, that we had better increase the premiums and keep up exhibitions of that kind.

The question has been raised whether a horse is injured by trotting upon the track. I agree with Mr. Martin, that if a horse is in proper condition, and is properly cared for afterwards, it hurts him no more to trot than to do anything else. More of our horses are spoiled the first fifteen minutes on ordinary roads than in any other way. They are kept in the stable and overfed, and have too little to do, and when they are taken out, they are at once put to their speed, and the result is, they are spoiled.

As I am summoned home and do not expect to be here at the subsequent meetings, I want to say a single word in regard to

neat cattle. A drover was asked the other day by a farmer how much a pair of seven feet oxen would dress. "Where do you live?" said he. "What has that to do with it?" asked the farmer. "I will tell you," replied the drover. "If you should say you live in Readfield, or Winthrop, or Belgrade, or Waterville, I should say 2000 pounds. If you should tell me you live in the western part of Piscataquis, the eastern part of Somerset, North Penobscot or Aroostook, I should say 1700 pounds." I thought it was a little queer that a pair of seven feet oxen in Readfield should dress 300 pounds heavier than a pair of seven feet oxen in West Piscataquis. The trouble is just here. Almost all our farmers keep about three horned cattle where they should keep two; it costs a little more to keep the three than it would to keep two, and keep them well, and they are not worth quite as much as the two would be. Two good cows are worth more for dairy purposes than three ordinary cows. Two pairs of oxen, properly kept, are worth more than three pairs, as we generally find them. That is one great error that farmers have fallen into in many sections of the State.

One word more as to horse trots. Since a successful fair cannot be got up without the fast horse, it is indispensable to have him there as it is to have the ox, the cow, or anything else. In order to get the crowd, the horse must be there; they must know that the horse is to be there, or they will not come.

One argument against the horse trot is, that horses come in from abroad and carry off the biggest prizes. Suppose they do. We make up our list of prizes, and we have our "sweepstakes," as they are called, and we expect the smartest horse to take them. What is the result? The result is, that one, two, three, five or ten hundred people came in to see that trot. We can well afford to give them the highest prize, and perhaps give smaller prizes to our horses that are deserving. The younger horses are there, not for the money they are to get, but to show themselves. If you want a smart horse, and he is coming from abroad, you must offer inducements. In order to have the crowd, you must have the horse; in order to have the horse, you must offer handsome premiums; and in order to have the show, and have it successful, you have got to have the horse in it.

Mr. JEWETT of Oxford. I was one of the trustees of the agricultural society in Oxford county, for several years. I have often heard the objection brought up, that we were ruining the fairs by

having horse trots. My experience is, that we might as well undertake to make water run up hill as to get funds for our societies without the trot. The men who make that objection would do nothing to help make them successful if there were no trots. So far as my observation goes, they are men who take no agricultural paper, and would do nothing under any circumstances.

Adjourned.

AFTERNOON SESSION.

The Board met agreeably to adjournment, and took up the question of

MANURES.

Mr. WILLIAMS of China. I know of no branch of farming where there is so much waste, so much neglect among farmers, as in the care and management of manure. I find by experience, that manures, in the first place, ought to be housed. I have formerly used a barn cellar, but am now using a shed, from the fact, that I cannot conveniently build or have a cellar under my barn. The farmer can make his manures one-third more valuable, simply by having a proper place to house it.

Mr. WASSON of Ellsworth. It will be remembered by the members of the Board of Agriculture, that some eight or nine years ago, the Secretary of the Board was directed to give attention during the summer following to the value of refuse fish as a fertilizer. I well remember that in his report which followed this investigation, I found this remark, which seems to have been prophetic, because we have ascertained its truth, that in our inedible fish was to be found "a magazine of wealth." I believe we are now realizing that there is, in these shoal water fish, a magazine of wealth, not only by using them as a fertilizer, but also by appropriating them first as a cattle food.

I speak from some experience in this matter. I am experimenting now for the second year in the use of "chum," as we call it, or refuse porgie, as food for sheep and poultry, substituting it for Indian corn and turnips. I have been feeding for several years turnips and corn to my sheep, and my experience thus far is, that, pound for pound, as a provender for sheep, the "chum" is worth as much as corn.

I see before me a gentleman from Washington county, who has been experimenting for two years or more in feeding it to his

milch cows. He has abandoned that now on account of the unpleasant flavor which it imparts to the milk; but his experience has been that for young growing stock, or cows that have dried up, nothing else will give such rapidity of growth, or place them in so good condition in the spring. A gentleman who has been feeding chum to his sheep for two years past, and is giving it again this winter, told me the other day that it would increase the weight of the fleece one pound per head over and above what he would get by feeding anything else to his sheep, Indian corn only excepted.

To come back to the remark to which I have referred in the Secretary's Report, I believe we shall find in the shoal water fish along our coast line a "magazine of wealth" of which we have never thought. And even as a fertilizer, after we have passed it through the body of the animal, it may be that we have lost little or nothing.

The PRESIDENT. The gentleman speaks of the porgie chum. I would inquire whether other refuse fish are good for sheep and cattle?

Mr. WASSON. The herring chum is supposed by some who have used it to contain even a greater amount of nutriment than the porgie chum. I cannot conceive wherein is the difference between that and the other shoal water fish which we call the flounder, the tom cod, the sculpin, and the smelt. I know no reason why the tom cod should not be as valuable as the porgie chum for cattle food.

One single fact in regard to this chum which I forgot before to mention. Those who have used the chum associate with the name that peculiar odor which attaches itself to it unless it is properly prepared. We are now learning the proper way to prepare this refuse. It is taken from the press and dried until it is as inodorous as dried cod fish, and may be handled without imparting any offensive smell at all; and it is surprising to see with what avidity sheep and cows will eat it. They will pick up every bone, no matter how large or how small.

The question was put to me by an intelligent gentleman, if we did not render ourselves liable by allowing our sheep to eat the bones, as it is impossible for them to eat the chum without the bones? I have never noticed any injurious effect from that. To show how eager they are for it, I will mention that I feed it to my sheep in the morning, and they cannot be quieted until they

receive their chum. I feed at the rate of two quarts a day for every twelve sheep.

HON. OAKES HOWARD of Winthrop. People in the country generally suppose that sheep or cattle will not eat fish without learning. Is it a fact that they do eat this chum readily when it is first offered to them?

MR. WASSON. I should say they would not during the warm season, as long as they can have access to good pastures. I noticed when I first commenced feeding it to my sheep, that it required about a week before they would eat it readily, especially the younger ones; the older sheep would eat it the moment I offered it. There is no salt used in its preparation, so that it is as fresh as when the fish came from the water. Sheep or cattle readily learn to eat it. It is natural for them to want such kinds of food.

Secretary GOODALE. With regard to herring, the practice is, almost universally, to pickle the herring, and more or less salt remains in the chum. Porgie chum is usually quite fresh.

I have had this matter of feeding refuse fish to sheep under observation for ten years and more. It struck me as very queer at first; I could hardly believe the reports which were given of its success; but I have not found a single man who has given it a fair trial, with good material, who has not found it successful. And if you will look at its composition, you will not wonder. It is too concentrated a food, too nutritive, to be used alone for sheep or cattle, for their organs of digestion are so constituted that it is necessary they should have bulk as well as nutriment. The fish will furnish them, in an inoffensive form, a highly nitrogenous food, which will supply those elements of growth in which our poorer forage products are deficient. It will come in mainly as a supplement to another food. We have a good deal of bog or swale hay, and of other inferior fodder, and this is lacking mainly in nitrogenous elements, those constituents which go to make flesh; and by giving a moderate amount of dried fish, you supply just what is lacking in the poor fodder, and it will enable you to get along with a much smaller amount of good hay, and thus make your hay go a good deal further.

The importance of this subject has been growing upon me from the time it was first mentioned. If there is any one feature which characterizes Maine as a State, it is the vast extent of her sea-coast, including bays, inlets, &c., which supply fish, and her great

resources for furnishing marine manures. We have all along our coast a large amount of material which was formerly thought of no value for manure except in the immediate neighborhood where it was found. We have in Casco Bay and various other bays and inlets, a vast amount of muscle mud, which is exceedingly valuable, but from its great weight can be carried to no great distance. Sea-weed in its green state does not differ very much in manurial value from fresh cattle excrements. You would be surprised in looking over analyses of sea-weed, to find how nearly its composition corresponds with that of fresh manure. I suggested, at the time to which the gentleman refers, nine years ago, the possibility of preparing sea-weed by drying and grinding, and I am happy to be able now to say that I have learned, within a few days, that we have upon the coast a factory which is turning out a considerable amount every day, which is sent abroad, as I am told, under a contract. It is said to have been found to be very useful in the cultivation of flax; and I know no reason why it should not be as good here as it is abroad. I hope the day will come when all these resources will be utilized, and when we shall economize all the manurial elements to be found in the State.

Sea-weed contains from seventy-five to eighty-five per cent. of water. That water can mostly be driven off, and when it is driven off it is a valuable and somewhat concentrated manure. If taken from the rocks, piled up at once on the ground, in a short time it heats and ferments, but it is used largely in composts, in which it sets up an active fermentation, which causes all the other matter to decay rapidly, and makes the compost rich and effective. Dried and ground sea-weed has been used to some extent in the interior, and I am told with exceedingly diverse results. Some say they perceive very little effect from it, while others tell marvellous stories about its efficacy. The explanation is to be found in the fact, that we know very little as yet where it will do the most good. I am very much in hope, that when that is utilized as it may be, it will not be all carried out of the State.

In regard to this matter of fish, I wish to say one thing further, and that is, that we have an enormous amount on the coast, and I suppose nine-tenths of it is sent away, and goes to fertilize the States of the South and the West—more particularly those of the South; so that a large portion of the manurial value of all that fish refuse is lost to the farmers of this State. You will find, as I have

said, exceedingly diverse accounts of its value. The reason of that is, that it is not, ordinarily, pressed very dry, and is put up very carelessly, I have seen piles of it, years ago, when they did not take much care in preserving it, which, in four days after it was taken from the press was as full of worms as it could be. I have seen a great deal sold in the market as fish chum, which did not contain one-tenth part of the value which it ought to have had, simply because it had undergone putrefactive decay, all the nitrogenous matter had been converted into ammonia and escaped into the air, and there was nothing left but a very offensive, but nearly inert mass.

Now, what ought to be done all along the coast is this: just as soon as that fish refuse comes from the press, it ought to be dried by artificial means. A great deal is taken during the summer months, when fogs prevail on the coast for days together, so that, if drying it in the sun is relied upon, a great deal of its virtue will be lost. I have never seen any fish chum in the market, with one single exception, that was not more or less offensive, and it was because it was not properly dried. The mode of preparation is this: The fish, when taken from the water are either boiled or steamed until the albumen is all coagulated. That permits the expression of the oil together with a large portion of the water which comes from the press. This is allowed to pass off, the oil separates, and afterwards is drawn off separately. The remainder they frequently barrel up at once, and if the weather is cool it will keep for a while without serious injury. Some of it they dry, but in a rough way, on platforms; sometimes after drying they barrel it up without grinding, and sometimes they grind it before selling. It ought to be dried by artificial heat, as they dry sea-weed; then it should be ground, and all possible danger to cattle from the bones would be avoided. It can then be used for any cattle except cows giving milk. I do not advise it for them, as I would not advise giving them turnips. It would give the milk more or less disagreeable flavor. But it will furnish that which will help make flesh, fat and bone, and that is the greater desideratum generally. The other food to accompany it may be swale, bog hay, or any common inferior fodder. I do not know why the whole amount of our refuse fish may not be used in this way; and so much of it as does not go into bone, muscle and fat, or go to support the every day wants of the animal, will remain for manure. Then, if you will save all the liquid excrements, by means of proper

absorbents, you will have one of the most efficient means of indirect manuring which you can have, although you bought it ostensibly as food.

And that brings up a question in connection with manure. I think it one which farmers ought to settle each for themselves, whether they can do better in buying manure directly, or buying it in the shape of food. In some cases, undoubtedly, you can best manure your lands by buying food and passing it through your animals, getting all you can in milk and flesh, and the balance in manure. But hitherto the question of manure in connection with feeding has been almost ignored. It is not so where agriculture is more advanced than it is here. In Great Britain, the farmer calculates, with as much care and exactness as he can, the most economical method of procuring manure; he figures closely, just as the manufacturer of cotton here figures the cost of his product—down to the fraction of a cent on a pound. He wants to know, not only how much fat and flesh it will give as food, but how much real product there is, how much manure he can get from it. If the fish resources we have in this State were properly saved and used here, first as food and then as manure, we might make the whole State of Maine as rich as a garden.

Mr. HOWARD. What is the value per hundred after it is prepared for food?

Secretary GOODALE. I have known very little properly prepared. The great bulk of it is barreled up as it comes from the press. A large proportion of what is sold has not half nor quarter the value it ought to have, and I have seen some that was absolutely inert. I bought a lot on the Penobscot river some years ago, and took it home and composted it with sods and other matter, and I saw no more effect from it than from the sods alone. But when it is properly dried, I consider it one-half as valuable as Peruvian guano, when used for manure, and more if used for both food and manure. If you can have the fish dried at once when it comes from the press, so that it will weigh no more than is absolutely necessary, it will be worth forty or fifty dollars a ton.

Mr. THING. I have but one word to say, and that is by way of exhortation. Marine manures are good, phosphates are good, ground bone is good; but I tell you we have got to depend mainly, in the State of Maine, upon the manure that we make around our barns and houses. Don't forget that. The more manure we can make about our barns, our sinks and our hog-pens, the better

we can afford to go to Portland, or elsewhere after special fertilizers. But we cannot afford to waste what we make ourselves, and then buy manure at five, eight or ten dollars a barrel. I hope we shall not let the idea that special manures are so valuable, divert our minds from the home sources of fertility.

Mr. SWETT of Oxford. I want to add my testimony to the truthfulness of the assertion of the gentleman from Mt. Vernon. I have used superphosphate, I have used other fertilizers; but I am firmly of opinion that we must rely mainly upon our own exertions in making and saving manure from our barns and buildings.

Mr. HOWARD. I agree with the gentleman, that we must rely mainly upon our barn-yard manure, but it does not follow that we may not use other manures that are even cheaper than barn-yard manures. I have seen men who have used concentrated manures, and they have demonstrated that results were gained by their use more beneficial, and at a less cost than by barn-yard manure. When such a statement is made by a man of sound judgment and good understanding, it certainly is worthy of consideration. I have had some experience in the use of concentrated manures. I used, last year, on an acre of land, about two hundred fifty pounds, and I was satisfied that it increased the crop one-third. I do not know what it will do another year, but if it does as much as that this year, and for three years in succession, it is certainly the cheapest way of manuring land. The cost of labor is small. The whole expense is the cost of the phosphate, and you cannot manure an acre of land, by top dressing, for seven or eight dollars, that will increase the grass from one-half to one-third in three years. No man can do it. It requires labor, and a great deal of labor. While, therefore, I agree that we must rely mainly upon barn-yard manure, and be careful to save everything about the house and barn that will add to our manure heap, I still say that we may use to advantage, concentrated manures, which will produce a beneficial result.

Mr. SCAMMAN of Scarboro'. We are rather inclined sometimes to take extreme views on this subject of manures. One man says we must depend wholly upon barn-yard manures, or such as we can make about our farm buildings. Another man says, "It is cheaper for me to use commercial manures, and therefore I am going to depend upon them." Here are the two extremes. Now the judicious course is evidently that suggested by our friend from Oxford. He says we must depend upon our barn-yard

manure, and such manure as we can make about our buildings ; there is no mistake about that. We must *depend* upon that, and to the utmost extent of our ability increase that and apply it to our ground. Yet, at the same time, as our friend Mr. Howard says, we may use commercial manures. How? In what way? It strikes me that we should use them as a means of increasing the barn-yard manure. For instance, I go and buy a farm somewhat run down. I don't cut much hay and cannot keep many cattle, and therefore, for the time being, I have either to starve along or take some other course. We all know that to go to a city and buy manure and haul it five or six miles won't pay. We can get our manure more cheaply than that. What am I to do? I must scrape together and save all I can about my barn-yard, privy and hog-pen, and compost all I can, and go into the muck swamp and haul up all I can, and scrape the edges of the streets and gather together what I can, and compost it, and do the utmost possible in all these directions; but at the same time, I believe it will pay,—I know it will, for I have tried it, and the best knowledge is what we get from experience,—to go and buy some *good* superphosphate. I know there is a good deal that is not worth much, that will hardly pay for transportation; but we have an article of superphosphate made in the State of Maine that is worth all we pay for it. I believe it, because I have tried it, and tried it carefully.

Now, use that superphosphate. Not as a base; I would not do that, because I believe barn-yard manure is the base; our friend here is right about that; but as a means of increasing the amount of barn-yard manure. Use your superphosphate to increase your crop of hay, your crop of corn, your crop of turnips, or anything else, so that you may be able to keep more stock on your farm, more hogs in your sty, more hens about your poultry yard, and thus increase your supply of manure. As a means to this end, this superphosphate is worth all you pay for it.

Don't let us discard the barn-yard manure. Let us hold to it and make the most of it. Don't let us discard commercial manures, because a good many of us have been cheated by dishonest manufacturers. Let us go where we know men are honest, and buy the article and use it as a manure. I suppose there is no better way to increase the fertility of our farms or the amount of our crops, than by the application of some of these fertilizers. Grow clover as a fertilizer, or as adding to the amount of forage.

The roots of clover run down into the subsoil and bring up materials from beneath the surface and make them available as food for plants, to a degree that is wonderful. By the application of commercial manure you may raise a clover crop, and by turning that crop in and sowing wheat, you may increase the amount of grain and straw to a marvellous extent. But I will take up no more of your time on this subject.

I congratulate you, farmers, upon being here to-day, testifying, as your presence does, to your interest in agriculture. It is the foundation of all our enterprises, and when we can see our water power in this State occupied as it is in the city of Lewiston, to create a home market for our farmers, and business for our mechanics, we shall have a State that will rank high among her sister States, and be looked up to as one of the best and the most successful; because, as a State, we have the facilities, we have the water power, we have the soil, and, better than all, we have the men and the women who know how to improve these opportunities.

Adjourned to evening.

EVENING SESSION.

The Board met at seven o'clock, and Hon. SIMON BROWN of Concord, Mass., delivered the following lecture on

FARMERS' CLUBS AS EDUCATIONAL INSTITUTIONS.

One of the clear evidences of a healthful progress in rural life, is the tendency among our people to *ask questions*. No man seems contented with his present success, however complete and gratifying that may be. The sculptor is unwilling to rest until he makes the marble under his hands breathe. The painter longs to add one more touch to the face he has delineated upon the canvas, and make *his* subject speak. The physician will explore the mysteries of physiology, until he can take us to pieces and put us together again as good as ever. The manufacturer of the garments we wear is not satisfied in appropriating the labors of the silk-worm, the finest wool of finest Saxony or Merino, or the gossamer-like fur of the South Sea Seal, but ransacks the world for material more exquisite still. And the persistent *research*, and *question-asking*, which bring important practical results, may yet array some fair belle in a suit composed of thistle's down, or the ethereal substance which clothes the back of a fly!

The farmer, too, has become inquisitive and inspired. He is not satisfied now with turning up the furrows of the field because it makes hoeing easier, but asks, "What action is going on in these clods? What are the rain and frost doing there? What office does this sand and these pebbles perform? How came the bone found in the garden a complete net-work of roots? Why was the wheat crop where lime was spread three times as much as was ever obtained before? Why have young *pin*es covered the ground where oaks were cut off four years ago?"

Many questions of this nature come from farmers, *now*, with an evident desire to know more of the wonderful operations which affect their labors. Questions are also asked that no mortal is wise enough to answer; but at the present rate of inquiry and research, may be solved, and enable the farmer to increase his crops, and at the same time to lessen his labor.

It is not long since the question was asked: "Can wool and cotton be spun by machinery?" Your mills answer it affirmatively, and have hushed the cheerful hum of thousands of spinning wheels around the domestic hearth.

Every improvement in the arts or manufactures has a tendency to elevate the race benefitted thereby. This elevation is the reward of those who *toil* for it, and will live among men through all time.

When Harvey discovered the circulation of the blood, he discovered no new thing in nature; but by patient investigation, revealed to us a truth; such as renders the mind more capable of perceiving new beauties on the earth, and proving that the true is always the beautiful.

Before entering upon suggestions as to how we can improve in the art of farming, and make more money in it, let us inquire, briefly, why it is that the occupation is unpopular? That it is so, may be abundantly proved in several ways, but sufficiently so in the *decrease of population* in nearly all our rural towns! *That* is going on at an alarming rate, and threatens to prove disastrous to the progress and permanent prosperity of the nation.

Our employment is the oldest assigned to man. The first-born of the earth were farmers, though mother Eve and her husband commenced mechanical work in a small way. But while all confess dependence on the labors of the husbandman, it is a little singular that for a period of nearly six thousand years—with the exception of the bright interval during the Greek and Roman re-

publics—agriculture has not been regarded with popular favor. The world has always been more captivated by the splendid, than by the useful. The triumphal processions, emperors and kings are emblazoned on the page of history, while the sturdy labors of those who gave them strength to achieve their conquests, is lost sight of in the glitter of the pageant.

Nor has our art, until quite recently, been the recipient of political favor. The farmer who has supplied the resources of the rulers, has rarely been selected to sit in the councils of State, in consequence of the strangest of all fallacies, that one part of mankind must do the *thinking*, and the other part the *working* operations of life. But the works of ancient authors, as well as modern, including many persons of distinction of our own period, all refute the error, that denies to agriculture the exercise of thought, the abilities of statesmen, or the emotions of the patriot.

Now, however, the causes which once denied the popular favor, have been swept away. The elements of education are within the reach of all in the common schools. Books and newspapers record the discovery of all progress in the arts and sciences, report the doings of men in scientific conventions, and bring the prominent transactions of the moving world into the midst of the family, around its cheerful fireside.

There, in the freedom and protection which a fostering government affords, with the mind at liberty to direct its own courses and establish its own opinions, is the best school-room ever devised by man. There, the readings and conversation, the illustrations growing out of daily practice in factory or field, will prepare the mind for the keenest observation in the outer world, which, after all, will supply a large portion of the knowledge we ever possess. These are peculiarly *our* opportunities. They are common to every age and condition of citizens, and such as were never conferred on any people before.

If, then, we do not make progress in our art, and reach positions mostly occupied by men in what are called *learned professions*, it will no longer be the fault of government. That, thank God, recognizes no distinction in man but in moral worth, ability, and the will to execute. It cherishes our art as the key-stone of the arch; as the source of power and grandeur of the nation. It will not be justly chargeable to men of wealth and education. They extol the art at our annual gatherings, and when in the halls of Congress, cheerfully supply whatever seems to promote its

interests. Most State legislatures are convinced that a liberal encouragement of agricultural pursuits, is more than repaid by increased taxes on the public valuation.

The charge must come directly home to ourselves in the future. While other professions have studied, expérimented and *combined*, in order to excel, the farmer has stood *alone*, plodding in the footsteps of his ancestors, indifferent of success as a cultivator, but complaining of his position in social life. His prejudices have been next to impregnable; rooted as firmly as the oaks in his soil, against innovations of the old routine. When the mechanic proposed to furnish a machine which would cut ten acres of grass in a day, instead of one acre by hand, the project was viewed with indifference or contempt, as a visionary scheme. Our prejudices, however, did not excite us so much as they did some English laborers, as recently as in 1830; a band of whom visited many farms and destroyed all the machinery they found upon them, even down to the most common tools.

These preliminary remarks lead directly to the subject under consideration—

The Utility of Farmers' Clubs.

The first point to which I wish to call attention, is, that the business of the farmer is an *isolated* one. It must have space, and calls him away from populous places. Broadly cultivated fields and extended pastures, with forests and streams are indispensable to his success. On these he must fix his *home*, and provide for the family. This condition of things is imperative. Generally there is no choice about it, as no village and its suburbs would afford room for more than half a dozen farms. Compared with those engaged in mechanic arts, this condition is a solitary one; but still full of compensations. It is one where the young may grow up with simple tastes and virtuous habits; one that seems nearer the Infinite than any other; where His glowing manifestations lead to reflection and study, and where true patriotism is always found. But one, after all, where social influences are needed, to preserve a proper balance in the demands of our nature, for recreation, and the cultivation of the intellect and affections.

A PERMANENT HOME.

Few things tend so constantly, and so much to that calm happiness which we seek, as that of a pleasant, permanent HOME. A home not subject to increasing annual rents and notices to remove.

A home which is the centre of the affections, to which we turn with ever increasing delight, and whose sweet remembrances soothe weariness or sorrow, and inspire us in the battle of life!

Every man should do his best to own a *home*. The first money he can spare ought to be invested in a dwelling where his family can live permanently. Viewed as a matter of economy, this is important, not only because he can ordinarily build cheaper than he can rent, but because of the expense occasioned by a frequent change of residence.

Apart from this, there is something agreeable to our better nature in having a home that we can call our own. It is a form of property that is more than property. It speaks to the heart, and ennobles the possessor. The associations that spring up around it as the birth-place of children,—as the scene of life's holiest emotions—as the sanctuary where the spirit cherishes its purest thoughts, are of all value; and wherever *their* influence is exerted, the moral sensibilities are improved and exalted.

The greatest part of our happiness of to-day is increased by the place where we were happy on yesterday;

“Where all the joys of yesterday,
Were painted on to-morrow.”

And where, insensibly, scenes and circumstances gather up a store of blessedness for the weary hours of the future.

In the country there are fewer amusements than in the city, such as theatres, concerts, public exhibitions and literary and scientific lectures. Families, therefore, have to provide their own means of making home interesting. Instead of being dependent upon others, they must rely on themselves. If they would enjoy social pleasure, it must be of their own creation. They must be society for each other, and their intellectual desires gratified by books or their own united genius. This may not always be an easy task; but it is more within the reach of most families than is generally imagined. On the female members most depends; and even more on daughters, than on mothers. It is in their power to render any situation agreeable. Sadness and melancholy cannot long dwell in rooms echoing with the accents of their glad voices, whether in music or conversation.

Let us see now what can be done by

THE FORCE OF COMBINATION.

Having spoken of the isolated condition of the farmer, where

his labors are apart from the bustle of life, and his recreations comparatively few, and of the *home* whence must spring his internal prosperity ; let us inquire what power there is in *association* to bring that condition up to a fair standard with that of any other class.

All the great enterprises which man has achieved, have been the results of *combination*. Imagine a single man at the mouth of the Hoosac Tunnel, forcing his way seven or eight miles through a mountain of rock ; or one standing at the outskirts of the city of St. Louis, spade in hand, entering upon the construction of the Pacific Railroad ; or, look at another at Port Said, opening the way through a hundred miles of desert sands, to let the waters of the Mediterranean float the ships of the world into the Red Sea ! The task would only be as hopeless as unwise. No great work was ever accomplished in that way. Even the education of the young is gained by a *combination* of varied talent, associated, systematized, and imparted from time to time by preceptors and tutors. At least, such portion of it as comes from organized effort.

Mechanics combine for mutual instruction and protection. Merchants combine to prevent sudden fluctuations in trade, and speculators form a "ring" to triple the premium on gold. Physicians combine to prevent quacks from hurrying us to premature graves. Ministers combine to establish creeds and synods, or ecumenical councils, and manufacturers of every kind tax their powers to devise some mode of performing their work cheaply, in order to increase profits.

Mind needs the attrition of mind. To span a boisterous sea with the Menai bridge, to convey us comfortably through a rough country at the rate of thirty miles an hour, while we eat, converse, or sleep, or to appear in Chesapeake bay with the world-renowned "*Monitor*," when the existence of a nation was at stake, were not the achievements of a day or a year, but the results of a calm and patient investigation of immutable laws, such as the farmer must make into the realms of mystery about him.

In order to secure the advantages to which I have adverted, we must *combine* and *systematize*, and this leads me to speak of

THE ORGANIZATION OF A FARMER'S CLUB.

A constitution may be as follows :

Article 1. This association shall be styled the

Art. 2. Its object shall be to promote the interest of agriculture

and the welfare of the farmer, and to disseminate such knowledge, practical and scientific, as shall conduce to that end.

Art. 3. Its officers shall be a President, Vice President, Secretary and Treasurer, who shall be chosen annually, by ballot.

Art. 4. The President shall preside at all meetings of the Club, with power to preserve order and appoint speakers and committees.

Art. 5. In the absence of the President, all his powers may be exercised by the Vice President.

Art. 6. The Secretary shall keep a record of the proceedings of each meeting, which shall be read by him at the opening of the next meeting. He shall preserve all essays read by members, reports of committees, and conduct whatever correspondence is directed by the Club.

Art. 7. The Treasurer shall keep a correct account of all monies received, shall disburse the same as directed by the Club, and at each annual meeting present a clear and correct statement of the same.

Art. 8. There shall be at each meeting a discussion upon a topic previously announced; a member being appointed to read an essay upon, and two other members to commence the discussion, as leaders.

Art. 9. New members may be elected at any regular meeting of the Club, by signing the constitution and paying the sum of

Art. 10. The annual meeting of the Club shall be holden on of each year, for the election of officers; and all officers so elected shall hold their office one year, or until a new election is made.

An excellent mode of securing topics is by the appointment of a committee in mid-winter, to select and assign them to each member, before its adjourning for the season. In this way, each person has his subject several months before it will come up for discussion, so that it becomes a text, upon which he may *observe, reflect* and *write*.

It will be found convenient to print the subjects, give the names of essayist and leaders, with the date and place of each meeting, and furnish each member with a copy.

Now, then, having such an organization, let us inquire *what advantages may be derived from it*, in a practical point of view?

Annual taxes, physician's bills, groceries, machinery and implements, clothing, school books, carriages, and numerous other

things, demand a certain amount of *cash* every year. In order to meet these demands, the farmer must *buy* and *sell*, and thus becomes a *merchant* as well as farmer.

If he understands nothing of the laws of trade, he is liable to be continually deceived. What will it avail him to know how to raise cattle or sheep of great excellence, or horses, which, in the hands of a skillful dealer, would sell for three or four hundred dollars each, if all were to go for 20 or 30 per cent. below a fair market price?

The successful rearing of stock requires a large experience in the nature of the soils upon which they are to be fed, in the quality of grasses, climatic influences, and the habits of animals. The senses of sight and touch may be educated to a high degree in a certain direction, so that some persons will quite accurately tell the weight of an ox, alive or slaughtered, by carefully observing and handling him. All this knowledge, however, is of little service if he cannot get the true value of the animal when sold.

When the subject of marketing animals is discussed in the Farmers' Club, the technical terms and queer deceptions practised by dishonest men are related, so that the inexperienced market man is forewarned and on his guard. Some gathered knowledge from others, therefore, and some experience in the peculiarities of buying and selling, are indispensable to success, as in the nature of the case the producer must *sell*, and in some degree become a *merchant* as well as farmer.

A case which occurred quite near me singularly illustrates the point which I wish to enforce.

Two neighbors, living on opposite sides of the road, each had one hundred and fifty barrels of apples in the same month of October. They were all of the Baldwin variety, grew on the same kind of soil, and were of the same quality. B. and H. took them to the same market during the same month. H. received \$375 for his, and B. received for his \$525, or one dollar per barrel more than H. received! Upon inquiring of B. how this occurred, he replied, "simply by *knowing how!*" It was done in this way. We take ten barrels at once as a load for one horse. I selected flour barrels of the same height. Some of them had flat and others round hoops. I made them uniform—all flat. The barrels were then washed inside and out, and dried in the sun. The apples were graded into classes one and two, as they were placed in the barrels under the trees, and were not headed up. Then

loaded upon the wagon, and there was no further handling of them. They were then covered with an old white sail cloth, and in this condition taken to market.

On backing up to the curb-stone about sunrise at Quincy Market, a man with a snow white frock on inquired, "Have you apples?" "Yes sir." "Let me look at them. What is the price?" "So much for No. 1, and so much for No. 2." "I will take them all," said he. "But," said B., "I cannot let you have the barrels." "Why not? I will give you as many as I take." "Because they fit my wagon, and are clean." "Very well; then you must help me take them out." B. did so, and on removing them the purchaser found they were equally good in all parts of the barrel. After paying for the load, the buyer asked if he had any more to sell. B. replied, "Yes, a similar load every other morning during the month when the weather is favorable." "Back up here," said the man in the white frock, "and you shall have the market price for all you bring." B. sold the entire one hundred and fifty barrels without waiting a moment for a customer.

I then inquired of B. why his neighbor H. did not pursue the same course that he had. "Ah, he did not *know how*," said B. "He is not a member of the Farmers' Club, and of course did not hear the discussion 'On the *Preparation and Marketing of Fruits and Vegetables*' last winter!" "What course did he take?" I then asked? "Why, he used the first barrels that came to hand, long and short, clean and dirty, flat hoops and round hoops; filled them with apples *without grading*; threw a horse blanket over the barrels, and trotted off to the 'Hub' to find a customer." B. did not learn the process passed through in marketing, but only the result as stated by H. himself, that he received \$375 for his one hundred and fifty barrels of apples. B.'s good nature would not allow him to inform his neighbor that he had received \$150 more than that in the sale of the same number of apples, sold in the same market in the same month, and the fruit of the same quality!

Here, then, was the sum of \$150 lost on the sale of a single article in the short space of thirty days—a sum more than equal to all the money that some farmers in New England receive in the whole course of the year—a sum that would make many a mother's heart glad, if expended in schooling or clothing for children, completing an unfinished room and furnishing it with a lounge, a table and an easy chair for sick and weary hours. How such a sum would cheer the heart of some fair and dutiful daughter, could it

have been appropriated towards the purchase of a piano, for which she had long been yearning and patiently waiting. The interest of two or three thousand dollars lost in the sale of a single product of the farm, by not *knowing how*. This would have purchased two or three good cows, or a pair of steers to take the place of the old oxen just sent to the shambles, or a new horse to take the children to school, the women to church, or the men to market, or mill, or town meeting, in addition to his services on the farm. Following up this loss for each month in the year, would result in an aggregate of *one thousand and eight hundred dollars*, or a sum sufficient to purchase a good farm! and all because he failed to attend a Farmers' Club and learn the *mercantile* part of his business, as well as improvements in the agricultural.

Such losses are frequently occurring among farmers, and sometimes end in deplorable results. One recently occurred where a farmer, not well informed in regard to the value of timber land, sold it at what he supposed to be a fair price; but upon learning that the skillful speculator had more than doubled his money upon it, fell into a despondent state of mind, and is ending his days in an insane asylum.

How important, then, that farmers should frequently come together in systematic form, and not only discuss the best modes of cultivating the soil, but the markets, the demand for certain things for sale in them, and everything else that pertains to their interest.

There is no other place where so much valuable knowledge to them can be gained so cheaply and pleasantly, as in a well organized *Farmers' Club*.

In *draining lands*, a single example will show the importance of a full understanding of this item of farm husbandry. A meadow near farm buildings had been mowed one hundred years in succession, and produced one ton per acre, worth \$10 per ton. It was drained, plowed and slightly manured, at a cost of \$50 per acre. The succeeding year it produced a ton and a half of hay per acre, worth \$16 per ton. The second year it was mowed three times, and produced five tons per acre, worth \$16 per ton.

Product first year, 1½ tons at \$16.....	\$24 00
“ second “ 5 “	80 00
“ fall feed, two years.....	10 00
	\$114 00

Cost of reclaiming.....	50 00
Gain, per acre, in two years.....	\$64 00

The increase of hay in two years paid the cost of reclaiming, and left a balance of \$64. The land continued to produce abundant crops, with a light top dressing, for ten years in succession, and was then plowed, and the tile drains working as well as ever.

The whole process of underdraining may be stated and explained by diagrams, so that the beginner may take hold of the work and prosecute it with success, by a single evening's exercises in a well organized Farmer's Club. Scarcely any improvements in farming have resulted in more obvious benefits, than in draining off from lands their surplus of cold water. The advantages to be gained are too numerous to be stated here, but would form a topic of great interest in some future discussion.

Prejudices against the use of machinery on the farm have been materially modified among us, but still prevent many from availing themselves of the means of averting human labor to that of brute force. The efforts of genius in devising helps in cultivating the soil, are as important as they are in foundries, in cotton, woolen, and a thousand other mills, in sail or steam navigation, in the use of railroads, or to the unnumbered appliances in conducting the sciences and arts. They are *more* important, because agriculture underlies and sustains them all—freights the ships, furnishes the raw material for the mills, and feeds and clothes all who labor in them.

Well informed members of a *Farmers' Club* speak of their experiences in the application of machines to the business of the farm, and thereby enable those who have not purchased to select the best, and thus avoid vexation and loss. One and another will occasionally introduce some new implement or machine, and finding it an actual *helper*, will commend it to others, who will find especial benefits in its use.

Political Distinction.

It has already been stated as a reason why farmers do not hold a fair proportion of political offices, that they have not endeavored to qualify themselves for such places. The door for such distinction is open to all; but he who enters it, must work before he wins.

The farmers' and mechanics' association is the natural stepping-stone to preferment. It must have a presiding officer, who may

learn by application, all the parliamentary rules required in the government of a deliberative assembly. A year's practice here will qualify him for moderator at the town meeting, or chairman of a political convention; and when he enters the legislature, he will not be surprised to find his name among those who are candidates for Speaker. His knowledge of local affairs, and correct administration of public matters, will call him to places of still higher trust and responsibility, until he reaches the goal of a worthy ambition, the highest gift of a free and intelligent people—the proud spot where the lamented Lincoln stood, where Gen. Grant stands now!

The other officers of the association have similar opportunities for improvement, while all learn to express valuable thoughts with ease, in a clear and forcible manner, in extemporaneous discussion, or in the essay form.

This familiar association leads to *thought, reading, careful observation* and *research*. The expressions of one excite expressions in others, and thus new powers of mind are developed, the imagination awakened, and a comprehensive use of language secured.

Let us now inquire—What is the most important knowledge to the farmer? Briefly, it is the same which is important in every other profession—a knowledge of the principles, or the laws of nature. That is, when a boy studies arithmetic at school, the teacher refers him to certain rules which govern the whole proceeding; they express the nature of the subject. Step by step he observes these rules, and thus masters the task before him. This should be the object of all education, to fix principles in the mind of the student which shall enable him to understand the details which are governed by these principles.

The farmer, or the mechanic, cannot be much benefitted, even by a profound knowledge of a *single* science, standing alone. A thousand times more profitable would be a less perfect acquaintance with several sciences. It would be more valuable to him to know something of geology and botany, animal physiology and hydraulics, than how to build the Pacific Railroad or Victoria Bridge, and nothing of these other branches.

It is assumed by some that the science of *chemistry* includes most of the knowledge that is involved in agriculture. By others, that *vegetable physiology*, or a thorough knowledge of the elements of which the vegetable structure is composed, is the most impor-

tant. I cannot assent to any claims of this nature. A man may possess the most accurate chemical knowledge, or that of animal and vegetable physiology, or any other single branch in science or art, and not be a good farmer.

We must commence lower down on the ladder of instruction, and grasp all aids within our reach as we ascend; must learn the use of tools and machines which divert human labor; the names and composition of soils, and the plants adapted to each; the appropriate time for doing certain things, such as seeding grass lands, plowing, pruning, cutting and curing grass and grain crops; learn the habits of animals, upon which prosperity greatly depends; how to plant and cultivate fruit trees, replenish forests, and how to fertilize soils so that, Phoenix like, they shall bloom in perpetual fertility from their own ashes. We must learn to make soils productive by removing cold water from them, so as to admit light, heat, and fertilizing atmospheric agents, and make them porous, rich and active.

We *can* do this—not by the aid which any single science affords, but by a combination of them all.

The farmer ought to understand some of the leading principles of *chemistry*, because the soil which he cultivates is not a mere inactive mass, but a vast laboratory, full of many and strange materials, always in action, warring, combining, changing perpetually, to-day receiving accessions from the heavens, to-morrow pouring them into the wide sea, to be again supplied to other lands. The earth is all but a living creature; and the farmer should surely understand the soil's nature, its elements, its likings and its diseases.

He should read works on the nature and structure of his animals, because he has under his care some of the noblest forms of creation—the horse, the ox, the sheep. If not, can he be a breeder, who has never studied the peculiarities of races? Can he fatten cattle profitably, if he knows nothing of what kind of food is best adapted for this purpose?

He should read, briefly at least, some work treating of the weather, of animals, birds and insects, and freely, works relating to mechanics. Information gained from the latter will be of daily advantage in most operations of the farm.

He will learn from *chemistry* the value and sources of manures which he employs, and that man himself “gets his bones from the rocks and his muscles from the *atmosphere*. The iron in his blood,

and the lime in his teeth, were once in the soil; that these could not be in his body, unless they had previously formed part of his food. And yet, we can neither live on air, nor on stones. It is by means of the vegetable creation alone that we are enabled to convert the mineral into flesh and blood. The only apparent use of plants is to change earth, air and water into substances fitted for the food of animals. The little lichen which, by means of the oxalic acid it secretes, decomposes the rocks to which it clings, and fits their lime for assimilation with higher organisms, is, as it were, but the primitive bone-maker of the world.

‘The granite rocks disorganize,
To feed the hungry mass they bear,
And forest leaves drink daily life
From out the viewless air.’

“By what subtle transmutation inorganic matter is changed into organic, and dead, inert matter quickened with life, we cannot tell. But this we do know, that an express apparatus is required for the process—a special mechanism to convert the ‘*crust*’ of the earth, as it is called, into food for man and beast.

“In Nature everything moves in a circle—perpetually changing, and yet ever returning to the point whence it started. Our bodies are continually decomposing and re-composing—indeed, the very process of breathing is but one of decomposition. As animals live on vegetables, even so is the refuse of the animals the vegetable’s food. The carbonic acid which comes from our lungs, and which is poison for us to inhale, is not only the vital air of plants, but positively their nutriment. With the same wondrous economy that marks all creation, it has been ordained that what is unfitted for the support of the superior organism is of all substances the the best adapted to give strength and vigor to the inferior. That which we excrete as pollution to our system, they secrete as nourishment to theirs. Plants are not only Nature’s scavengers, but Nature’s purifiers. They remove filth from the earth, as well as disinfect the *atmosphere* and fit it to be breathed by a higher order of beings.

“Without the vegetable creation, the animal could never have been, nor be. Plants not only fitted the earth originally for the residence of man and the brute, but to this day they continue to render it habitable by us. For this end their nature has been made the very opposite of ours. The process by which we live is the process by which they are destroyed. That which supports

respiration in us, produces putrefaction in them. What our lungs throw off their lungs absorb; what our bodies reject, their roots imbibe."

Such are a few of the strange and interesting workings of Nature, to which the exercises of a Farmers' Club will lead, and make it an *Educational Institution*.

There is no knowledge useful to any, which would not be serviceable to the farmer—none but will increase his intellectual powers. What, perhaps, may be important to some, is that there is scarcely a physical science, a knowledge of which would not tend to put money into his pocket.

How many valuable lives of cattle, sheep and horses might be saved by a little study in the curative art. How many household conveniences enjoyed, repairs made and bills escaped, by a slight knowledge of the use of carpenters' tools. It is more important for him to understand something of various trades, because he cannot conveniently call in the aid of others to assist him. If farmers, therefore, would become self-instructed in science, art and literature, in a larger degree than they have yet attained, no profession would be more popular, nor more ardently sought for by the progressive of all classes. Instead of young men rushing from the country to the city, the city youths would yearn to be farmers; and instead of the chief emulation being who should save most money, the strife would be who should accumulate most by the profoundest experiments, most successfully carried into practice. By these means, farming would cease to be a "dirty-handed industry." Every operation would become scientific, based on great principles, breeding new thoughts and new results, and ending in valuable acquisitions. Instead of the poet describing the farmer as one who

"Wandered on, unknowing what he sought,
And whistled as he went, for want of thought,"

we should have farmers themselves distinguished authors of valuable works—scientific, at least, if not poetic.

Mr. Emerson says:—"If young men miscarry their first enterprise, they lose all heart. If the young merchant fails, men say he is ruined. If the finest genius studies at one of our colleges, and is not installed in an office within one year afterwards in the city or suburbs of Boston or New York, it seems to his friends and to himself that he is right in being disheartened, and in complaining all the rest of his life. A sturdy lad from New Hamp-

shire or Vermont, who in turn tries all the professions—who teams, farms it, peddles, keeps a school, preaches, edits a paper, goes to Congress, buys a township, etc., in successive years, and always, like a cat, falls on his feet, is worth a dozen of these city dolls. He walks abreast with his days, and feels no shame in studying a profession; for he does not postpone his life, but lives already. He has not one chance, but a hundred chances.”

Let these suggestions encourage the establishment of institutions for mutual improvement by farmers and mechanics. Other classes combine, and why not “Nature’s noblemen” do the same, and share the rich reward? Can any one man, working alone on his farm, learn as much as one hundred men, of similar ability and application? May not each discover some practical and important fact, and should not his neighbors know it? A farmer must be slothful indeed, if during a year he has not learned *one* new fact in relation to agriculture, or in the arts; and should a hundred neighbors meet, then each will learn ninety-nine new facts for the one communicated by himself.

Boys on the Farm.

I have spoken of the depreciation of population in the country towns. There is a reason for this. What is it? The *cause* and the *remedy* may become an interesting subject of inquiry in your Association. If you secure a remedy, you will greatly advance the cause of agriculture and the mechanic arts, perpetuate our institutions, and give a new power to the nation.

Several causes combine to call young men away from the farm. The idea that farming is “dirty drudgery” has been thoroughly instilled into them by the popular voice. In too many instances the one supposed to be the brightest is selected for the store, bank or college, and money expended upon him, a portion of which might have given all fair opportunity for a practical education. Young persons in villages or cities, they say, are better clad, have more amusements, more association with each other, better opportunities for acquiring polite manners, the art of conversation, and other graces which adorn good society.

By obtaining situations in stores or counting-rooms, boys think they are raising themselves to distinction, in the minds of society. And society *has taught* them to think it more honorable to wear fine cloth and have soft and delicate hands. Many of the causes, then, for absenteeism may be fairly attributed to farmers them-

selves. I dwelt, purposely, on what the farmer's *home* ought to be, in order to show that boys and girls would look upon such a home as affording more privileges than most others, and that around such an old family hearth-stone, would be the most desirable spot on earth. And when the suggestions I have foreshadowed exist, the occupation and the place *will* become so. *Home* must be made attractive to the young, not alone by affording opportunities for social intercourse and amusements, but also by such comforts and tasteful decorations of the dwelling, as means will permit. As a general thing, the rooms of the mechanic, although in a hired house and subject to removals, are better provided with carpets, easy chairs, books, pictures and other cheap, but appropriate and suggestive ornaments, than those of the farmer. The contrast is quite as decided in the articles of dress. If you want boys and girls to hang their heads, dress them meanly. If to walk erect among their peers, let their costume resemble that of their peers; not extravagant in cost, nor extreme in fashion, but becoming their age and condition. It will not do for the farmer to say that this cannot be afforded, because probate records show that he leaves more property than any other class, of an equal number, taken promiscuously. It would be a sound argument to say that much of his property is invested in real estate, and not available for such purposes; but still would not much affect the proposition.

When these advantages are enjoyed, contentment will take the place of brooding restlessness, and an ambition be excited for intellectual pursuits. The young will come into your association with a freshness and zeal inspiring all with new energy. With heart expanding under agreeable surrounding influences, they will be all *thought*, all action. They will learn that the natural world has treasures beyond their imagination; wonders that have never been explored; system and perfection, most lovely and sublime, all their own, scattering their matchless perfections as dew-drops on their paths.

Furnish, then, to the young, those things which their nature demands. Gather around them as many refinements of life, as other callings of equal means present, and they will rarely fail to remain on the homestead to comfort and sustain the declining years of the aged, or to cultivate their intellectual powers, and qualify themselves for any station to which they may be called.

A boy or girl of moderate ambition will not long rest contentedly

to live in the kitchen, where the associations of his daily toil are never removed. Nothing but stern necessity should force the family to live in the same room where the cooking and domestic work of the family are done. There should be a living-room away from the steam of pots and kettles, and consecrated to rest, to social enjoyment and mental cultivation. The ruin of many a youth begins in the want of such a room in the farmer's home, or in the fact that it is seldom used. Children have social natures, and if they are not provided for at home, they will seek them abroad.

It was once a common practice for the farmer to return to the kitchen fireside at night, and after eating a hearty supper, sit the long winter evening with the same boots, hat and coat on, which he had worn through the day, dozing and sleeping at intervals, without much thought, reading or conversation. Such was the example. No wonder that children strayed away from home.

All progress in our art and in mental culture, must spring from *labor*; from a judicious employment of both head and hands. Labor is a scriptural injunction. According to Paul, "We are laborers together with God;" and that if any would not work, neither should they eat. All honor and distinction to the laborer; to the worker, who, with head or hands, causes a single blade of grass to grow, or flower to bloom in fragrant beauty; as well as to him or *her* who transfer the toil of many hands to a single machine, or discovers new planets moving in their sublime courses. If I were called upon to give a toast at the Mechanics' Association or Farmers' Club, it should be to practical, profitable labor.

"Here's to the man with horny hand,
Who tugs at the breathing bellows;
Where anvils ring in every land,
He's loved by all good fellows.

And here's to him who goes afield,
And through the glebe is plowing,
Or, with stout arms the axe doth wield,
While ancient oaks are bowing.

Here's to the delver in the mine,
The sailor on the ocean,
With those of every craft and line,
Who work with true devotion.

Our love for her who toils in gloom,
Where cranks and wheels are clanking;
Bereft is she of nature's bloom,
Yet God in patience thanking.

Oh, shame for him who sneers at toil,
 And shuns *his* share of labor ;
 The knave but robs his native soil,
 While leaning on his neighbor.

Here may this truth be brought on earth,
 Grow more and more in favor ;
 There *is* no wealth but owes its birth
 To handicraft and labor.

Then pledge the founders of our wealth—
 The builders of our Nation ;
 We know their worth, and now their health
 We sing with acclamation.”

And now, my patient hearers, let me turn in closing, to a single point intimately connected with your prosperity, and transcending in importance any single topic yet considered—the women of New England.

It is said by careful observers and teachers of experience, that the largest portion of the education of our people is acquired before they arrive at the age of twelve years. If this be so, *women* are not only co-laborers with men in sustaining life and its amenities, but they are the prime educators of the children who are to make the future laws of the nation, fight its battles, continue its homes, and keep untarnished its renown.

In order to afford such opportunities as is required for this great work, some essential changes ought to take place in the customs of society. Women must have more leisure hours ; better opportunities for travel and observation, and more time for reading and reflection.

On the farm the wearisome details of household duties cannot be averted, but many things may be introduced to modify them, if not to illumine and render them agreeable. Most women are of a hopeful temperament ; so long as there is *progress*, they press on with wonderful resolution and faith. They can do anything and everything well. Perceptive and executive, of quick sight and steady hand, they know what is wanting, and supply the deficiency with a tact and cleverness peculiar to themselves. They quickly comprehend the capabilities of persons as well as of things. They are patient, energetic, and seldom disappointed into inaction. Though obliged to teach the same thing over and over again, they never weary of their vocation of arranging and ordering, and never less than hopeful of favorable results. These traits are common in every home where *progress* is the talismanic word.

The changes, then, in farm life, which I have briefly indicated, *must take place* before the farmer's home will possess the attractions which it ought to present.

An Italian statesman once said, in argument among his peers, "We govern Rome, but our wives govern us." This may be as truly said here as in Italy.

Some persons have attempted to impress the minds of women with the idea that her sphere is in the direction of domestic duties alone. But this idea she has refuted in all ages. What man has accomplished physically or mentally, she has and can accomplish. Her position was undoubtedly designed by the creator to be one of comparative retirement. But when the way is opened for the exercise of her powers, the world has never witnessed examples of sterner heroism on the field of battle, or more tender solicitude and untiring devotion to the sick and wounded, than in the late rebellion. No example is recorded of such consummate skill in furnishing aid and comfort to the soldiers in the field. Our armies were in considerable measure sustained by the unnumbered tons of clothing, medicines, condiments, and what was of equal value, the letters of consolation and encouragement, which fired the heart of the soldier with fresh emotions of love of country. To these may be added the wonderful skill displayed in devising amusements for sick and broken soldiers in hospitals. A love almost surpassing a mother's was breathed in a thousand daily letters, or wrought into amusing stories over which the weak and crippled might forget the tedium of hospital life.

"Many a woman pines because she has no great object before her. She feels no strong current sweeping through her veins, impelling forward some mighty work that shall be seen and admired by others. She sees her husband go forth to some kind of stirring enterprise; he meets his fellows and they bow to his power; his genius finds applause, and his labors reward, while she discharges her domestic duties in retirement. But his is child's play compared with the grandeur of the task which lies before her. And if her labors meet with no well-coined currency in exchange, it is because the world has none in which its value can be estimated. Let no woman sink down in despondency and say, 'My labors all go for nothing in this great scale of human efforts.' They are too great for mortal computation, and hence unestimated, rather than overlooked."

Opportunity is all that is needed, in order to gain distinction. This has been verified in numberless instances. Women have distinguished themselves in sculpture, in painting, in astronomy, in poetry, in general literature, and in the most heroic devotion to vital principles. When financial skill is required, they often manage business with singular ability. The fortunes of the husband are often in the hands of his wife, inasmuch as his own power of exertion depends greatly on her. His moral strength is inconceivably increased by her sympathy, her counsel, her aid.

The influence of women is also an item of importance in the political affairs of the State and Nation. It is quiet, steals over us imperceptibly, perhaps, but moulds many rash opinions into channels more safe and just.

A late writer says: "It is not presumptuous to believe that if Henrietta, the wife of Charles I., had been born a Huguenot, instead of the daughter of a Catholic king, the civil wars, the Commonwealth, and the Protectorate of England, would never have been." The same Henrietta was the mother of James II., whose devotion to the Catholic church caused his expulsion from the throne, and the revolution which seated William and Mary upon it. Henrietta, therefore, may be said, in a certain sense, to have changed the course of modern English history, and affected thereby the destiny of the world. Who shall say that women wield no political power?

Having spoken of some of the leading topics which seemed appropriate to advance your own views, I beg in closing to say that the surest safeguards of our institutions are with us. Our agricultural blessings are too numerous, too diversified, and too closely connected with civil and individual liberty, ever to be surrendered at the call of faction, or sacrificed upon the altar of party.

Our pursuit is eminently religious in all its bearings, for no man with ordinary perceptions can walk through fields luxuriant in verdure, through forests in which autumnal hues of every shade are so richly and beautifully blended—watch the swelling bud, the waving corn, and golden harvest, and not feel the conviction strong upon him, that there is over man a Superintending Providence of love, and wisdom, and power.

Our profession is also the best school of thought, for it tends to relieve nearly every want to which human nature is subject; ele-

vates man by daily communion with the fairest works of God's creation, and its intervals of repose are intervals of health and security.

It is also the loftiest school of patriotism. Our homes, our fire-sides and our fields are connected to us by ties of love, so sacred and so strong that no invader will ever reach them.

On motion of Mr. WILLIAMS, of Kennebec, a vote of thanks was passed to Gov. BROWN, and the Convention adjourned to Thursday, at 10 o'clock.

THURSDAY, January 20, 1870.

The Board met at 10 o'clock, and was called to order by Vice President THING, who introduced as the first speaker, CALVIN CHAMBERLAIN, Esq., of Foxcroft.

OUR HOMES; WHERE AND WHAT TO MAKE THEM.

BY CALVIN CHAMBERLAIN.*

In my short experience with these schools for general improvement,—Farmers' Clubs—a fact is disclosed, that their working force in many cases, comes through members whose daily labor and thought is not expended on the farm, but in other pursuits equally honorable and necessary in society; and from those who are usually seen as our most successful horticulturists.

The Board of Agriculture of this State is organized under instructions "to investigate all such subjects relating to agriculture, horticulture and the arts connected therewith in this state, as they may think proper." Taking this broad view of pursuits somewhat diversified—for there are many arts and interests "connected therewith"—it is proper at some time to discuss subjects in which all citizens have a common interest, beside that of agriculture proper. Having had a somewhat extended connection with that Board, and in the discharge of duties pertaining to that connection, I have been led to take comprehensive views of industrial pursuits, so far as I have been able, and at times have tried to discuss some matters of general application. With a design of this sort, I bring you this evening some thoughts on

Our Homes; Where and What to Make Them.

* The address as here given is from copy furnished by the lecturer, who desires to say, that subsequent to delivery at Lewiston it received a little modification for use before several Farmers' Clubs, as well as an addition, as will be noticed, near its close.

Home is a word of deep meaning, potent to awaken the good within us. Spoken to the ear of the young person when first cast among strangers, it quickens the sensibility to a degree that no other word in the language can do, save one.

The home—the domicil, as we are accustomed to see it—is a thing of great and grave significance. I have thought it strange that some highly gifted and cultured intellect, who moves the masses with the tongue, has not made the word a text for the finest play upon words that ever held an American audience. The professional lecturer has left it to us to be treated in our own way.

I come before you as one somewhat familiar with rural life and its industries, and can only speak to you understandingly who are in the same walks.

When we wish to hear what is adapted to our needs, and for our own interest, it is manifest in reason, and it is our experience, that we must look to those whose chief education and interests are in our own pursuits. We must seek our own counsels, and do much of our own talking.

American homes, as we see them, are the outgrowth, the exponents of the civilization in the current of whose onward flow we find ourselves cast. “This civilization has been a plant of slow growth, originating under peculiar conditions of soil and climate, and propagated only over such portions of the earth’s surface as afforded similar conditions.” This civilization is what is called, in the forcible language of H. T. Buckle, “the European epoch of the human mind.” It depends in its effects upon the relation between the climate and the laborer; and its progress is through the energy of man, which may be unlimited. There is another kind of civilization, springing up in fertile districts within the tropics, flourishing for a time and to a degree, which derives its force from the bounties of nature. It had an existence in favored spots long anterior to our historic period; and has flourished in southern China, in India, Egypt, Peru and Mexico. To understand something of this growth—this European civilization—and the laws which govern it, to comprehend in some degree the causes through which has grown the degree of human culture and improved condition of which we partake, we may well spend a few minutes in looking along the lines of its progress.

“Every living organism, whether animal or vegetable, has a certain geographical range, which is determined by the conditions

of soil and climate." Within a particular zone, these living forms attain their full development, but deteriorate when transferred to a different zone. Man is not an exception to this law. It is seen that only on a limited portion of the earth's surface has man developed to the full extent his physical and intellectual vigor. Naturally the weakest and most defenceless of the mammalia, during his long infancy his food must be artificially prepared and his body artificially clothed. Below the other animals in keenness of vision, in rapidity of movement, in strength, and in the acuteness of most of the senses, yet being endowed with reason, by its exercise he can make up for all these deficiencies, can repel or subdue all other animals, and make them subservient to his uses. "He can clothe himself to endure the rigor of an arctic winter, and can shield himself from the burning rays of a tropical sun; he can lay up a stock of provisions in one quarter of the globe to be consumed in another;" and at this day the intellectual man, through his intimate commercial relations, commands the luxuries of every climate. "Other animals live in the immediate vicinity of the region which affords them the means of subsistence, and hence their migrations are determined by this cause."

While, therefore, the range of man is greater than that of any other organism, whether vegetable or animal, yet, outside of certain lines of temperature, that range is at the expense of his physical and mental powers. At one extreme he becomes effeminate and incapable of vigorous and prolonged exertion; at the other he becomes dwarfed in stature, and so unremitting are the exertions required to procure the means of sustenance, that the animal propensities are developed at the expense of the intellectual, and his instincts become little exalted above those of the beasts of prey. In the region embracing the happy mean, where the climate is such as to invigorate the system, and nature is so far genial as to require the appropriation of a part of his time only to secure the means of support, leaving a portion to be devoted to the cultivation of the intellect, man attains his full physical and intellectual development; and here is seen that system of artificial wants and refinements which is peculiarly the offspring of a high civilization.

This favored region is traced on the Eastern Hemisphere by the isotherms of forty degrees and seventy degrees of mean temperature. In this zone has originated almost every name associated with greatness. Outside of this zone a very different social econ-

omy prevails, attributable to no other cause than that of climate. "Even those nations occupying its borders have not the methodical industry, the persevering application, or the business capacity of those who occupy a central position in it." *Buckle*, in his "History of Civilization" says: "Climate influences labor not only by enervating the laborer, or invigorating him, but also by the effect which it produces on the regularity of his habits. Thus we find that no people living in a very northern latitude, have ever possessed that steady and unflinching industry for which the inhabitants of the temperate regions are remarkable. The reason for this becomes clear, when we remember that in the more northern countries the severity of the weather, and, in some seasons, the deficiency of light render it impossible for the people to continue their out-of-door employments. The result is that the working classes, being compelled to cease from their ordinary pursuits, are rendered more prone to desultory habits; the chain of their industry is broken, and they lose the impetus which long-continued and uninterrupted practice never fails to give. Hence there arises a national character more fitful and capricious than that possessed by a people whose climate permits the regular exercise of their ordinary industry.

Indeed, so powerful is this principle, that we may perceive its operations even under the most opposite circumstances. It would be difficult to conceive a greater difference in governments, laws, religion and manners, than that which distinguishes Sweden and Norway on the one hand, from Spain and Portugal on the other. But these four countries have one great point in common. In all of them continued agricultural industry is impracticable. In the two southern countries labor is interrupted by the heat, by the dryness of the weather, and by the consequent state of the soil. In the northern countries the same effect is produced by the severity of the winter and the shortness of the days. The consequence is that these four countries, though so different in other respects, are all remarkable for a certain instability and fickleness of character; presenting a striking contrast to the more regular and settled habits which are established in countries where climate subjects the working classes to fewer interruptions, and imposes on them the necessity of a more constant and unremitting employment."

When we trace the isotherms of forty degrees and seventy degrees across the North American continent, the same diversity in

the habits of the people and their business pursuits will be found. The line of forty degrees mean temperature is near Quebec, and the line of seventy degrees crosses Florida. Without tracing the social organization of British America north of the isotherm of 40°, or that of the Southern States, it is sufficient that we give our attention to the central portion of this belt, embracing the Eastern, Middle and Western States, and westward to the Pacific.

Here the industry of the people is methodical, their habits provident, ever ready to adopt and improve upon the practical arts of life. Such is the spirit manifested in accumulated wealth, in inventive capacity, in labor saving machinery, and in associated capital to carry out the most colossal schemes. This belt receives the bulk of immigration from the Old World, which now counts a third of a million each year. The climate and soil of this portion of America is very similar to the region of the Black Sea, where it is supposed the Caucasian race had its origin. If that region could produce a race with moral feelings and intellectual powers, within a physical structure of beauty and perfection, superior to that of any other spot on earth, surely here that superior specimen of manhood ought to thrive and maintain unimpaired his original organization.

When the crowded state of Europe projected its surplus of people upon this continent, some trifling circumstances directed the Celtic* branch of the Caucasian family to the southward, which left this rugged belt, a century later, open to the Teutonic branch of the same family—the only people possessing the qualities equal to the task of changing so vast a forest into fruitful fields.

Nowhere else in the temperate zone has there existed, in the historic period, so extensive and dense a forest as occupied this country from Maine to Florida, and westward to the land of prairies. And probably nowhere else, in a period of two centuries, has man accomplished a task in one kind of labor, so vast in its magnitude, so important and far-reaching in its effects, and bearing with such directness and force upon the destinies of civilized man, as the removal of these forests. The task may now be considered as accomplished. The great obstacle that our fathers encountered is removed. The existing slender remnant certainly is no clog to the nation's prosperity.

The young women of to-day can gain but a faint idea of the

* One writer on ethnology gives this "Kelt," "Kelts."

numbers of smutty shirts that passed through their grandmothers' wash-tubs while these forests were being consumed by fire, before the advent of washing-machines and wringers. Some of us, old men, from the newer portions of this State, have borne our full share of that smut.

Many a man who has hewn out a farm from the wilderness in Maine, when the task of burning away the wood is done, and before he is well settled down to the bottom clearing—draining the swamps and removing the stones—has found his farm rapidly decline in its products. He finds himself in a precarious position. Something akin to this is the present position of our whole country.

But little is known here yet, practically, of that methodical and wisely-directed industry which in some of the old countries is causing a still increasing amount of product, on fields that have been tilled for thousands of years. Our people find themselves possessed of a country vast in resources, but imperfectly developed. Seeing on every side avenues opening to the exertion of human energy and skill, they are restless, eager for gain, and bound by few local attachments. They subdue farms and erect buildings with reference to their market value, when they are ready to migrate. They plant few trees, because too much time elapses before they attain their growth. If appealed to, that their acts will be commended by posterity, they are ready with an answer in the spirit of the language used by the English statesman, "Confound posterity! What has it ever done for us?"

I have so far in this effort aimed to lead you along with me to my present stand-point, where I see a degree of sameness in the physical aspect of our country, from the Atlantic coast to Kansas—bleak hills and unsheltered plains, swept by continental winds that freeze us in winter, and too rapidly bear from us the life-giving moisture in summer.

It is right for us to examine all that is roughness and deformity in the country that embraces *our homes*. If we cannot be at peace in contact with its character as it is, it is the part of wisdom in us to seek a remedy. The zone of earth is narrow, as we have seen, that produces the men who govern the world.

If we tire of winter and abandon the situation to enter upon a life of dreamy repose under tropical shades, we surrender our interest in the future progress of man as he tends to a still higher type. If we migrate on a line of latitude in search of the ideal,

we all the way find people more restless and unsettled than ourselves. In proof of this, a western man, (Samuel P. Boardman, of Lincoln, Ill., since deceased,) says, "Did you ever think that it is not the east that emigrates and settles the west, but the west settling the west? Where one New England Yankee picks up his traps and puts out for the far west, a hundred Buckeyes and Hoosiers and suckers will put out some bright morning before their nearest neighbors have learned that the 'notion' has 'tuck 'em.' Moving, to a western man, seems like a small affair; and having already 'improved' one western farm, on moving to a still newer country, they unload their wagon, start a shanty, set a breaking-plow to running, and have a team started to the nearest timber for poles for a 'Shanghai fence' before the New Englander has got done meditating on his courage in pushing off from home and friends into a western wilderness. However, 'use doth breed a habit in man,' and the *Suckers* say that some Hoosiers move into Illinois and back to Indiana so frequently that they can borrow meal anywhere on the road, to be paid when they move back again. That story with regard to their chickens coming up and crossing their legs to be tied whenever they see the wagon sheet bent on, I can't wholly believe."

We should examine critically, to see if the seeming ills that oppress us may not be so far overcome or modified as to render life reasonably useful and comfortable without so much turmoil and constant change of place as we see.

We inherit from our European ancestry, and imbibe from European literature, certain ideals of home felicity. We now have our own national ideals. In the rural districts it is made up of hill and valley; it is woodland, pasture, meadow and field; pure springs gush out in shaded places, furnishing perennial water to the trout-stream that we knew so well; the farm house and ample barns, protected by forest-groves and fruit-bearing orchards, from winter winds and summer heats; clumps of trees to which cattle resort for shelter; with a conspicuous feature in the landscape of the church and school-house, a sign and symbol of morality and intelligence.

Such an ideal is here realized; and to many of us in our early years was thrown in the additional enjoyment of an occasional ramble in deep forests, boating on secluded lakes, and climbing mountains for the luscious wild fruits of the season.

To those who live in town or village, the outward ideal of the felicitous home is somewhat varied, with the features narrowed in limit, but embracing the shaded street and the well stocked and well kept garden. All these have their influence on mind and character.

Men in cities who toil for wealth, have their incentive in their ideal of home—many of them of country life, meaning to realize it when the city task is done.

My friend in New York lives over the country pleasures of his boyhood. Being of a mechanical turn, he brings out the model of his country house that is to be, and dissects it to show me the conveniences of its parts. If its exhibition does not essentially contribute to the wayside knowledge gained in my city visit, it does *him* good. He is growing old in his toil for those he loves; and the only country house he will ever enjoy as his own, is his ideal and its miniature that he exhibits.

City bred men, when the desire for country possessions takes them, shape their demands by the mode of advertising farms for sale. Some of the good points required in a farm of fifty acres are these:—land smooth, free from stones, rich, gently undulating, giving fine views, easy to till, good buildings, healthy location, convenient to schools, churches, mills, railroads, steamboats and the world generally, good society, plenty of choice fruits, good water, no incumbrances, and the price very low. They expect to find a plenty of such places any day. There is just a spice of presumption in such expectations; yet advertisements still read, “suitably divided into tillage, meadow, pasture, &c.,” not taking much account of a systematic rotation. There would be better sense in describing the house as being suitably divided into cooking, eating and sleeping quarters.

Ideals of stable homes and domestic comforts seem at present not to be the ruling passion. This is rather an era of stupendous movements of human enterprise and energy. The railway across this continent and the two others projected; the ship canal across the Isthmus of Suez; the telegraph cables uniting Europe and America, and others to be laid to make the islands of the ocean telegraphic stations; the Isthmus of Darien to be cut by a ship canal; whole nations engaged in migratory movements, seemingly breaking up to re-form themselves under more favoring conditions; the spirit of emigration agitating different peoples under different

circumstances, whirling them off to localities thousands of miles away.

Is all this to be viewed as an accident in the economy of nations? If *design*, it is a stupendous one, planned ages back among a complication of causes, and projecting itself far forward to connect itself with other events, it may be, of more importance to the race than any that this age has seen.

We here in Maine have always been active partners in this depleting business, moving west; and I have concluded it is time the partnership was closed. I believe we can now afford to stand by Maine as she is, till we can transform her into our ideal of what she should be. Let the stream of restless humanity go past us; their task to carve out their homes at the west will be harder than ours.

I have looked over the whole domain as carefully and impartially as I am able without a personal inspection of its several acres, and I am here to report my observations in a general way as bearing upon the question, "where shall we make our homes?"

(I feel a degree of embarrassment in attempting to present this subject in a digested connection, in so much as I had occasion last winter to deal with the matters of the physical geography of the country, its climate, forests, &c., in a Memorial to the Legislature of this State; and as that paper is now in print, I desire here to avoid a repetition of any of its positions.)

The influence of man in changing the physical condition of a country, has passed into an axiom, requiring no further argument. Withdraw man, and the principal disturber of all law is removed. Where his acts have injuriously disturbed the harmonies of nature, his first duty is in the direction of the restoration of that harmony. Connected with the knowledge that our acts affect climate in an appreciable degree, is the further knowledge that we can become the architects of our own abiding place; and that the character of our selected home may be fashioned upon, as our material habitation, and improved beyond the impress of nature so as favorably to affect our physical, moral and intellectual being.

If a place could be found in the zone to which we are adapted, where nature in her bountiful provisions had left nothing out to be desired, where roving, restless, migratory man had nothing to do but enter into possession, and dispose himself in a manner most favorable to the nursing of the little spark of a thing called laziness that may unfortunately have been dropped into

his composition, it might not take long, with the use of the telegraph, to gather to it a sufficient number to people a considerable neighborhood. Sufficient exploration has been made for such an Eden, with a result satisfying us that any spot so favored, with a location towards the setting sun, is as great a myth as anything we read of.

I have said that we now see a degree of sameness in the physical aspect of the country from the Atlantic to the plains beyond the Mississippi. This is true in degree, and as affecting climate, as the forests are being removed, leaving little more than the configuration of the naked land to break the sweep of the winds, cold and dry, as is their prevailing continental character.

In comparing the climate of the Atlantic slope with that of the great central valley of our country, where it assumes the character of treeless plains, it is found that the summers become warmer there, and the winters cooler.* Great as are the extremes on the coast, they become greater on the prairies, thus showing the effects of the earth's radiation over vast surfaces remote from internal seas, and deprived of forest-belts.

“The presence of the ocean tends to mitigate the excessive temperature of the Atlantic slope, and the same effect is attributed to the presence of the forests which clothe the crest and the slopes of the Alleghanies. The great lakes exercise a similar influence over the adjacent region.”

Hence we see the isotherms of spring and summer, when traced from a point on the coast, as New York, pursue a uniform westerly direction until past the western shore of Lake Michigan, when they take an abrupt curve to the northwest. The isotherms for the fall and winter, as they relate to the upper Mississippi region, are depressed to the southward. Thus at St. Paul the summer temperature agrees with that at West Point, and the winter with that of Montreal.

Having on a previous occasion considered the forests of our country in their intrinsic value as wood and timber, as well as their conserving influence on climate, there still remains so many specific claims of the trees for our protection, and for our ever increasing regard, that my present purpose is not half accomplished if I fail to present some points convincing to *some* minds, that home in a treeless region, if endurable to a Spaniard, can never satisfy such a people as we are, and ought never to do so.

* J. W. Foster, LL. D., Chicago, 1869.

Among the many properties of trees, that of their influence upon the electrical state of the atmosphere, should not be overlooked in this country. Hailstorms are always accompanied by electrical disturbance, and may be produced by a specific electrical action; and the belief is, in all countries particularly exposed to that scourge, they have become more frequent and destructive in proportion as the forests have been cleared.

It is written, "when the chains of the Alps and the Appenines had not yet been stripped of their magnificent crown of woods, the hail, which now desolates the fertile plains of Lombardy, was much less frequent; but since the general prostration of the forest, these tempests are laying waste even the mountain soils, whose older inhabitants scarcely knew this plague."†

In some seasons tornadoes are of common occurrence, sweeping over the prairies of Illinois, involving the crops and the buildings in a common destruction.

It is hoped that our people will awake to a sense that we are on the swift road to dire evils consequent to reckless waste; and such facts as stand in proof of our imminent peril should be kept constantly in sight, till such a course of practice attains as shall here secure a country improved beyond any that the combined forces of nature and art have yet revealed. Timber trees have been cut on the Pacific coast so as already to materially lessen the amount of rain-fall.

The ingenuity of Maine lumbermen is employed in cutting the hitherto inaccessible pines on the Alleghanies, and to operate through the entire pine groves of the north-west. We see it stated that the annual receipts of white pine lumber at Chicago alone are in excess of one thousand million feet; and the same authority claims, as based on careful explorations, that the extensive pineries of Michigan and Wisconsin will be exhausted in the next twenty years.*

The valuable lumber trees of this variety in Maine, in accessible positions, cannot last much longer. A western writer on the rapid destruction of the forests in the United States says: "The products of the lake pineries are distributed over nearly half a continent. From them are built the farm houses of the pioneers

* "The Mississippi Valley," a work almost exhaustive in its presentation of the physical geography of our country, its topography, botany, climate, geology and mineral resources, and of the progress of its development. By J. W. FOSTER, LL. D. Chicago, 1869. † Caimi.

upon the prairie, and the bridges that span the waters of the Kansas and the Platte. The destruction of hard wood timber is going on at a pace equally rapid. Nothing strikes the emigrant from the Atlantic slope, on returning after years of absence, so forcibly as to see those hills which in his youth were forest-crowned, now bare and desolate, and the streams in which he was accustomed to fish, dwindled to mere trickling rills." Another generation will need a greater supply than can be furnished by the forests left to it by the present, especially in the vast woodless regions of the west.

Our whole country is destined soon to feel a scarcity of wood and timber; and this want will first, and with greater force, fall upon that portion which originally possessed the least. Those states and territories which have received a large share of the emigrants from the Eastern States, must have recourse to extensive tree planting for timber-growth, as well as for the local protection that timber belts will afford to orchards, dwellings, barns and stock, from the fury of cold winds.

Everybody has a general notion of the thermal effects of trees as arresters of cold winds; yet there has been a singular neglect to make observations and put them on record, to establish its degree; and, indeed, I have not seen a reported case till quite recently.

Mr. John H. Tice, of St. Louis, says: "My neighbor, Mr. Henry Shaw,* at his Botanical Garden, has a dense hedge of Scotch fir about a thousand feet long and fifteen feet high, extending north and south. One bitter cold day, when the wind was blowing from the west at about twenty miles an hour, curiosity induced me to make some thermometrical observations along the exposed and sheltered sides of the hedge. The day was cloudy, and the time between two and three o'clock, so that if there was any solar influence it was on the west side of the hedge. On the west side the thermometer indicated 9°; on the east side, partially hung in the hedge, 15°. Passing eastward, with a considerable ascent of the ground, the mercury gradually sunk, and at about ninety feet east of the hedge it stood 11°. A trial at different stations on both sides of the hedge gave the same average results."

* The name of Henry Shaw stands deservedly by the side of that of George Peabody as a public benefactor, he having donated a large, highly improved and valuable tract of land to the city of St. Louis, for the purpose of a public park.

A great storm occurred in January, 1864, moving from west to east on the same parallel of latitude. At Kansas City, where it struck the timbered land after traversing the plains from the Rocky Mountains, the temperature observed was about 29° below zero; in St. Louis county it was 22° below; at Cincinnati 12° below; at Portsmouth, Ohio, at zero only, showing that it had warmed up 29°.

Storms from the west, northwest or north are observed to be five degrees warmer at St. Louis than at Kansas City. This difference is attributed to the fact that no storm can reach St. Louis without passing through a more or less densely timbered district for one hundred and fifty to two hundred miles; while it reaches Kansas from any of these points through an almost treeless region. Observations have been made in Iowa, and at Chicago, with results corresponding with those noted by Mr. Tice at St. Louis. The beneficial effects of tree shelter in winter, as seen at the west, will probably be found in like degree here in Maine. In summer, trees exert a greater influence in the economy of nature than is seen in their winter effect. It comes within my plan to notice some of these effects; but to do so in simplest brevity will be unsatisfactory to you and to me, and fail to do justice to the trees.

On an occasion like this, if anywhere outside of a purely scientific effort, we may be allowed to pause, and to offer reverence to the divine spirit of life, as manifest in plants. While we deal with the practical subject of locating and constructing *a home*, the whole matter of vegetable life so presses upon us, so enters into all our estimates and balances, so far over-reaches other considerations, that our choice of location is well nigh made from these intelligible indices of soil and climate.

The phenomena of existence in the vegetable world, though in our present condition concealed from us in its *essence*, are cognizable by our senses in that which it produces, and that from which this product is brought forth. We feel the rushing of the vital current in the joy which pervades our being when in spring it bursts the buds and covers the earth with showers of blossoms, and when in summer and autumn it presents to the husbandman the seeds and the fruits. The plant, whether it fulfils its appointed task in one brief summer, or not until after centuries of life, is equally the subject of our regard.

The inquirer has advanced by two paths up to a certain point, near the mysterious laboratory of vegetable life; first, by obser-

vation, gaining a very accurate knowledge of the structure of plants; second, that of chemical experiment, by which the constituent elements of plants, their means of sustenance, and some *transformations* of their *substance* occurring during growth, have been ascertained.

“From the results arrived at by these researches, a special science, called Vegetable Physiology, or the knowledge of the vital phenomena, conditions and laws of plants, has been attained, and of this science *Agricultural Chemistry* constitutes a principal division.”*

Among the problems connected with practical agriculture which this science has to solve, that relating to the nourishment of plants is most important. For if the farmer knew what nutrients would best promote the growth of his plants, in what form, quantity, and at what period they must be applied, to best results,—if he were acquainted with the sources of their cheapest supply, “he would be able to make the most extensive, diversified, and profitable application of this information in his calling.” But science is not matured to furnish all this with certainty.

In the case of animals, by our senses we are able to perceive what they take as food, and how they take it; not so with plants. We know that soil, moisture, air, warmth and light, are necessary to the growth of plants, but as the soil, the water, and the air contain very dissimilar elements, the essential point is to find which of these separate elements are received by the plants as nourishment. Here arises a necessity for an exact knowledge of the chemical elements of the plant itself, as well as of the soil, of water, and of the air.

The first question then is, of what do plants consist? As the main pillar of their structure, as well as that of all living creatures upon the earth, four elements particularly claim our notice. They are called, oxygen, hydrogen, carbon and nitrogen. These receive a general name of *organic constituents*; also called *combustible* elementary substances; and sometimes take the name of *atmospheric* elementary substances, because they are contained in atmospheric air. But I do not propose to be led so far from the direct line of my subject as to attempt to show our daily dependence on the whole vegetable kingdom; but rather to speak of that class of plants called trees; and these are more nearly composed of the three elements, carbon, hydrogen, and oxygen, which three simple elements make up about 90 per cent. of their structure.

* Dr. J. A. Stoeckhardt.

Plants obtain these, their constituent elements, by absorption through the pores of their roots and leaves. Hence, everything which can contribute to their nourishment—all their nutriment—must be either liquid or gaseous. Plants receive their oxygen and hydrogen from water. They absorb carbon in the form of carbonic acid, which is an unfailing constituent in our atmospheric air and spring water, and is formed in every soil that contains organic matter. This carbonic acid is a kind of air which is constantly produced in vast quantity by the three great chemical processes most universally diffused in nature—the respiration of men and animals, the combustion of wood, coal, &c., and the putrefaction or decay of animal and vegetable matter. It is evolved by fermentation of liquids; and it streams forth from the earth in volcanic action. All the carbonic acid generated by these different processes is taken up into the air. If it should continue there the air must of necessity become unfit for respiration. But in the present balance of nature's forces, it does not remain there in excessive quantity. The vegetable world discharges the functions of supporter and protector of animal life—as *supporter*, by providing the animal kingdom with nourishment—as *protector*, by absorbing carbonic acid, retaining the carbon to build up its structure, and exhaling pure oxygen during the light of day.

There was a time in the existence of the earth, when the atmosphere was so charged with carbon that no animal life of a high order could exist. Then all portions of the earth's surface had a torrid climate, which favored an excessive growth of vegetation. Subsequent geological changes buried the remains of that vegetation, and locked up a vast amount of carbon in the coal-measures as they now exist. Vegetation, as we now see it upon the earth, holds another considerable portion of the original quantity, so that for a time the atmosphere has been so far purified of this gas, as to sustain a high order of animal life.

The atmosphere contains nearly all the essentials to plant growth; for it holds nitrogen in the form of ammonia, which is a volatile gas continually rising from the decay of animal and vegetable substances, and which seems to be the force power in the growth of plants; and all these elements may be absorbed by the leaves directly from the air; and some recent observations go very far to favor the hypothesis, that plants do take in a considerable portion of their food in this way. These several elements exist-

ing in the atmosphere, are seized upon by the aqueous vapor, which, when condensed into snow, rain or dew, brings them to the ground, and to the rootlets of the plants, and imbibed by these it is conveyed through the stem and into the leaves where the superfluous water is restored to the atmosphere by exhalation, while the residue is converted into the substance of the vegetable. The water exhaled may be again absorbed by the roots laden with a new supply of the other elements from the air again exhaled, and so on. In this way the atmosphere is repeatedly purified by the rain, and those gases and vapors washed out, which else by their accumulations, would prove injurious to man and animals, and are conveyed to the absorbents of plants which they are adapted to nourish.

Carbonic acid gas contains just its own bulk of oxygen, and by the decomposition of this gas in the leaves of plants, pure oxygen is returned to the air. Vegetation alone in nature operates to give to the air free oxygen, which is indispensable to animals at every moment of their lives. While animals consume the oxygen of the air, and give back carbonic acid, which is injurious to their life, this carbonic acid is the principle element of the food of vegetables, is consumed and decomposed by them, and its oxygen returned for the use of animals. Here is seen the perfect adaptation of the two great kingdoms of living beings to each other; each removing from the atmosphere that which is noxious to the other—each yielding to the atmosphere what is essential to the continued existence of the other.

How dependent is man upon vegetation! While the vegetable kingdom is independent and did exist alone for ages, yet it is absolutely essential to the life of man.

In this brief view of some of the wonderful processes in nature, we see that a beautiful harmony exists between animal and vegetable life, and that action and reaction takes place between them; thus preserving through the centuries of a geological period, that balance of the elements favorable to human life. Man, as an actor upon the scene, is a power of sufficient magnitude to work local irregularities, if not an appreciable change in the whole vital economy. The destruction of a large portion of the forests of a continent in a brief period, is an act that cannot pass without being noted in the account current of physical nature.

A great many facts have been recorded that are of interest as

illustrating some of the principles here shown, and to prove that the infection and diffusion of malaria or noxious emanations are arrested by trees, whose structure and foliage act as barriers to break the flow, as an absorbent of those emanations, and as eliminators of oxygen.

Among the Romans, the advantages of such barriers were recognized, and the practice of planting trees, to intercept the miasmata emanating from the marshes with which Italy abounds, was enforced by law. Observations have been made in many of these States that clearly show the saving influence of trees on human health. Similar facts are obtained from India, from Western Asia, and from South America.

One of the summer effects of plants and trees, that contributes directly to our comfort, is to render the atmosphere cooler by the great quantity of water that is exhaled from the leaves. This exhalation is dependent on the capacity of the air for it, and the presence of the sun. The refreshing coolness of a grove is something more than the simple result of the shade.

A singular fact is here worthy of mention: That in South America, in the centre of the torrid zone, over the broadest plain upon the earth, with a prodigious amount of rain-fall, and the consequent enormous vegetation, the scattered inhabitants along the banks of the overflowing rivers—people representing different races of men—are a healthful people; and that the heat there is at no time so great as is often experienced in summer in the temperate zones. There nature is balanced in her vast unbroken field, where man has not yet entered to mar the admirable proportions of her work.

In the absence of trees, sun-flowers have been planted between a malarious swamp and dwellings, and the health of the people thereby preserved. A sun-flower $3\frac{1}{2}$ feet high, with a leaf surface of 5,616 square inches, was observed to perspire at the rate of 20 to 30 ounces every twelve hours, or seventeen times more than a man.†

Tree planting along crowded streets and in parks of dense cities, cannot be too strongly recommended, as a measure of sanitary economy.* But the practice of surrounding a house with dense

† In the village where the writer now lives, (Foxcroft and Dover) not one-tenth the relative number of cases of summer fevers now occur as thirty years ago. How far this improvement in the health of the neighborhood is due to the great number of our beautiful trees, that have mostly been planted and grown within that period, would be interesting to know. *J. H. Rauch, M. D.

shrubby and shading it with large trees, is very far from being commendable. Sunlight is more essential than shade, and should strike all portions of the wall during the day, and be allowed to enter our windows. When it is too obtrusive, it is better to exclude it wholly or in part by some other device.

My plan compels me to pass so hastily, that I can give you but a gleam of the course of reasoning by which I am convincing myself that emigration from Maine westward, to avoid the rigors of a New England winter, proves a failure in the design. If to obtain cheap lands—lands are cheap enough here. If to secure other facilities to rear a comfortable home at a limited expense—here the materials for building are cheaper than there, and for the future the prospect is more in our favor. Selecting for health, scenery, climate, society, markets, good and abundant water, lands productive, honest and generous—fruits in their healthful variety—the ease with which a desirable location can be found and paid for, there is no spot on earth better for the sons of Maine than Maine herself.*

American country homes, in too large proportion, present a bleak aspect, uncomfortable and uninviting in such a climate—the West suffering most in this regard. The improvement, the entire correction, even, lies in extensive and judicious planting of trees; and herein the Eastern States have the advantage in time, for our plantations are already well begun; and here we have most admirable nurseries of evergreens in our pastures, ready grown and at hand. Of the twenty-nine hundred varieties of evergreens, trees and plants, in the catalogues, that are or may be grown in the States, our natives are among the best—sufficient in variety—good enough for all purposes.

In such an assembly as this, the larger number own their homes. But there is always a considerable number in every community, particularly in manufacturing neighborhoods, who find it most convenient to hire a house. Then the young men are taking their places in active life, earning and holding property. For these

* While looking over the Monthly Report of the Department of Agriculture for October, 1869, the frequent occurrence of loss by drought in the local statements, led me to select the crop of widest geographical range—Indian corn—and note the States where loss in greater or less degree occurred. The result is, that more than half the area of country embraced in the report, suffered loss from that cause. Of the other portion, some sections suffered severely from the other extreme. In a series of years we shall find Maine more exempt from such climatic casualties than the country as a whole, and probably suffering less than any other single State.—C. C.

classes in particular, I have a word of advice: Buy a piece of our good mother earth. Take the nearest available acre—one that nature has treated with a fair degree of kindness—improve upon it; both you and the land will be made the better by the act.

Having thus, inferentially, presented the claims of our State to our continued regard—honestly and fairly, as I believe—it only remains to me to speak of our homes as they ought to be. What shall we make them? is an interesting inquiry.

While pursuing this task, my convictions have all the way gained strength, that the effort will end in disappointment. My subject as announced naturally promises a different train of thought from my design, and might lead a stranger to expect a production differing widely from such attempts by country farmers. If I have already failed, I cannot hope to effect a redemption in the few minutes left to me, in which to present the claims of matters that employ the lives of men and raises them to the dignity of professions, and whose works are before us in many attractive volumes.

A home pre-supposes a house; a house is always a teacher; it becomes an agent of civilization. When the house embodies fitness, truth and dignified simplicity, it sustains the national roots of these republican virtues. The dwelling exerts a mighty influence on its inhabitants.

It has been said of the farmers of New England, that there is no race of country-livers in the world, who, with equal intelligence, are so destitute of all sense of the graces of life and home. If this be true of us, how wide is the margin for our improvement! One reason why the correction of this want of balance in New England character is retarded, is, that a large majority feel unsettled; they purpose to sell, and look up a new home. This feeling of unrest is the bane of all permanent improvement. When our people manifest more of a settled feeling, then we can talk with better courage of improvements, of trees, and home attractions. This lack of settled feeling fosters a want of permanence in all we build.

A single illustration may apply to many localities in the State. In the immediate vicinity of my home, there is an apparent abundance of slate, as good, and as favorably located for quarrying as at Brownville or anywhere; a broad vein of lime-rock, tracable across several farms, where it out-crops in steep hills, affording natural drainage for extensive excavations—the lime pure and

strong, and the rock promising an excellent marble for ornamental building purposes—all lying unworked; clay as good and as abundant as at Brewer, Pittston or Westbrook; plenty of sand, and mountains of granite—yet, in the centre of this neighborhood so remarkably rich in nature's enduring bounties, there is a growing village, dating back half a century, where the buildings are still being erected almost wholly of wood, the roofs covered with cedar shingles. A wiser people than we are, would here build a beautiful town that could not in one unfortunate hour be changed into smoke and ashes. The rubbish from the slate, that may here be wrought within two hundred rods from the cars, with this lime and sand, would form a concrete for the walls of buildings, more substantial than bricks—of solidity to resist any shock short of the force of a Western tornado, or a St. Thomas earthquake. But such is the force of habit, and the persistence of folly, that we may yet see men go from this village to Alaska for a pine tree, rather than use a better material for the same purpose, lying under their feet.

The enjoyment to be derived from living in the country, depends in great measure upon two things—a tasteful house and a pleasant garden. Many village places afford these in full measure. With us, these conditions of enjoyment are within the reach of every healthy, industrious man. Neither imply the presence of wealth. They are the results simply of good taste, with some cultivation, acquired through books, society or observation. This cultivated taste becomes a large available capital in the hands of a poor man, when he comes to deal with the things of nature. They stand to him as treasures, without which, elegance and luxury are nothing but tinsel and a vulgar sham. You believe with me, that a farmer's home may possess some grace and beauty, and be somewhat suggestive of high hopes as well as others. There is no good reason why they and their families in particular, should yield their lives to the discomforts of a primitive style of life, and the wearing monotony of thoughtless toil. The possibilities of a noble life are here so easily attainable, that every country dweller by improving his opportunities, may, beyond his money gains, increase his knowledge and cultivate his appreciation of the beautiful in art and nature. When he neglects his peculiar opportunities, the sum total of the nation's intelligence and happiness falls immensely short of what it should be.

In a country so diversified as this, there is ample range for the

inventive talent of the people—when that talent shall take this direction—to work out the graces in our homes; art joining with nature in each case.

It is well that beauty is not to be measured by any standard—that it is not seen in omnipresent and eternal features. Beauty in its essence is not a physical fact. Lord Bacon says, “the best part of beauty is that which no painting can express.” Beauty is the child of the soul’s intercourse with given objects and phenomena of the external world. It is not in the object alone, nor can the soul of itself generate it. It is developed whenever the soul comes in contact with what excites its most valued and agreeable emotions. There are particular as well as general adaptations between mankind and the external world.

In early childhood there awakes the sense of beauty in some particular department in nature. Nature is the expression of truths and principles; and the more we foster in ourselves the love of whatever is noble and good, the more beauty do we see in nature, and the more does she react upon us—making a broader surface for impression, and the multiplication of beauties.

Nothing is more remote from selfishness than a generous expenditure in building up a home, and enriching it with all that makes it beautiful without and lovely within. He who builds a good house does it for the whole neighborhood.

Children that are surrounded by books and cultivated natural objects, become refined in thought by early familiarity with art. Whatever expenditure refines the family and lifts it into a larger sphere of living, is really spent upon the whole community as well. Communities need examples to excite ambition. Fine grounds not only confer pleasure directly on all who visit or pass by, but they excite every man of any spirit to improve his own grounds.

Every element that adds to the pleasure and refinement of the family puts honor and dignity upon it. Whoever makes home seem to the young dearer and more happy, is a public benefactor. Not all young men who fall into bad habits were brought up in meagre homes; but it is certain that children whose homes are not interesting to them by affection, or by attractive objects, are more easily tempted into dangerous places.

But our question returns. The dogmatic assertion that “home should be a thing of beauty and a source of joy,” does not dispose of it. Neither do I intend to dispose of it at all. I mean to leave

it on your hands with all the responsibilities to work it out—each one for himself.

If I have my plans for the renovation of my house, to include the modern improvements; if I have determined on what trees to set upon my place for shelter, for timber growth, for their effect on the landscape, or for their fruits; if I have a hundred things to add to my surroundings to contribute to my comfort, and to add to your enjoyment when you visit me, and if I have a clear comprehension of the time and the manner to do it all, they are all matters applicable to my place alone. If I study my place and succeed in making it enduring, what I have learned is not applicable to your individual cases, only in a general way, even if I had the faculty and the will to impart to you all the knowledge I may have thus gained. There must be a plan—a conception, and an execution for each home, and there are a great many links or steps between the two. While these homes are taking form and comeliness and substance under your hands, your best capital is a boundless love for the thing. This is particularly true when you deal with the vegetable kingdom. It is wonderful how much may be done with trees on no capital but a little time, with the taste and the *love*.

The humblest farmer may venture in some things, in which his wife may join, with no fears that they may go out of fashion. He may invest in trees, in flowers, and green turf, and may spend around his home with such grace, such affluence, such economy of labor, such unity of design, as shall enchain regard, and ripen the instincts of his children to a finer sense of the bounties they enjoy. We have here a great class of small landholders, who control the most of our rural landscape, and the fashioning of our wayside homes; “and when they shall take pride, as a body, in giving grace to these homes, the country will have taken a long step forward in the refinements of civilization.”

I have aimed to read a practical lesson, with a purpose deeper and more substantial than the amusement of the current hour; and before leaving the platform, desire to make sure that my raft is well launched in the right current.

The suggestion has often been thrown out in the sessions of the Board of Agriculture and elsewhere, encouraging agricultural societies to offer premiums on *home improvements*. The Cumberland County Society once set a good practical example by carrying on for a time a plan of this kind, which resulted in much good.

I have thought that Farmers' Clubs were institutions better calculated for such a course of action, than an association covering a larger area; and that some plan of this sort is worthy the attention and the experiment of these new practical schools. In these social clubs, sufficient zeal ought to manifest for the success of a cause so worthy, without the stimulus of money premium. A club of earnest men and women thus enlisted would not fail to produce samples of homes worthy of general imitation, and be a means of hastening on the better time when American homes shall present an aspect of general comfort, which at present is rather the exception than the rule.

It was my fortune to make this suggestion at the late session of the Board of Agriculture in Lewiston, and from the favorable manner in which the idea was received, I took courage to try to keep the thing in sight. To this end I applied to a gentleman*—the one best qualified in the circle of my acquaintance—for a definite plan of action.

This was subsequently furnished in an appropriate letter covering the whole ground, making the points and suggestions sufficiently clear and full for our purpose. With the permission of the gentleman to use his ideas any where for the good cause, I only regret that his entire letter cannot be put into the hand of every person in the State. The force of some of his sentences will not be destroyed if we read them out of the connection, as follows: "How can the farmers of Maine, large and small, learned and unlearned, rich and poor, be led to make their homes more attractive, and thus check in some degree the out-flowing tide of bone, muscle and brains (our young men and women)—a continuous stream—to enrich other States by their indomitable energy and acknowledged ability? How can all men and women, boys and girls, be led to see in this their true interest and profit?"

How to do it.

"Repeat it in lectures wherever an audience can be gathered; and see to it that a good proportion of your listeners are females. I have much faith in what the women and girls can do when they set about a thing." "Preach it from the Board of Agriculture. Teach it in the Agricultural College. Publish it in the newspapers. Talk it in Farmers' Clubs. This is the first thing,—talk it up. Let it be seen; make it popular—fashionable."

* Hon. Samuel F. Perley of Naples, Maine. *

“When the steam is well up, set it usefully at work. And here I wish most fully to endorse your suggestion, *that farmers' clubs take this matter in hand.*” “In my zeal for *practice*, I will throw out a few suggestions as to how the clubs may act efficiently.

First, They should offer no money premiums; partly for the very good reason that most clubs have no money to offer. Another reason is, money premiums often excite enmity; whereas *emulation, friendly emulation*, is the result desired,—the lever with which we may hope most successfully to raise the mountain.

Second, The awards should be of commendation merely; and as many as there are competitors—based upon the *merit*, or rank *system*, as is often practiced in schools, viz: 1, 2, &c.

Third, The highest awards should not necessarily follow the largest expenditures of time and money, for in that case the most wealthy could certainly win.

Fourth, The highest awards should follow the improvements made with the *greatest taste* and *best judgment*.

Fifth, Each club should decide for itself in what direction its competitors should expend their efforts; for if each competitor is allowed to select, there may be such a diversity of objects—some of profit, others of adornment, that a committee would be puzzled to decide which should take precedence.

Another plan, and perhaps a preferable one, might be, to let each competitor select the object or objects, which his fancy or his greater necessity might lead him to labor for, and the committee be instructed to report upon each object, in this wise:

Mr. A in propagating ornamental trees, stands No. 1; Mr. D do No. 2, &c.

Mr. B in gardening, stands No. 1; Mr. E do No. 2, &c.

If the number of competitors is large and the objects many, it might be well to have several committees. Say a committee on orcharding, one on gardening, one on buildings, on ornamental trees, on flowers, &c.—and in this way committee men (and women?) could be selected to judge of things in which themselves were not competitors.”

This plan is so feasible, and seems so completely adapted to draw the members of a club together in harmonious action, with a oneness of purpose for the common good,—a plan so calculated to bring to the aid of each individual, the advice, encouragement and sympathy of friends, which we all need so much, that I feel to urge it most persistently upon this club for immediate adoption,

as a plan offering larger surety for its stability and usefulness, than any other course of procedure which the history of like associations has hitherto presented.

One of our countrymen,* whose thoughts often drop like sparkling gems, has put in my way the words that so beautifully supply and fill my remaining space, that I am most happy to give him the credit, and thank him for them as cordially as my auditory will thank me for stopping here. "If I have no coaches and horses, I can, at least, hang a tracery of vine-leaves along my porch, so exquisitely delicate, that no sculpture can match it; if I have no conservatories with their wonders, yet the sun and I together can build up a little tangled coppice of blooming things in my door-yard, of which every tiny floral leaflet shall be a miracle. Nay, I may make my home, however small it be, so complete in its simplicity, so fitted to its offices, so governed by neatness, so embowered by wealth of leaf and flowers, that no riches in the world could add to it, without damaging its rural grace; and my gardeners—sunshine, frost and showers, are their names—shall work for me with no crusty reluctance, but with an abandon and a zeal that ask only gratitude for pay."

Mr. WILLIAMS of Kennebec. I would like to ask one question. In alluding to the grove of evergreens, and to the temperature of the atmosphere on both sides of the grove, and in the vicinity, I understood him to say that the average temperature of the atmosphere in the vicinity of the grove, and beyond its influence, was eleven degrees, and that to the leeward or eastward it was elevated fifteen degrees, while on the west side it was reduced below the average. My inquiry is, why the temperature on the west side should be reduced below the average temperature.

Mr. CHAMBERLAIN. The gentleman misapprehends. The temperature was noted on the west side of the ledge as nine degrees, and on the east side 15 degrees. The observer walked eastward, as the land ascended on the lee of the hedge, and noted the temperature at different distances, and at the distance of ninety feet from the hedge it was eleven degrees, still two degrees warmer than it was on the west side; showing that the influence of the hedge extended ninety feet beyond it. That is in accordance with observations made in Europe, that a barrier against the wind affects the climate a distance of some eleven or twelve times the height.

* Donald G. Mitchell.

Mr. WILLIAMS. The explanation is satisfactory. I misunderstood the statement.

Prof. FERNALD. Was it in the summer or winter?

Mr. CHAMBERLAIN. Winter.

Prof. FERNALD. The difference can be easily accounted for in two ways. When the temperature is low, trees draw warmth from the earth, which they impart to the surrounding air. On the other hand, when the temperature of the air is above a certain mean, the temperature of the trees is less, and they abstract heat from the air, and the result would be to establish an equality. Then in the summer season, the effect would be to render the surrounding air somewhat cooler; in the winter, exactly the reverse takes place; the trees impart warmth to the surrounding air, and thus a higher degree of temperature is attained.

Again, the prevailing wind, which is from the west, banks up, so to speak, on the western side of the forest, and forces its way through the trees. Now, what is the effect of the friction as it passes through the forest? There can be no friction without heat, and the result is a slight elevation of temperature.

Taking these two causes together, it seems to me we have enough to account for the difference of six degrees between the western and eastern sides.

I saw, a few days ago, a pamphlet bearing on this same point, and it was stated that near the Mississippi river, where an observation was made in the forest, it was found that on the western side the temperature was four degrees; in the centre of the forest, sixteen degrees—a difference of twelve degrees. On the eastern side the temperature was a few degrees lower than in the middle, although higher than on the western side. Another illustration of the same kind and in point here, and doubtless due to the same causes—the warmth imparted by the trees to the surrounding air, and also to the elevation of temperature caused by the friction of the wind in passing through the forest.

Mr. WILLIAMS. Do I understand the Professor to say, that the mere friction of a current of air will lower the temperature?

Prof. FERNALD. It will elevate the temperature. At least, it has that tendency. Friction cannot take place under any circumstances without producing heat. Two masses of ice rubbed together will generate sufficient heat to melt the ice. It is a law of nature, that wherever there is an expenditure of power, that power will manifest itself under the form of heat.

There is one very interesting aspect of this question, which has relation to the influence of trees upon health. Reference was made to it in the lecture, and some instances given. A very interesting illustration of the effect of trees in arresting malaria was mentioned by J. Stanton Gould of New York, at the Farmers' Convention, held in Manchester, N. H., a short time ago. Near Annapolis, Md., there is an asylum at which, a few years ago, cholera prevailed. It seems that near this asylum there was a cesspool, into which the sewerage of the asylum and of the surrounding buildings was drained, and between this cesspool and the asylum was a clump of trees, in a certain position. The matter was investigated, and it was found that it was the custom to allow the windows on the side of the building towards the trees and the cesspool to be opened during the day, and that all the cases of cholera were in those rooms between which and the cesspool no trees intervened. Those rooms that were in a line with the cesspool and the trees, so that the trees were between the windows and the cesspool, were entirely exempt from cases of cholera. The trees seemed to arrest the malaria, so that it did not develop itself in those rooms, but in all the others there was disease. I think there have been other cases recorded where trees arrested malaria in a similar way.

Trees undoubtedly act also in purifying the air, not only directly as arresters or absorbers of material deposits, but in their chemical relations, by purifying the air, as has been noticed by Mr. Chamberlain, in removing carbonic acid from the air, appropriating the carbon to their own growth, and throwing off the oxygen into the air. Indeed, the only known source of the supply of oxygen to the air, which is being constantly taken from it by combustion, by expiration, by putrefaction, by the processes of decay—the only known means by which this supply is maintained, is through the action of vegetation in absorbing carbonic acid and returning oxygen to the air. This process, as has been stated, goes on most completely under the influence of the sun, whereas, during the night, it is arrested, or the reverse process takes place; so that the question which frequently arises, "Are flowers in a room a source of health?" may be answered, in brief, in this way: During the day time they are. They take up noxious vapors, they decompose carbonic acid, which they absorb, and appropriate the carbon and give forth oxygen to the air, thus purifying the air. During the night, this process is arrested or reversed in a measure;

that is, plants are known to absorb, during the night, a small amount of oxygen, and throw out a small amount of carbonic acid. But during the twenty-four hours, the amount of oxygen thrown to the air is very much greater than the amount absorbed, and the amount of carbon appropriated very much greater than the amount given out, so that on the whole, they act as purifiers.

Gov. BROWN. I think every gentleman present will realize the force of the remark in the excellent lecture to which we have listened in regard to the effect of trees in ameliorating the temperature of the atmosphere, if he will call to mind how he stood in the street yesterday or this morning, conversing with a friend, when the wind blew by him pretty rapidly, and caused him to be so cold that he retreated round the corner to the shelter of the buildings. Your body is in the same condition as the ground on the western side of this hedge. It contains a certain amount of heat, and when a current of air sweeps over it, it carries away a portion of the warmth of the body. So in the case of the hedge. The cold wind sweeps through it, with its thousands and tens of thousands of branches and twigs, and all the time the solar rays have been darting down on the west side of the hedge and warmed the earth, and the earth is radiating heat into the atmosphere continually. I realize this every year of my life. I have a hedge on the northwest side of my garden, and I can work all day on the southwest side of the garden, when I could not stand it an hour on the northeast side. The ground remains frozen there for weeks after I can go to work on the southwest side.

I only mention this to show that we can gain a great deal by planting trees on our farms. The most remarkable case that I know of is at Nahant, in Boston harbor. Mr. Tudor—the man who introduced the ice trade between this country and foreign countries—lived on the island. Having a great taste for gardening, and everything of the kind, he planted trees there, but could not make them grow. At length it occurred to him to make a fence on the easterly side of his garden. He did so, and then he found he could make trees grow pretty well; but he found that by putting up a high fence with small spaces between the slats, the trees grew a great deal better than with a light fence, because the cold air was warmed and its force broken as it passed through that fence. Mr. Tudor died a few years ago, but before he died he succeeded in covering those rocks (for there was very

little soil on them) with the finest shade and fruit trees, and vegetables now grow there as well as on your best soil.

A member of Parliament said, some time ago, in a discussion, that the condition of a nation might be fairly judged by the amount of sulphuric acid that they used. I think he was right. There is scarcely a thing done in the arts in which sulphuric acid is not used; they could not get along without its use. Now, if that man comes to this country, and goes among our artisans and chemists, and sees that they are using large quantities of sulphuric acid, he will write home to the *London Times* that we are a go-ahead people and are getting on in the world, because we use so much sulphuric acid. That applies precisely to the position of the lecturer to-day. Let an observing man come to this country from abroad, and you may tie a handkerchief over his mouth and not let him speak a word to anybody, and he will write home that we are setting an example to the world of genius, industry and goaheadativeness, such as has never been presented by any other people. Let him look at our homes and see the comfortable things that we have in our houses, almost everywhere, (I mean, everywhere except among farmers.) He will see lounges and easy chairs, and pianos, and the various decorations that make home so attractive, and he will write home that we are really a wonderful people; and he will tell the truth.

We are, as a people, just what our homes are. That will hold good everywhere. You may depend upon it, that the man who owns a house and lives in it, is pretty much such a man as his home appears to be. Now, if you don't want your neighbors to judge harshly of you, make your home comfortable and attractive. Build a wood shed, if you have not got one; have soft and hard water for your good wife; have all the modern conveniences; the best wringer, the best clothes dryer, the best churn, the best water pail, and everything you can possibly find to lighten the labor of the houses, and what a reputation you will have for being a good man from all your neighbors, as they pass by your door!

On the other hand, go with me some cold day through Broad street, in Boston, and I will show you some things there that you will never want to see again as long as you live. You find these people wherever you go in our cities, and their personal appearance and language indicate just what their homes are. You do not need to go to their homes. If you will talk with them, you will easily find out what their homes are; or, if you go to their

homes, you will know what they are, out in the avenues of life in the city of Boston. So, I say, we are just what our homes are.

Now, we are bound to improve every moment of our lives. I hold that the man who has not this conviction on his mind, that it is his duty to God and to his fellow-men to be constantly improving, is, I was about to say, God-forsaken, but I do not believe He ever forsakes us; but it is our duty to learn to do something better and to *be* better every moment. Do not entertain the idea that knowledge is to be lost to us when we are done here; that is always going with us, and it is so much clear gain if we lay it up in this world.

All these things that we are trying to do, and that we come here to learn from you and you from us, are civilizers; they are elevating us in the scale of being every day. The very arctics you have on your feet are civilizers. The kitchen cooking stove is one of the greatest civilizers in the land. Take it away when you get home, and see what a row there will be in the family to-morrow morning! I don't believe there are many of you who would dare to do it. Why, it is one of the most graceful things there ever was in the world. They shine like a crow's wing under a neat woman's hand. She can do three times as much work with a stove as she could with the old-fashioned open fire-place. Is it not a civilizer? It gives her time for reading and intellectual culture, time to mend the clothes, and when the children come home from school and sit down at night to puzzle out the hard sums, the father or mother can help them, for the work is all done and everything cleared up,—because they have the cooking stove! I say again, it is a civilizer.

So it is with the sewing machine. Tell me what has ever done so much to advance the welfare of the women of your household as the sewing machine? We never could have got through with the rebellion as we did without the sewing machine. Our soldiers would have perished for want of clothing and the comforts of life. So it is with the reaping machine and mowing machine. There are many men who almost broke their backs when they were young, in mowing too much, who now live comparatively easy, and make money faster than they ever did before, because they have got the mowing machine on their farms. And you must not forget that you are doing the world good as well as yourself when you use them. You are increasing your profits. I do not want to leave that out of sight. Every one of these things puts money

into your pockets. One man takes a particular breed of cattle, the Ayrshires, for instance, and makes the best he can of that; another takes Devons, or Shorthorns, or Jerseys; another takes pears. See what has been accomplished by the efforts of Colonel Wilder, in Massachusetts, in introducing pears. Another takes an interest in apples. You have not a hundredth part as many apples in the State of Maine as you ought to have. How many families do you suppose there were in this State last October or November, that had not a single barrel of apples, or fruit of any kind. I know there were a great many in Massachusetts in that condition. No family ever ought to close the cellar doors in November without at least, four barrels of apples in the cellar. Yet I have no doubt there are more than ten thousand families in the State of Massachusetts that did not have a bushel of apples in the house during the year 1869.

Are you not going to reform these things? I see a man before me who raised 2500 bushels of potatoes last year in this State. I saw 700 bushels of the Early Rose in one bin, and a handsomer sight is not to be seen anywhere. I feel obliged to this man for introducing new varieties of the potato, where the old ones are running out so fast.

There is another thing which is a civilizer, which I am inclined to think a great many people never have thought of. That is the common hoe. Will you tell me what would tempt you to give up the use of the hoe for the year 1870? I don't believe there is money enough in the country to induce the State of Maine to give it up for a single year. That is a civilizer. Only think how it is used in all the operations of the garden and the farm. So is the shovel. I remember when we had to work with a shovel made of wood, shod around the edges with hoop iron. I have shoveled many a day with that kind of a shovel. I suppose there were, at that time, shovels made of steel, but I did not see any. You have to hire men to do the digging on your farms, and a man will do more work in one day with a steel shovel with a long handle, than he would do in two days with the old-fashioned one. This is so with all the other tools. The pitchfork used to be made by the village blacksmith, and was four times as heavy as it ought to have been. Take one of the modern pitchforks and see how much more easily you can do the work.

One word on another topic. I was glad to hear the suggestion of the lecturer, that there should be in every town some person

appointed whose duty it should be to look after the shade trees of the town. If there are no such trees in a town, so much greater the necessity. We have had such a person in our town for a great many years, and he is dignified by the name of the Town Forester. We send here or into New Hampshire every year for two or three car loads of rock maples, and when they arrive, the Forester gives notice that any gentleman is welcome to those trees who will agree to plant them on his premises and take care of them. In that way we have filled our town with shade trees, in fact we have the nursery in the village; but all over the town you will see rows of young rock maples growing vigorously. Imagine what they will be thirty, forty, fifty years hence, if well attended to. If you do this, what effect it will have upon the health of your people. The fact stated by Prof. Fernald is a good illustration of this. It is all-important that you do these things..

I mention this because if there is a piece of land in New England that has been badly treated, I think it is the land between Portland and the city of Portsmouth, in New Hampshire. I have hardly ever passed over a piece of land that looks so cold and so destitute of almost every kind of vegetation as that whole extent of country, with trifling exceptions. When I rode the other day from Saco to Limerick, the road side was mostly barren of trees. For mile after mile, on either side, there was scarcely a tree to be seen, and very few trees had been set by the road side. What are you coming to here in the State of Maine, if you go on this way forty or fifty years longer? If I lived in one of the towns on that road, I would not sleep until I got four or five men to act with me in town meeting, to secure the passage of a vote appropriating a sufficient amount of money to line those roads with rock maples, elms, and such other trees as are best adapted to the soil.

I would not live a day without doing it, and I hope none of you will. It is sad to see how barren of trees that road is. It will be equally barren of other vegetation one of these days, unless you do something for it.

I say we are what our homes are. It is true, a home never can be attractive to young or old unless its surroundings are pleasant. Not only must its internal arrangements be convenient and attractive, but its surroundings must be pleasant. I do not know that it is possible to have a home attractive and agreeable inside without pleasant surroundings. I am quite certain that a person, who is neat and orderly inside the house, will be equally so outside.

But I want to see the time when every man who has an acre of land will have a good garden attached to his house. There is nothing more economical than a good garden. You may feed the family all through the summer months by going to the pork barrel and to the garden, and live well, too, instead of paying out two or three dollars at a time for butchers' meat. There is nothing more wholesome than garden vegetables, and certainly nothing more economical.

You want fruits also in the garden. A great deal of meat in hot weather is not so healthful as a vegetable diet. You want apples, pears, and the small fruits—strawberries, raspberries, currants and grapes; especially the currant, for I think that stands at the head of all our small fruits. It continues much longer than the strawberry or raspberry does, and that is an object. You want all these things in your gardens, and interspersed here and there a rose bush or some other beautiful flower. Then you will have a home that will be attractive to your children, and they will not be all the time planning to go away to Boston, or Lowell, or Portsmouth, or Portland, or some where else. They will have associates growing up with the same tastes as themselves, and they will have homes that they will regard and that never will be forgotten as long as they live, let them go where they will.

Dr. ALONZO GARCELON of Lewiston. I was very glad to hear the remarks which have been dropped by Gov. Brown, more especially in regard to ornamental trees, and to the importance of making their cultivation a matter of public interest. I speak the more feelingly on this subject because, some seven or eight years since, I commenced a home on the hill by the side of our grammar school house. The soil was unfavorable to the growth of forest trees, but by dint of perseverance and replanting, I succeeded in getting a beautiful row of elms, of about three years' growth, on three sides of my lot. Gov. Brown says he wants the towns to vote to plant trees; and so do I; but the authorities of this goodly city took it into their heads to take down the grades of the streets, and uprooted all those trees in which I took so much pride, believing that they would be an ornament to the town; and to-day my house stands as barren as if a tree never grew in the State of Maine. What is to be done in such a case, when the public authorities of a city like Lewiston can themselves lay vandal hands on the trees planted by those who take pleasure in beautifying the town?

I regret having been unable to hear the lecture which was delivered here this morning. Had it been possible for me I should not only have come myself, but brought my wife, for she wanted to hear the lecture. Unfortunately, I was under the necessity of being away, and could not hear it.

I wish to say that I take great interest in agricultural matters, and nothing pleases me more than to see an interest manifested in this subject generally; and I am extremely—I was about to say displeased, and I do not know but I might use the word properly—not to see a much larger number of my neighbors, and of the farmers of this goodly county of Androscoggin here to listen to these discussions, and by their presence to show that they feel a deep interest in this matter, which lies at the very foundation of society. I was reading the other day a book on the Chinese, in which I found an account of the methods by which they sustain a population of four hundred millions and upwards upon a territory no larger than these United States, where we have a population of but forty millions. I found that they avail themselves of every possible means of enriching their soil and making it productive. I also noted this important fact, which shows how very different the people of China are from our own people in their appreciation of the value of agriculture. We are told that the people who take the first rank in China are the *literati*—the men of letters; but next to them, and those who receive the greatest respect, are the agriculturists—close up to the throne, as it were. How different it is here! Look at your Legislatures. Look at the position which farmers hold in the community. Where are they? At the very bottom of the scale, so to speak, when in truth upon their prosperity depends the prosperity of all the other interests of society. They ought to be the men of the first rank here as well as in China. We want our men of education, we want our men of influence, to be more interested in agriculture, and if they would be so, my word for it, we should never see so sparse an audience and so largely made up of gentlemen residing out of the immediate vicinity when we hold our agricultural meetings.

Adjourned to two o'clock P. M.

AFTERNOON SESSION.

The Board met at the hour appointed, and the discussion was resumed.

Mr. NICKERSON of Readfield. I noticed that in the remarks this forenoon in favor of planting shade trees, some three or four trees only were mentioned as desirable for the purpose of ornamenting a home. I think there may be many more added, which would not only be as handsome shade trees as those spoken of, but be profitable to cultivate. It was said this forenoon that there were many families who had not a barrel of apples or other fruit in their cellars. If they would plant apples and pears by the side of the highway, instead of maples and elms as suggested, all those families might be supplied with those useful fruits. I think a good apple or pear tree is as handsome a shade tree as a poplar, a willow or an elm, which produce no fruit. The forest trees grow large and strike root widely and deep, and destroy fertility to a considerable extent around them, or injure it more or less. It does not make so much difference if a man has a great deal of land. But if he has only an acre, twenty maple or elm trees, when fully grown, would destroy his garden, which might otherwise support his family during the summer. I do not know any greater luxury than to be under a tree with ripened fruit upon it in the fall of the year, and certainly, in the spring, the sight of any fruit tree in blossom is very beautiful. I would put large trees away from my house, and not have them so near that their branches will chafe against it, nor keep the sunlight out. Sunlight and air are of the utmost importance to health.

Mr. WILDER of Pembroke. There has been much said and written upon the subject of setting out ornamental trees by the wayside, and many towns have gone to a good deal of expense in planting trees, and have succeeded, while other towns have taken as much pains and have failed. The trouble is, that cattle run at large, and they have spoiled the trees. It is not in this section of the State as it is in the eastern part, where I reside. A tornado passed over that section last fall, and laid it waste. More than three-quarters of the lumber in Washington county, lies as flat as a field of grain after the reaper has gone over it.

It seems to me there ought to be a law enacted to protect these trees after the towns have been at the expense of setting them out. It has become a matter of necessity for us to plant trees,

and I think we should recommend the setting of trees along the highways,—either fruit or forest trees.

Secretary GOODALE. I would inquire if the loss of trees set by the highways is chiefly due to the cattle running at large?

Mr. WILDER. Yes, sir, it is, in my section. In many instances, districts and towns have taken away the fences, and the roads are all exposed in winter times, and cattle are permitted to run at large and destroy these trees. It seems to me that a man owning a stock of cattle should keep them at home as much in winter as in summer.

Secretary GOODALE. The statement of the gentleman leads me to remark that I am greatly disappointed, as I have no doubt you all are, that we cannot listen this afternoon to the lecture which was expected and announced from Mr. Lebroke of Foxcroft, on Farm Law, embracing Rights and Duties relative to Division and Road Fences, Breaches by Cattle, and related subjects. I learn that he is detained by illness. I have no doubt we should have been much enlightened upon a matter of great importance to the public. This lecture would have gone far towards enlightening us with regard to a point which is generally misunderstood, and that is, that the highway, except for the purposes of travel, belongs to those from-whose land it was taken. I have no more right to allow my cattle to run in the road that forms a part of your farm, than I have to cut the grass on any part of your farm. When it is fairly understood that the public have no right in a road, except to make, repair and *to use it for travel only*, we shall have taken the first step towards doing away with this difficulty, and it is a very serious one.

There is no tax that comes more heavily upon the farmer than that of fencing, and road fences are needless. This is a tax we have imposed upon ourselves. We have done it voluntarily, and it has come to be supposed that the road is public property, for any use, and that anybody has a right to let his cattle graze in it. To such an extent has this idea prevailed, that towns have sometimes voted that cattle be allowed to run in the highway. They have just as much right to do it, I suppose, as to vote that they may run on any part of my farm, or of yours. I am no more bound to fence out my neighbors' cattle, than to double lock my house. If a man comes into my house and takes away my property, he is accountable for it, whether he walks in at an open door or breaks locks or windows. If he allows his cattle to come upon

my land through the highway,—it makes no difference whether there are fences by the roadside or not—he is responsible for whatever damage they do. If I own the land on one side of a highway, I own to the middle of the road. If I own on both sides, I own that land, and if the road is discontinued, all its uses revert to me; the public has no longer any right to it for any purpose; and at no time have they any right, except to use it for a road to pass over.

Mr. KILGORE of Lewiston. The State of Maine goes by the cognomen of the “Pine Tree State.” Has anybody thought how important it is that we cultivate the pine, or, at least, do not destroy it. What is better as an ornamental tree than the pine? I have thought it almost a crime for the woodmen of the State of Maine needlessly to destroy a pine tree. Think of it for a moment! A large portion of the county of Oxford is natural to the pine. I have reaped grain upon land where logs could now be cut large enough to make quite a stock of boards.

But a vandal hand is laid upon the pine, especially the little pines. Fifty years will produce a crop of pines in the State of Maine, and yet these trees are ruthlessly cut down everywhere. It is astonishing that people should believe that the elm and the maple, that are barren of leaves half the year, produce a handsomer shade tree than the pine, which is useful as well as ornamental.

The importance of cultivating the pine should be brought to the attention of the people. There is comparatively but a small portion of our country that is capable of producing the pine to advantage, and my idea is, that it should be cultivated on such lands as are adapted to it.

There is one other subject I wish to speak of. We were told in the lecture this morning, that trees make the land warmer. Such has not been my experience. I may be mistaken, but my experience was, that when I made a large clearing, I could raise corn, where prior to that, the forest would injure the crop. Is that so? It does not seem to me that we are going to gain any thing in that direction by cultivating forests; but if we cultivate trees for beauty and ornament, we shall be great gainers.

I hope that the subject of cultivating the pine, which was the point I rose specially to speak upon, will be taken into consideration.

The subject was then laid on the table, and the Board took up the subject of

THE GRASS CROP.

The discussion was opened by LUTHER CHAMBERLAIN, Esq., who delivered the following lecture :

The Grass Crop—Preparation of Land, Methods of Seeding, Cutting and Curing.

Mr. President:—

In years past it was said "Cotton is King." In later years it was said with equal truth, as applicable to the Western States, "Corn is King;" but with us in Maine, and perhaps in all New England, grass is the King of crops. This is true taking the world at large; for the statistics of nations prove that grass is the most remunerative and the most necessary of all cultivated crops.

It is estimated that the hay crop of Maine for the year 1869 will not fall short of 800,000 tons, and that the crop of this year falls short about one-fourth of the usual average, bringing it to more than 1,000,000 tons yearly; in value about \$15,000,000. Now if we add to this the value of the grass consumed in our pastures, which does or should amount to more than this, we have upwards of \$30,000,000 as the yearly value of the grass crop of Maine. With this \$30,000,000 in mind, if we compute the value of any one of the other crops, or all the crops combined, we shall see at once where they stand in the comparison. Still keeping this same \$30,000,000 in view, can we not by some means within our power double that amount without increasing our acreage? Do we throughout the State average more than one ton of hay per acre? I know of some farmers who boast of having a few acres on which they cut two to three tons per acre, while at the same time they say nothing of three times as many acres that yield less than half a ton per acre. I have seen a very few acres where a cow obtained good forage through the summer on one acre of ground, and on the same farm I have seen ten acres that would starve two sheep.

This is not as it should be. Every acre of ground mowed should give from two to three tons of hay, and every acre pastured should be able to feed one cow well. These results can be obtained, but only by careful, judicious, scientific farming.

It is a natural propensity in man to add acre to acre until he

owns all the land that joins him ; but I am inclined to believe that it is a more laudable ambition to extend his possessions perpendicularly rather than laterally, and thereby gain more in depth, while he loses nothing in surface.

It was a great oversight in the first settlers of this State, not only in clearing too much land, but, in many instances, clearing the wet, rocky land for cultivation, leaving the best part of many farms for wood land. And, I am sorry to say it, the same heedless and fruitless waste is still going in some parts of the State up to the present time. But we must take things as we find them and do the best we can ; and with these preliminary remarks I am led to the firstly of my theme, viz :

The Preparation of the Soil.

Many of us are not aware how large a portion of our farms need underdraining. We are not aware how near the surface of the soil the cold spring water stands nearly the whole season ; and still wonder why those lands do not produce better crops after being manured so liberally, when the truth is they are chilled to death.

Wherever water stands the land must be cold. Any one of you can tell the effect of evaporation by wetting your finger and holding it in the wind. The evaporation of water from the surface has the same effect upon the soil, and it lies shivering in the wet. Now if we wish to save all this heat which is constantly going off from the surface by the evaporation of water, we must draw this water from the bottom by careful drainage, and thereby save the great amount thus wasted.

Lands well underdrained will add two weeks to the length of our seasons, or rather there is less danger from spring and autumn frosts ; as the temperature of such lands is raised from ten to fifteen degrees above its former rate.

It may be true that grass endures cold and wet better than most crops, but that is no reason why that crop cannot be benefited by drainage ; and if we wish green fields early in the spring and late in the autumn, drainage will effect more than any other one thing. By careful drainage we can double the depth of our soil. It is beautiful in theory that man owns the soil from the surface of the earth to its centre ; but ownership is not always possession ; and in many instances cold water has possession of all but a few inches of surface. Water is very good in its place.

We could not live without it, nor could our animals; but neither man nor animal can live in it; neither can grass flourish in it.

There are thousands of acres throughout the New England States that support but a scanty supply of herbage, and that of very poor quality; not because the soil is not capable of supporting more and better, but because the plants cannot subsist upon water alone. Drainage will change the character of these lands, and nutritious grasses will take the place of coarse aquatic plants.

Drainage is the fundamental principle, the root of all improvements in cultivation; but that alone cannot accomplish all the desired ends. Drawing off cold water from the bottom of the soil instead of allowing it to evaporate from the surface, and letting air occupy its place, assists the decomposition of the vegetable and mineral matters already in the soil, and renders them digestible food for plants; but there are very few of our farms that have all the plant food needed, and that deficiency we must supply. We must not expect to get something for nothing. We do not expect to cultivate a field and take a crop from it year after year without returning an equivalent. Although, in the process of plowing and cultivating, the vegetable matter of the soil is more exposed to the action of the atmosphere and consequently wastes more rapidly, still our meadows cannot endure this exhausting process forever without a fair return.

What has been done in other States can be done in this. We occupy one of the best grass-growing States of the Union. In New York are large tracts which, a few years ago, were considered so entirely exhausted and worthless that the owners sold for a mere pittance and emigrated West. Now those very lands are among the most productive in the State; and that is largely due to drainage.

F. P. Bissell of Hebron, Conn., says: "Drainage is too much neglected. I drained a small plot of ground which was so soft I could not drive a team over it in a dry season. Now I can go over it at any time, and the quantity and quality of the grass are increased three-fold."

John T. Norton, Farmington, Conn., says: "Wherever there has been standing water, or a cold wet soil, I have put in drains, either stone or tile, with admirable effect, a single crop almost paying the expense."

Wm. C. Young, Mansfield, Conn, says: "Much benefit is derived

from drainage. By this process the hay crop has been increased from half a ton to two tons or more per acre."

John H. Dickerman, Mount Carmel, Conn., says: "Drainage has been in practice here for the past fifteen years, and always with the best results. Much meadow has been reclaimed by its use which could be done by no other means. Meadows so reclaimed give a crop of two or three tons at each mowing."

That is what drainage has done in Connecticut; and what it has done there, other things being equal, it will do for us here. But drainage cannot do everything. It cannot supply all the elements necessary for the production of the grasses. As I said before, there is a deficiency which we must supply. There is quite a portion of our meadows, that, for several reasons, is not susceptible of successful cultivation, and still is natural grass land. Such lands should be kept up to their maximum of productiveness by top dressing. Our natural meadows and river intervals that are annually overflowed do not need it, for the water leaves what is most essential to perpetuate the grasses. But I have reference to our high lands only. Stable manure alone is not sufficient, as it does not contain in sufficient quantity all the elements necessary; but an equal amount of swamp muck which is composed almost wholly of vegetable matter mixed with a few casks of lime and plaster, will make a compost which will bring such soils to the required condition. Too close mowing with close grazing in the fall, thus exposing the roots to severe action of the frosts of winter, are two great causes of the frequent running out of our meadows, and should be avoided; for the compost heap cannot repair the damage done by either process.

If you will examine some of your meadows, you will find large patches of soil between the roots of the growing grasses that are entirely bare. Such places require an application of seed of a different variety from those already growing, before the application of the compost, and you will find these barren places will become occupied, and the whole soil productive; and the result will be an increased crop of richer and better hay.

But, say you, we have not the manure to spare. All we make is needed for our cultivated crops. Then cultivate less for a year or two, at least, or try some method to make a little more manure. Get enough, if you buy it, to top dress a few acres. The more manure the more hay, and the more hay the more manure. The

two are so closely allied, that if one fails both fail, and if the hay crop fails, then fails the State of Maine.

In seeding cultivated fields something more is necessary—and first, draining; then manuring and clean cultivation. By clean cultivation, I mean, raise nothing but the crop intended. Every weed allowed to mature its seed, takes not only from the cultivated crop, but spreads its thousands for the succeeding crop. It is true that grass will in time overcome most weeds, but it can never kill the seeds that lie buried beneath the surface, and when that land is again plowed they spring up like the hydra-headed monster. It is easier to kill one weed than the thousands that follow. After these things are successfully done, then a thorough pulverization of the soil.

Most grass seeds germinate best at the depth of one-fourth of an inch or less, and at the depth of half an inch or more, usually fail. It is yet the practice in some places to harrow in grass seed; and at the same the surface of the soil is partially covered with loose stones, tough sods and hard clods of earth; and farmers who follow this custom are continually complaining of their poor success in seeding to grass. Is any one present surprised at the result? If you wish to succeed in this you must first remove loose stones, and crush those clods to powder; and then harrowing will cover a large portion of the seeds too deeply. The harrowing should all be done before the grass seed is sown, and after that, the roller alone should be used.

But with the utmost care in seeding, in our usual way, we often find in newly seeded meadows, as well as in old fields, large patches of soil between the roots of grass entirely naked. There may be several causes for this; and one may be the use of poor seed; another, probably, is the want of a sufficient quantity, and the third, certainly, is the want of a proper variety. And this leads me to the next division of my subject, viz:

The Varieties of the Grasses.

In speaking of the grasses, I shall include red clover, as that is sown with the grasses and for the same purpose. It is the custom among a large portion of our farmers to seed with herds-grass and red clover, using about 40 lbs. to the acre. If a man has a field of light sandy land, he uses 20 lbs. of clover and 12 quarts of herds-grass, and if he has another field of wet, clayey land, he uses 12 quarts of herds-grass and 20 lbs. of clover; no distinction

being made on account of the situation of the land or the quality of the soil; nor whether it is filled with water nearly to its surface, or dry as a last year's bird's nest. I cannot account for this, except that it is the fashion, and we have become as much wedded to it as a lady to a fashionable bonnet.

We have many grasses that will make as good hay as herds-grass or red clover, and some better than either; although for reasons which I shall give hereafter, I would upon no consideration dispense with red clover.

Grass is an indigenous product of our soil, and wherever lands are left without seeding, such grasses as are best adapted to those lands will spring up and flourish. Let us then look at nature, and if we must sow clover and herds-grass, let us also sow not only two or three other kinds, but all the varieties adapted to those soils.

You may, perhaps, think you will overstock your soil by getting on too much seed, or too great a variety, but I have yet failed to see the thing done, and I never heard of but one instance. H. S. Collins of Collinsville, Conn., uses these words: "Ordinarily we do not use enough grass seed. Often not over one-half the ground is occupied. I once put on too much seed. The land was very rich, and I used Timothy alone. It grew exceedingly fine, and lodged badly every year before it was ready to cut. I cannot tell how much seed per acre was used."

This is the only instance to which my attention has ever been called, and I doubt the conclusion in this instance; but I do not doubt that he applied too much herds-grass seed. Probably there were not herds-grass elements enough in the soil to support the amount of seed that germinated, but at the same time there were elements in the soil lying dormant that would have supported several other varieties. If then he had sown the same amount of seed, with only one-fourth of it herds-grass and the remaining three-fourths of three other varieties, the presumption is, there would have been more hay, of a better quality, and it would all have stood upright.

As I said before, we must take things as we find them, but we are not always obliged to use them before we make some improvement; and we find much of our soil too wet for either herds-grass or clover to grow successfully. In such cases I would first under-drain, and then, if I must, sow herds-grass and red clover, because it is the fashion. I would add red-top, because it is better adapted

to such soils than either of the others. Red-top will produce more hay per acre than either herds-grass or red clover—will continue growing and thickening at the bottom, and remain green longer than either of the others, and consequently will be more liable to be cut, cured and housed before it passes its prime, and therefore make better feed. But I would not stop here. This is a step in the right direction, but not yet sufficiently radical.

An examination of rich pastures will frequently show you fifteen or more distinct varieties of the grasses growing closely together, and with none of those vacant spaces, which are often to be found in our newly seeded meadows, with their roots so completely united that one cannot be removed without destroying several others; and all these native grasses nourishing food for sheep, cattle and horses. In some parts of England where neither soil nor climate are better than ours, a single shovelful of turf will show *thirty* different varieties; and an acre of such pastures will fat an ox, and at the same time give good grazing for four sheep.

If these native grasses will thus spring up voluntarily and flourish in our pastures, can they not be made to flourish more abundantly in our cultivated fields by seeding? And does that not show conclusively that those soils are well adapted to all those varieties? I would then make another step in the right direction; and instead of seeding with herds-grass and red clover, with an occasional sprinkling of red-top, I would select several or all the different varieties that are adapted to my soil, and sow them together, but more abundantly of those particular varieties that were specially adapted to different fields; bearing in mind at the same time, that it is better to sow in any one field, those varieties that ripen at the same time.

The grasses most common and peculiar in New England, all of which are to be found in this State, ripen in the following order: Spear-grass, meadow-foxtail, sweet-scented vernal and white clover, which ripen in May, or in the colder parts of the State, not until the first week of June. Following these, from the middle of June to the middle of July, are June grass, orchard grass, herds-grass, the several varieties of fescue, rye grass and red clover, with a great many more of less importance. From the middle of July to the middle of August, we have red-top, fowl-meadow and blue grass, with some of less note that continue green until killed by frost. Here we have a dozen or more of the most prominent, which may be all that are necessary for common

use, but in cases of necessity as many more might be added to the list, any one of which, when made into hay would not be disdained by our lean and hungry kine.

It is contended by some farmers that they raise of herds-grass and red clover all their soil will support. In one sense that may be true, and that is one reason why vacant spaces are found in so many of our newly seeded fields. But different varieties of grass require different elements from the soil; and while these two are taking all the elements that are in the soil necessary for their support, may there not be, and are there not, probably, many other elements lying dormant which would support some of the other grasses; which would fill up all those vacant spaces, and add largely to every year's product? This is one of the reasons why I would sow several different kinds at the same time. I do not think there is any great danger of overseeding. I once heard of a man who made the remark, that "he had sown as much as three pecks of rye to the acre, and he did not think there was the least danger of sowing too much." In his case there was not; and in sowing grass seed, remember the more seed the finer hay; and I presume your stock, as well as mine, will take fine hay in preference to coarse.

It may not be out of place here to speak more fully of the relative value of some of the grasses. Timothy or herds-grass has generally been considered the king of New England grasses; but in my estimation it is not entitled to that position. It is composed almost wholly of one single straight stalk, with a small amount of leaves, and it changes suddenly from starch and sugar to hard woody fibre, by not being cut exactly in the right season. Its principal root is a bulb, and the fibrous roots do not enter so deeply into the soil as the roots of some other varieties, consequently it is more easily affected by droughts.

I presume you have all seen, at a little distance, what appeared to be a splendid field of herds-grass, that from your stand point showed two or more tons per acre; but upon examination you find one very grave reason why there should not be; and that reason is, there are not more than half stalks enough to do it. You can almost travel through the field without stepping upon a single stalk. One great objection to this grass, is too much stalk and too little leaf. Standing by itself it is too open, letting in the hot sun to burn and parch the soil. Another is its bulbous root, which has too many enemies, and whenever the bulbs are

destroyed the whole is gone. Mice, every winter, destroy an almost incredible number. Wherever fall feeding is practiced, (and it will be to a considerable extent, let you or I say what we will to the contrary) sheep and horses destroy as many more, They are very fond of them and will get them whenever and wherever they can. They graze very close, and wherever a bulb shows, they take it, even if they take a little of the soil with it. The consequence is herds-grass runs out sooner than almost any other grass. In some places in Piscataquis county, herds-grass has rusted so badly for the last two years as to be almost worthless.

Four years ago I saw two and a half tons of clover and herds-grass cut from one acre of ground, and probably more than three-fourths of that was clover. The next year there was scarcely one and a half tons, and the larger part of that was herds-grass. The third year there was less than one ton and no clover, and last year there was less than three-fourths of a ton, including the herds-grass and all the native grasses and weeds that had volunteered to assist in making up the crop. And in this case the native grasses and weeds amounted to more than the herds-grass. You may well ask, why this failure? To me the reasons are plain, for I know the land and the manner of cultivation. The reasons are—want of drainage—want of manure and clean cultivation—want of sufficient seed, and want of variety of seeds. If that same field had been attended to as it should have been before seeding, and orchard grass and red-top taken the place of the other two, or sown with them, with an addition of two or three native grasses, it would probably have yielded as good a crop the tenth year as it did the third.

Orchard grass is more luxuriant in growth and quite as nutritious food either for grazing or for hay. It furnishes grazing earlier in spring, roots deeply and is consequently less affected by the droughts of summer, and continues growing until covered by the snows of winter; and yields a more abundant harvest than any other grass, with one exception.

In speaking of it, Mr. Hyde of Lee, Mass., quotes the following from the late Judge Buel, who was one of the most discerning observers of everything pertaining to agriculture: "The American cock's-foot or orchard grass is one of the most abiding grasses we have. It is probably better adapted than any other to sow with clover and other seeds for permanent pasture, or for hay, as it is fit to cut with clover, and grows remarkably quick when cropped

by cattle. Its good properties consist in its early and rapid growth and its resistance to drought. Sheep will pass over every other grass to feed upon it. I prefer it to almost every other grass."

He quotes from Mr. Sanders of Kentucky, who says: "My observation and experience have induced me to rely mainly on orchard grass and red clover. Indeed, I sow no other kind of seed. These grasses mixed make the best hay of all the grasses for this climate. It is nutritious and well adapted as food for stock. Orchard grass is ready for grazing ten or twelve days earlier in spring than any other. When grazed down and the stock turned off, it will be ready for re-grazing in less than half the time required for Kentucky blue grass. In summer it will grow more in a day than blue grass will in a week." This is the testimony of a man from the grass-growing State of Kentucky, where we have been led to suppose that blue grass was the king of the grasses. Many other eminent agriculturists might be cited who would confirm the testimony of these two, but this is sufficient.

Mr. Hyde further says: "I would advise no man to sow it on his lawn, for it would need cutting every morning before breakfast. We have had it in one field for eight years, and see no diminution of the yield, though cutting two crops regularly each year. If cut while in blossom, both cattle and horses are exceedingly fond of the hay and do well upon it."

If sown by itself it is much inclined to grow in tussocks, leaving many vacant spaces in the soil. So will some of the other grasses; but this is not an objection to it, but only another reason why no one grass should be sown by itself; but sow a sufficient number of varieties to take into requisition every element of the soil that is fitted for plant food. Another objection is, that it loves a deep, rich, moist soil. I have no doubt that upon such a soil it will produce as much or more than any other grass. But what grass does not love just such a soil, and if you have not such a soil, make it so by deep plowing and manuring. From what I have seen and read of this grass, I have become convinced it will become the standard grass before the King of the Earlies takes the place of our old Early Sebec potato.

The next to which I call your attention is red-top. It has been supposed that this grass would grow only on low, wet, swampy lands, but experience has proved that it will grow on almost any soil that will sustain herds-grass or red clover. If sown with

those grasses it will scarcely be seen the first year, but upon close examination will be found to occupy all the spaces between the herds-grass and clover that would otherwise have remained vacant. But as the clover dies out the red-top takes its place, and furnishes for neat stock, a large amount of hay of the first quality. It is a little later in coming to maturity from the seed, but after it has once ripened its seeds, it starts as early in spring as any other, except orchard grass, and continues thickening at the bottom until the seed is ripe, and even after that there are an abundance of green leaves. It will produce more to the acre than herds-grass if sown by itself as a standard crop, by reason of its compact mass of stalks and leaves.

George F. Platt of Milford, Conn., says: "The rule we follow for seeding is, three quarts clover, four quarts herds-grass, and one half bushel red top." In that place red top is the standard grass.

C. H. Brown of Gilead, Conn., another place where the hay is fed on the farm, says: "I think red top makes the best hay for working oxen."

F. P. Bissell of Hebron, Conn., says: "Red top is the best grass I have found for pasturing." And he gives the market value of the different kinds of hay, thus: Red top, \$20 per ton; herds-grass, \$18; and other upland grasses from \$12 to \$15 per ton.

T. Lyon of Danbury, Conn., in giving his opinion of the relative value of the grasses "considers clover the least valuable of all the grasses." He calls clover a grass, but he is excusable in that as he comes at the truth afterwards. "Timothy stands next. Red top and the natural grasses first. Many class Timothy first on the list, but unless it is cut very early it is the least nutritious of all."

Without speaking farther of the merits of this grass, which I think has not hitherto occupied its merited position in the list of standard grasses, I will here say, that the gentlemen from whom I have quoted were correspondents of the Secretary of the Connecticut Board of Agriculture, in reply to questions put to them as intelligent, practical and successful farmers; and these replies are reliable as applied to their several localities.

While speaking of varieties, it may be necessary that I should say something of two species of clover; and I will first call your attention to the Alsike or Swedish clover.

This plant is a native of a climate and soil somewhat resembling

our own, and for that reason we may expect it to flourish here as well as in its native land. It is a very hardy plant, standing the rigors of a Maine winter better than red clover. It yields as much hay per acre and of a finer quality.

It will grow on very moist soils, a companion to red top. It blossoms a little earlier than red clover, but after the first blossoms appear it continues to branch and throw out new blossoms from four to six weeks, making it the best bee pasture I have ever seen. It can be cut for seed before the last blossoms are opened, and at the same time make very good hay.

The stalk and leaves keep green as long as long as any blossoms are forming; and if cured as all hay should be cured, without being burned up in the hot sun, the ripe heads can be threshed without breaking a straw or taking a leaf from the stalk; and the chaff thus obtained being entirely clean, will yield upwards of two pounds of clean seed to the bushel, the seed being about one-third the size of the seed of red clover. I have never seen it in pasture, but from its resemblance to white clover and its hardiness, I believe it will answer equally well for grazing, and in this opinion I am confirmed by George F. Platt of Milford, Conn. Mr. P. says: "The Alsike clover I think superior to the common white clover as a pasture grass, as it grows a foot high and furnishes much more feed. The blossom is only a trifle larger than the white, and of a beautiful pink color. One of the chief merits of the Alsike clover is, that its blossom is accessible to the honey bee, which is not the case with red clover. It was full of bees while in blossom, they seeming to prefer it to the white clover."

The habit of growth of the Alsike clover is creeping, or somewhat prostrate, and a mixture of the upright-growing and self-sustaining grasses is requisite to keep it upright.

Last, but not least, is red clover. I cannot agree with Mr. Lyon when he places red clover at the bottom of the catalogue as the least valuable.

The value of fodder does not consist wholly in the amount of nutriment cattle can extract from it, but also in part in the value of the manure resulting from its use. The bulk or weight of hay is no sure guide to its value; and so it is with manure. As I said before, "the more manure the more hay," so I can say with equal truth, the richer the manure the more hay. The manure made from a ton of oat straw is estimated to be worth \$2.68; from a ton of good English hay, \$5.85; and from a ton of red clover, \$9.64;

or nearly four dollars more than the manurial value of English hay, and almost four times as much as oat straw. Red clover contains, both in its green and dried state, a large proportion of lime, magnesia, carbonic acid and potash, and also considerable quantities of phosphoric and sulphuric acid, chlorine and nitrogen; hence its value as a manure. It roots more deeply into the soil than any of the grasses, and yields largely to the acre. It is supposed to obtain a very large proportion of its nutriment from the air and from the sub-soil, and it will grow well on almost any dry soil; and wherever used as such, it has been found to be the best manurial plant known. A well set clover lay imparts to the soil as much benefit as ten loads of common barnyard manure to the acre, and sometimes more.

Now for its hay value. Clover hay contains almost twice the amount of flesh-forming constituents that are contained in good English hay, or 22.5 per cent. against 13.5 per cent.; then clover hay is worth almost twice as much as English hay for young and growing stock. Again, clover hay contains more of the constituents essential to an increased flow of milk; consequently clover hay is better for milch cows than any other; but mind you, this clover hay was something more than the dry stalk; it contained intact all the leaves and blossoms that ever grew upon it. But I discover that this last sentence carries me into the next division of my theme, viz:

The Time to Cut Hay.

While gathering statistics for the preparation of this article, I have consulted more than fifty different writers upon this subject, and I find the different opinions about as numerous as the wives of Brigham Young. They vary in date from the 13th of June to the 1st of August. The date—that is—the month or the day of the month has nothing to do with the subject, it is the grass and of what it composed that should decide the question.

In the first place, for what do we want the hay? To what purpose do we intend to apply it? For we want the grass cut when it will best subserve these ends. The dairy man wants hay that will make the most milk, and at the same time keep his cows in good heart. The sheep breeder wants it for the same purposes. The breeder of neat stock wants it not only for these purposes, but to keep his young stock on the increase through the winter instead of leaving the barn "spring poor." But we farmers want

it for all these purposes, and also to give strength and vigor to working oxen and horses. And is there any one stage in which grass will answer all these requirements?

It is true of grass that it combines all the elements in its composition necessary to support the life and physical organization of all herbiferous animals, in a perfection attainable from no other food; for in it are united all the nutritive and fat producing constituents. Hay cut at the right time and cured in the correct manner, contains almost in perfection the same which we found in the grass. And when shall we do it?

There are generally two roads to almost everything, a long one and a short one. Necessity at this time compels me to take the long road.

Within the last two years quite a lengthy article appeared in one of the papers of this State on this subject. It purported to be written by a man who was a large mail contractor, and had for several years fed a great number of horses. His decision was, that grass for hay should be cut while in the "second blossom." He had fed many horses and carried the mail over several counties, and he ought to know just when grass should be cut.

Nearly all of our religious, literary and political papers have a column devoted to agriculture, and they too must have the credit of disseminating useful knowledge among us poor ignorant farmers; so they too must publish the same article, especially the part containing the "second blossoming." But there might be some in the State who would fail to see any of those publications; so our friend of the Maine Farmer must do his share, and he too acknowledges the point and throws up his hat. See Maine Farmer, January 16th, 1869—"The second bloom is probably the best time and is generally recognized by farmers." This then is the final decision. But they have all arrived at this conclusion without asking my opinion, and of course I shall dissent even if I am obliged to make out a minority report.

More than forty years ago, when a summer school boy, I heard this theory advocated by a man who, if he lived now, would be called an "old fogey." He always planted, sowed, killed his hogs, &c., according to the moon. He did every thing by the moon except cut his hay, and the time to commence that was the "second blossoming." And it was always with him as with every one who advocates this practice; by the second week of his haying he was always cutting *seed-hay*. When I first heard this

thing, like an inquisitive Yankee, I wanted to see it, and commenced looking for it; and I will tell you precisely what I discovered then.

I discovered that the grasses and grains generally commence blossoming at the bottom of the head, but few blossoms appearing at first, but as these fall off new ones appear a little above, and so it goes on to the top. I discovered that as fast as the blossoms dropped off the seed commenced forming. I discovered that it required from three to five days for all the blossoms to appear and disappear from a single head; and furthermore, although I have watched carefully and patiently, I never have discovered a single head of grass or grain that blossomed a second time. Do not take my word for it, but examine and investigate for yourselves; and if you believe there is a second blossoming you will have the patience to wait for it; but believe me you may wait as long as Father Miller did for the "second advent," and you will end as he did; you will die without the sight.

But I again call your attention to the question, is there any one stage of grass that will answer all the purposes required, viz: the production of milk, fat, bone and muscle? There certainly must be, for those things are just what grass is made for. The principal requirements for these ends are gum, extractive and fatty matter, albumen, &c., starch and sugar; and all these are constituents of the good grasses. It is generally considered that pasturage is best during the last half of June, or in the colder parts of the State until some days into July. It will make more milk, more fat, more growth on young stock, and more bone and muscle for working oxen and horses, than at any other time. And why? Because it contains more gum, starch and sugar at that time than at any other season. Before that time it contains more water—after that time it contains more wood. All the grasses contain these as soon as they appear above ground, and if left to themselves, as in our meadows, they continue growing with their growth and strengthening with their strength until the blossoms appear; but immediately after the blossoms appear the seed commences forming and the nutritive constituents commence changing to woody fibre; and this change is more rapid than many suppose. Chemical analysis proves that at the commencement of seed-forming there is more loss of nutritive matter in one day than the gain of one week before.

Again, if the grass in our pastures is most nutritious during the

third and fourth weeks of June and the first week of July, is it not a reasonable conclusion that it is the same in our meadows? Then that is the right time to cut it. But if we cut it then we get but little more than half a crop. Very true, and some of us will get but half a crop if we wait even until after the "second blossoming." But I am not speaking of these half crop lands; I mean where we have drained, manured and generously seeded. Suppose we do get but half a crop; we can get another half-crop by the first of August, and that makes a whole one; and that whole crop is worth enough more than a late crop to pay for harvesting both of them. That is my opinion, take it for what it is worth. You have also some of the reasons why I have arrived at this conclusion. But farther: The end and aim of all the grasses in the course of nature, is the production of seed for the perpetuation of their species. No matter how often grass is cropped, if not too closely, it will struggle on until that end is gained. It is then ready to die; and it contains scarcely a particle of those elements necessary for the production of milk, fat, bone or muscle. It is unpalatable and almost worthless. Sheep will leave it and take fir brush in preference. Some farmers prefer it after the seed has formed because it "spends better." So it does; and whatever cattle dislike most "spends" the best.

But before going farther, I will cite you to some authority outside of this State:

T. S. Gold, Secretary of the Connecticut Board of Agriculture in 1868, addressed letters of inquiry, concerning the grass crop, to the farmers of every town in that State; and among these inquiries was this: "Time and manner of cutting and curing hay?" I have examined the replies published, (thirty-two) and nearly all of them say, "cut grass while in blossom," and they give the same reasons I have given before. Not one of them says *commence* when your grass is in blossom, but "*cut it then.*" In all the replies, not one has mentioned the "second blossoming;" and I sincerely believe that in the State of Connecticut, Timothy has a steady habit of blossoming but once.

Mr. Gold, in summing up the replies makes the following very pertinent remarks: "As to the time of cutting hay, it would seem as if the testimony here presented would be sufficient at once to convince us of our delinquency and insure a reform. The average time of cutting hay is at least two weeks too late. (The time mentioned for commencing, by nearly all of them, was June

20th.) The proposition is here presented as being true, that if all the grass in the State was cut at the proper time, instead of tolerating the present delay, the saving would amount to as much as the entire cost of securing the crop. The loss consists not only in the quality of the first crop, but also in the failure of the second. The grass loses in quality and substance, more than it gains in bulk. Such hay spends well, not because it is nutritious, but because it is unpalatable to the cattle and they refuse to eat it."

I cannot leave this part of my subject without calling your attention to some remarks made by Dr. Fisher, at a meeting of the Massachusetts Board of Agriculture, at Amherst, last year. He is an eminent practical farmer of Fitchburg :

"I believe in the early cutting of grass, and I presume I believe in an earlier cutting of grass than any gentleman in the hall. I believe that grass should be cut just when cattle like it the best, and that is long before it is in flower. If you will give cattle their choice, you will find that they will take invariably the earlier and shorter grass, before it throws up its flower-stem. It may be that if you cut grass at that time you get but a small crop ; but it is just as much better as it is smaller. I have been experimenting upon this subject for some years, and I have concluded that the best time to cut herds-grass, if I can have my choice, is just when the seed-stem begins to show itself, and when the grass averages from ten inches to a foot in height. At that time the grass contains more nutriment than it does afterwards, because as it goes on it changes to woody fibre very much faster than it increases the soluble ingredients which serve for the nourishment of the animal. I therefore intend to cut my grass at that time. I used to make the same mistake that almost everybody does. I did not begin to cut my grass until my first field was ripe, and the consequence was, when I ended, my last grass was spoiled, which is the case with a great many farmers.

It is important to cut all grass when it is in good condition, and the only way we can get along with it is to cut the first too early. I watched mine this year daily, and I came to the conclusion that if I had cut it all on the 15th of June, it would have been worth more money to me than if cut later. I began about the 13th of June and finished on the 3d day of July.

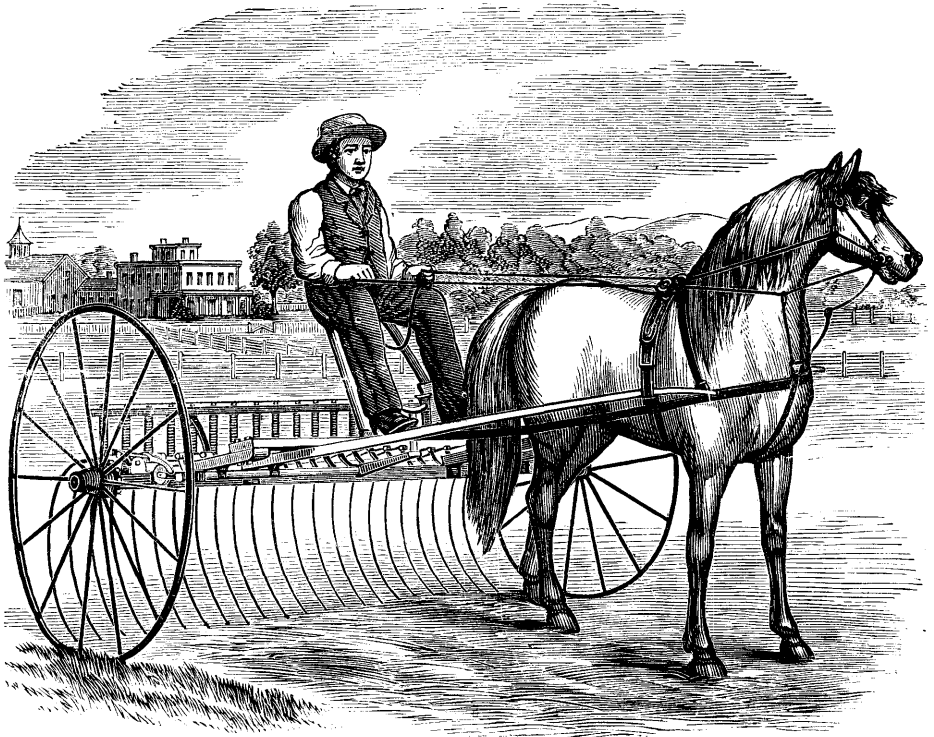
I cut my herds-grass before it had shown a blossom, and I should be willing to put that hay before cattle by the side of any other hay, and if they did not take mine in preference to any cut



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New England and Maine State Agricultural Societies, Portland,	-	1869.
Vermont State Agricultural Society, Burlington,	- -	1869 & 1870.
Conn. River Valley Agricultural Society, Brattleboro',	- -	1870.

later, I am greatly mistaken. Then there is another thing to be considered. You get a second crop, which is large and of equally good quality. It does not disturb the digestion of animals as rowen often does; and certainly two crops are worth more than any one that can be got off the land.

The effect of this upon cattle is just like grass—a great proportion of it is soluble, and animals thrive well upon it; takes less to keep them; they will give more milk, make better looking butter and more of it. Such hay will do admirably for horses. Town or city horses kept on it will hardly thank their owner for a run at pasture, and they will thrive on a smaller quantity than otherwise. I have two horses now which have been kept for some years upon six quarts of meal daily, and late cut hay. It required that amount to keep them in condition. I now give them only two quarts of meal (and have given them only that quantity for the last year and a half) in combination with hay that I cut early, and they are in better condition than they were two, three or four years ago. I consider them the best arguments I can produce. They certainly thrive better on two quarts of meal and the hay they get now, than they did formerly upon six quarts of meal and late cut hay.”

I intended to leave this part of my subject here, but I must add, that instead of following all the old foggy notions of our grandfathers, it is better occasionally to take a lesson from our good old grandmothers, who were always ready to assist us with their *herbs* in all the ills that flesh is heir to. They knew before you or I were born, that all kinds of herbs were almost worthless after they had passed the blossom. They always cut them when in full bloom or before. God bless the ladies; what should we do without them? Instead of standing as we now do in this enlightened and progressive age; we should probably be just emerging from the days of barbarism. And I come now to the fourthly of my text, viz :

The Curing of Hay.

Judging by the various practices of our farmers, we may conclude that opinions in regard to curing hay are as numerous and diverse as in regard to the time for cutting; but among them all there can be but one right way of doing it.

We should first consider for what purpose we want it, and then how we can best gain our object. Is our labor to be bestowed

merely to get it dry for winter's use? or is there some other object to be gained? I have stated before what we want of it. It is to make milk, fat, bone and muscle. If our grass is in the right stage to do that, then we should preserve it in as near that condition as possible. Let us take another lesson from our good old grand-mothers, and preserve it as they did their herbs, in the shade, thus saving all the nutritive elements contained in it. Yes, but they tied their herbs in small bundles and hung them in the shade; and we cannot do that with all our hay. Very true; then let us do the next best thing, and dry it in the sun as little as possible.

"Make hay while the sun shines," is an old proverb and seems to be understood by many that we must keep our hay opened to the hot sun until it is completely dried up, and that hay cannot be made at any other time. Hay should not be *dried* but *cured*. It should not be cut while there is any water upon the stalk, either from dew or rain; neither should it be permitted to be left more than three or four hours in the hot sun to wilt. As soon as it is fairly wilted it should be put into the cock as soon as possible. And here let me say, in regard to red clover, that one of its chief items of value, is as a manurial agent; and that is due chiefly to the nitrogen it contains; and the nitrogen is almost wholly in the leaf and flower; so that clover dried in the sun until the leaves are brittle; by the time it is pitched over three or four times as it must be, it is about as useless for hay as mullein stalks.

Grass cured with little exposure to drying winds and scorching sunshine is more nutritious than if longer exposed. If over-cured it contains more woody fibre and less nutritious matter. A little sweating in the cock is better than too much exposure to the hot sun; and the probability is that a little sweating is a benefit rather than a damage. After it is well wilted and in the cock it should not be again opened to the hot sun, as once pitching over will generally cure it sufficiently for housing. Hay should not be exposed to dews nor wet by showers while in the process of curing.

Water in whatever way it is applied, dissolves out the soluble constituents, and leaves little except woody fibre, insipid and un-nutritious, and as unpalatable and indigestible as if left standing until after the "second blossoming."

And now, Mr. President, let me add in conclusion: If, in any one of these several divisions of my subject, I have made a single

point which will assist you toward increasing the value of your hay crop, either in quantity or quality, my end is gained. I am perfectly well aware that not in one, two or three lectures can this matter be discussed fully in all its bearings; and my principal object has been to impress upon you the importance of the subject, and lead you to examination, investigation, discussion and experiment, which are the only sure guides in the pathway to success.

H. G. ABBOTT of Vassalborough. Some years ago I bought a mowing field of forty acres, which had been "run out," as we term it, and not having dressing enough to bring it into good condition, I tried pasturing sheep on it. I turned about ten acres of this field into a pasture, and put fifty sheep on the ten acres. I expected that in the course of three or four years they would subdue it and bring it into such a condition that I could plow it and get the benefit of the sheep pasture. After the expiration of one year I found that the grass began to make its appearance. I will state that the field was nothing but white weed and yellow weed; the grasses had been killed out. At the expiration of one year, as I say, I noticed this greenness coming in. I let the sheep run another year, and the next spring, on examining the field, I found there was a great change in its appearance, and I called the attention of one of my neighbors to it. He said he had been observing the same thing. I was induced from the appearance of the field to let the grass grow, and when the time came for mowing, I found the heaviest grass there that we have ever grown with any amount of dressing. Herds-grass and red-top came in thickly, and the clover was so heavy that the mowing machine would not work in certain portions. This last year I mowed it with as good results as other fields that have been under manure. What future crops will be, remains of course to be determined; but I wish to bring to the attention of the audience the importance of putting sheep on land which we intend to cultivate. A great loss is sustained by every farmer who does not pasture sheep upon his improved land. In one sense, it has cost me nothing to bring these ten acres into the condition in which they have produced this amount of hay. I may say it has been an entire saving, because we usually let our sheep run on unimproved land, which we can never cultivate. I have great confidence in that manner of managing land.

In the matter of curing hay, as all persons know, it is impossi-

ble to cut all our hay at just the right time. I suppose it takes, on the average, three weeks to harvest the hay crop; consequently we must cut some of it too early and some too late. I would like to take three days in curing hay. The first day, after the dew is off, we set the machine at work, and as soon as we have mowed and the grass gets wilted enough, (which is not till after dinner) we put it up in bundles and let it remain through the next day. The third day we throw it open, but without exposing it as much to the sun as is generally done, and then get it in. I have secured the best hay, by curing in that way, that I have ever had.

The PRESIDENT. Do you mean to be understood that the fifty sheep were kept on only ten acres?

Mr. ABBOTT. I do sir. I had a letter from the manager of the State Farm, who saw a letter I wrote to the Maine Farmer giving an account of the experiment, asking whether the sheep had water and grain. They had access to water, but had no grain or provender. They were on the ground from the spring until fall, and were in the very best condition. They had no lambs.

Gov. BROWN. I should like to inquire in what condition the pasture was; whether it was smooth and without bushes.

Mr. ABBOTT. It was, sir. The soil was a clayey loam, slanting a little to the north and west. An old field, which was in the smoothest possible condition, without a stone or a stump. It had been mown for twelve or fifteen years previous to my buying it.

Mr. WILDER. The quantity of seed named by the lecturer was large compared with the amount that many persons put on. The general practice has been throughout this State to seed our land in the spring of the year, when we sow grain, and if we sow no grain, we seed at that time without. We need to sow a large amount of seed in the spring, because the birds destroy a great deal, and much is destroyed after the seed springs up; it often comes on dry, and the young plant withers away. Now, if we will sow grass seed in October, after the birds are gone, a peck of seed will produce as many plants the next year as three pecks sown in the spring. Many farmers would be surprised to see the difference between sowing in fall and in spring, when sown without grain. It is the usual practice in some parts of the State to sow on purpose for grass alone without taking off a crop of grain. We get a large crop of hay the first year, and our crop will be larger for many years to come.

It has been said that hay is the king of crops. It is so in this

State, for without that we could do very little, if anything. I agree with the lecturer in regard to the importance of cutting hay early. If I could cut it when I want to, I would always do so when the herds-grass heads were not more than half way up. Some say this is too early to cut grass because it shrinks so much. But if you take two pairs of oxen, and feed one on hay cut early and well cured, without any meal, and feed the other pair on hay cut when the grass was in its "second blossom," with six quarts of meal daily to each, at the expiration of three months the oxen fed on the early cut hay, without meal, will be in better condition than the others. I have in my mind a five acre lot that has been mown for ten years. The owner was in the habit of cutting late, as many of us have been. He thought he would try a new plan upon that piece, and he commenced cutting early. He has pursued that course ever since; and he told me last season that he had put very little manure on that land, but the crop had increased every year since he first commenced cutting the grass early. It was his opinion that he could take an old worn-out field and increase the yield every year, by simply mowing it early. It is very important that we understand the facts in regard to this, for the grass crop is our most valuable one, and if we can feed our cattle well without giving meal, why should we not do it?

[Mr. SWEET of Oxford, in the Chair.]

Mr. PUTNAM of Aroostook. I rise to endorse what friend Chamberlain said in regard to cutting our hay early. I have been in the habit of cutting mine before the herds-grass headed out, where I mow twice. It is generally lodged some. I mow it and spread it in the fore part of the day, and about noon put the tedder on and stir it up, and then cock it up as soon as I can. I cure it without the sun. I would as lief cure hay in cloudy weather as in sunshine, if it did not rain. It wants to be *cured*, not dried so that the leaves break off. When thus cured one ton is worth as much as a ton and a half, at least, of that dried in the sun.

Such has been my practice for many years. I was brought up in Massachusetts, where they hay early. I have known people to finish haying there and then go to the St. John river, when it took three weeks to get there, and then do the haying, because they began to cut in the second blossom. I know old and woody hay does very well for tavern keepers, because they give grain also, and the horses don't eat much of such hay. But we who have

milch cows and oxen, will find an advantage in cutting hay early, and curing it properly.

When I was a boy, my father used to raise and cure tobacco. We never left it out in the sun. As soon as the tobacco was cut, it was carried into a shed and put where the sun could not reach it. Bye-and-bye it was packed down and allowed to sweat a little, and then taken up and cured in the shed. I cure hay very much as we used to cure our tobacco, and I find it is a profitable way.

Mr. WILDER. When I was up before I intended to state my mode of curing hay. It is to put the mowing machine into the field after the dew is off; and if I catch what we call a good hay day, I haul that hay into the barn at night, and spread it over the scaffold, and keep doing so until I get all the scaffolds covered. I let it lay there as long as I can, and then pitch into the mow. By treating it in this way, I find that it comes out in winter almost like grass.

Mr. THING. I don't believe in one or two men receiving all the ridicule, and I want to stand between Mr. Wilder and Mr. Putnam, and take my share. I noticed there was quite a laugh when they spoke about the second blossoming. The idea has prevailed for a great many years, that the time to cut Timothy was when it was in the second blossom. I have believed, and believe to-day, that it blossoms twice. That is my belief. I do not know whether such is the scientific fact or not; and it makes no difference. What I mean is, that sometimes, as we all know, it begins to show blossoms, and after a few days, we do not see them; then it comes out in full bloom. It is in blossom then, whether you call it first or second—luxuriant, full, sweet, fragrant. That is the time we were taught, when a boy, to cut it.

Now, if every man in this house will cut his hay as soon as that, and will cure it so as to compare with the time of cutting, he will have hay, which, if not so good as might be, will be a great deal better than most of the hay cut in the State of Maine.

There is more danger in getting hay into the barn before it is dry enough, than when it is dried too much. I don't want smoked hay, nor mow-burnt hay, nor musty hay, nor sour hay. I don't want it got into the barn when it needs to be spread on the scaffold and kept there two or three days before it is put into the bay. I want a good man to put it into the bay. There is no place where it is more important to have a faithful man than there. You want your hay trod down solid. The next day put on some

old hay, if you have any, or straw, to absorb the moisture as it rises from the new hay. I believe the rule in regard to cutting grass at the time of the second blossoming is a great deal better than to begin the last day of the month, or the Monday after the 4th of July. I know of men now, who make all their farm operations bend to the one point of getting ready for haying the Monday after the 4th of July.

I do not find a word of fault with the lecture; I enjoyed it; but there was one point about which I want to say a word. It does not necessarily follow, that it is a better or more profitable time to cut hay, because if cut at a certain time, it is preferred by cattle. There is no doubt that they like it better, but the question to be decided is, when it is worth the most.

Mr. WEBSTER. I would ask whether all grass blossoms in one day? One man has a low meadow, another has high land; can all the grass be cut at the same time? Should not one wait longer than the other? Another question I want to ask is, whether hay cut just as the head comes out of Timothy, is not too laxative? It does very well for beef oxen, if you don't give too much, or give something to counteract the effect. I do not speak of this as opposed to cutting hay early. I think farmers cut it too late, almost invariably; but I should not want to cut all my hay, if I had fifty acres, when the head first blossoms out.

I have examined grass when in bloom, and there seemed to be two blossoms come out of herds-grass, but I thought no plant would really bloom more than once. One other point. I have cut hay late upon fields where wheat or oats had grown, and it would seem to be a third old stubble when I put it into the barn, and the cattle would not eat more than half or two-thirds. But when I cut early, I could scarcely find any of this stubble left. This seemed very strange to me. I would like to learn whether this hay, when cut early, does not sweeten the stubble so that cattle love it? I do not know why they should eat it if that is not the case.

Mr. M. B. SEARS of Winthrop. I came here to learn, and not to teach veteran farmers; but being a member of the Winthrop Farmers' Club, and a delegate here, I wish to give my testimony in favor of progress in agriculture. I will glance at some of the points under consideration.

One gentleman tells us that he has reclaimed his worn-out mowing lands by pasturing sheep. It is a good idea. If a man has more land under the plow than he can cultivate properly, let him

turn it to pasture, and sheep are the best animals to put upon it. Again, sheep are the best stock that can be pastured in orchards. There is no trouble about their gnawing young apple trees if they can find bitter herbs in the orchard. It is said that sheep require bitter herbs, and if there are none in the pasture they will gnaw tender fruit trees.

In regard to the second blossoming of herds-grass, I was taught it, and I have ever believed it. A few years ago, when I was able to labor in the field, I observed that a few days after my herds-grass had blossomed, it had the appearance, in the morning, of blossoming a second time. I know it is not natural that Timothy should blossom twice—nothing else blossoms but once—but I have been told that it does, and I believe it.

With regard to the time of cutting hay, I concur generally in the views that have been expressed. We used to cut our hay too late; we are now cutting earlier, and to good advantage. I have supposed that cutting grass before it seeded might cause it to run out. I own a low meadow that I used to mow after I cut my English hay. After a while, I mowed it before I cut my English hay, say the last of June or first of July, and I nearly destroyed that meadow. Whether the same result would follow in regard to English grasses, I know not.

I was told this season by a practical farmer, who has made very critical observations, that if we mow grass early it will mature earlier the next season. I throw out that hint.

With regard to curing hay, so much depends upon conditions that I can give only general rules. Everything in life depends upon conditions, and when I am asked an agricultural question, I have to answer it under conditions. This much is certain, that all grasses should be cut when they begin to lodge, and we should commence early enough in the season to secure our hay before the *third* blossom comes on any way. If we have stout grass that is lodging, we must mow it with the scythe. Perhaps that hay better lie in the swathe all day, and be covered at night to escape the dew; probably the next day it may be put in the cock. Where the grass is not lodged, and where it is more mature, the hay should be put into cock in the afternoon while it is warm, and before any dew strikes it. The second day, if it looks favorable, I would air it, and I would sun it more. But I deprecate drying or burning up hay. It is a bad way; it should be cured as much in the shade as practicable. It is better to let your hay sweat in the

cock, and then give it some air sun and get it in. If the weather promises to be favorable, I would let my hay stand in the cock a number of days. If I could be sure of the weather, I would never get any in until I got it all into the cock. I would get it into small bunches and let it stand, and get it in after it was mowed and cocked.

Now the question comes up, how much shall we make that hay? I do not recollect that that subject has been agitated here. There are various opinions about the amount of making that is necessary. The theory is obtaining about the country that we may mow our grass at the second blossoming, in the morning after the dew is off, rake it up at three or four o'clock in the afternoon, cart it in, and put it into a solid mow in a tight barn; and that afternoon mow is completed, we should put some old dry hay or some straw on top to absorb the moisture. That experiment has been tried all over the country, and I understand has proved successful. One of my townsmen says that he mows his grass in the space of seven days, and secures it all before the 15th day of July. His practice is to mow in the morning, rake up towards night, get it into the barn, pack it down solid, and he challenges any man to produce better hay than his. He says that a practical farmer who helped him put that hay into his barn, told him it must rot; but it came out bright and good and sweet. Mr. E. M. Clark of Winthrop village, tried that experiment. He cut some of his hay in a greenish state, perhaps in the "first blossom." The first lot of hay he put in was a little musty. The last, which he cut at the "second blossoming," as he termed it, is perfectly sweet and bright.

When I was a boy my father made his hay too much; he dried it up. When I came to occupy the old farm, I made it about two-thirds as much. It kept as well, and was greener, sweeter and tender, when we fed it out to our cattle. My son now has possession of the farm, and he makes hay about two-thirds as much as I did, and it keeps well. It is a fact that we formerly made our hay too much.

Now with regard to salt. I cannot conceive why any intelligent farmer should object to salting hay. Our cattle crave salt, and it does them good. We feed them with salt once a week, perhaps, in the summer time, when we turn them to pasture. Do not cattle require salt in the winter also? If cattle require salt, if salt does them good, let them have it. Now, how will you administer

it? How would you like it, if your wife did not salt your food for a week, and Sunday morning should set before you a teacupful of salt to make amends for dereliction during the week? Then why practice it upon your cattle? Give them salt in their food.

When I was twenty-two years old, I managed a noble farm in Winthrop, for an old sea captain. He let me boss it until it came to haying time, and then took command himself. But he would get in his hay not half made; sometimes not more than one-third made. I told him that his hay-mow would take fire and burn up. "Oh, no, laddie," said he. "We at Nantucket, used to know how to cure hay. We owned meadows out four or five miles, and would take our teams in the morning and go out and mow our grass, take it home, salt it well, and it always kept good. This hay, also, will keep good." I know that hay came out green. The clover was as bright as when mown, and there was no mould, no rot, no must, no sweat, no steam, no bad taste in that hay; his cattle thrived on it. But he put in too much salt, about a peck to a ton, and in consequence, his cattle were relaxed all winter. I would put in about four quarts to the ton. That is about what cattle require. If a cow eats a ton and a half of hay during the winter, she eats six quarts of salt, which is about the required quantity.

Now, how would I put that in? If I had a lot of hay in the morning that was not half made, and there was a storm coming, I would put it into my barn, and throw in six quarts of salt to the ton, and if I thought more was required, I would put in a peck. But when I had a chance to make my hay well, I would make it well, and put it on top of this green hay, and let it absorb the moisture from the salted hay beneath, and have it equalized all through the mow, even to the top.

I remember on one occasion I had eight loads of hay out one morning, and had tidings that there was to be a storm the next day. I said, "Boys, that hay must come in!" "Why," said the boys, "it won't do to get that hay in to-day, it isn't half made." "Half made or not, that hay must come in. It has got a little sweaty; break it up and let the air in, and then house it." We got in seven loads that afternoon, and salted it well. The load we did not get in lies in that field to-day. I saved seven loads of good hay by the application of salt. I should not have dared to get it in without applying salt.

I would not put four quarts of salt to the ton of English hay, if

I could cure it sufficiently without; but I would apply that amount to all swale, swamp and meadow hay, for then cattle will eat these coarser kinds with a relish. You can interchange it with English hay, and they will eat up the coarse hay better than they will the English hay, if the latter is not salted. They will eat it for the sake of the salt.

Col. Wm. SWEET of Paris. My experience in regard to salting hay is different from that of our venerable friend from Winthrop. When I commenced farming, a good deal was said about getting in hay green, and putting on salt to keep it. I tried it when I would have a load of hay a little damp, I would throw on salt, from four to six quarts to the ton. In winter, when I was pitching out hay and came to some of that which I had salted, I found the salt rattled out with the hay. That led me to think whether it was any advantage or not. I thought perhaps my salt was too coarse, and the next year, when I got in some hay that was moist, I put on Liverpool sait. I watched for that the next winter, and I found it was not dissolved. I judged I had as much salt on my barn floor as I put into my mow. I came to the conclusion it was of no use, and gave it up. If I have a load of hay that is a little damp, I put it in, but I am careful to have a dry load put on top of it.

I have had opportunity, during the last few years, to see the different methods of making hay practised among farmers in various parts of the country. I have seen men cut hay after the dew was off, shake it what they could, and put it into the mow before night. Those who practise this, however, have a different kind of barn from what you generally see. They tell me, "The lighter you can make a barn, the better it is. If you put green hay into a barn that is merely boarded, it will spoil; but make your barn tight, build up your mow, cover the top with straw or meadow hay, two or three feet deep, and the moisture will work up into that hay or straw so that it will rot, but your hay will come out bright." I have seen hay thus treated pitched out in winter and spring as bright as it was put into the barn.

I think the best way is to put the mowing machine into the field after the dew is off, and cut until about 11 o'clock. With a good machine and a good span of horses, you can cut as much as you want down in that time. After your grass is cut, put your horses into the tedder, put your boy on it, and every twenty minutes he will go over an acre of grass. After you have done this three

times, in a good fair hay day, your hay will be made enough by 5 o'clock to get in. And this I believe to be the best method of getting hay.

I have seen this method practised in many cases. Last season I drove up to a man's door about dusk. Said he, "Friend Sweet, there is the last of ten loads that I cut to-day, which grew on five acres of ground." That hay was made enough; I should not be afraid to put it anywhere. Said he, "I went over that three times with my tedder with what assistance I have had from my sons, and you can see what condition it is in." He cleared his field that night. There were a hundred tons of hay cocked up in that vicinity; the next day there came a tremendous rain storm, and all that hay was almost spoiled. With the help of a tedder he had saved his.

Mr. SEARS. My friend, the Colonel, will remember that I did not advocate putting salt in dry hay, but only in hay partially made. I would not put salt to hay that can be dried enough to go into the barn without salt, but apply it to that hay which cannot be thoroughly made.

Mr. PUTNAM of Houlton. I wish to inquire if any one here has salted his hay, putting it in green, so that it would dissolve the salt, and fed it to his cattle during winter, and got their coats off before August? I never saw the coat come off of a young animal fed on salt hay, before August. One year, when we had but little hay and a large stock of cattle, we fed them on hay that had been salted. They eat only a little of it, but they would fill themselves with water, and when they were sent to pasture, they carried their old coats, and retained them until August; and they were no bigger than they were in the fall.

Mr. GILBERT. It occurs to me, that because a man may like a salt-water bath is not conclusive proof that he would like to be pickled in brine. Persons in the habit of strewing salt on hay generally use altogether more salt than their cattle require. If salt is fed every day to stock, they will eat only a very small quantity. Four quarts of salt to the ton is much more than neat stock require, and more than they require is certainly injurious.

Now in reference to storing hay green, we farmers are very apt to run into extremes. For instance, we hear of somebody who is in the habit of housing his hay when it is scarcely wilted, and without inquiring into it much, we think it is a pretty good way to operate; it saves labor and anxiety, and we rush into it without

proper thought and calculation, and sometimes make a mistake. Let us look at it a few moments.

Reference has been made to tight barns. I have a tight barn. It is as tight as boards, shingles, clapboards, stone, lime and mortar can make it. I have had some experience in storing hay, and I have fed almost every pound of hay from that barn for ten years. I knew precisely the condition of every load of hay that has been put into that barn, when it was taken out, and I will say from my experience, that while I believe there is such a thing as drying hay too much, I believe a great deal more hay is injured by too little drying than by too much drying. I am not afraid of a little sunshine on hay; I am afraid of a great deal of rain or a little dew. I believe if you expose your hay to the sun, and take care of it, allowing no moisture to fall on it, sunshine will never hurt it.

If you have been in the habit of storing considerable quantities of hay in a single day, say six to ten tons, and have observed closely, you noticed that the top of that hay, although it may have been thoroughly made, became wet after it had been in the mow a week. When you store only one load in a day, the steam has time to pass off, and there is so little in a single load, that there is no large accumulation of moisture; but I have never yet been able to make hay enough, so that if I stowed away ten tons in one day the top of the mow would not be wet. If I found the top of that hay wet, with my drying; if I had stowed it away in a greener state, would it not have been more moist? Most certainly.

Now let us see how that will operate. Gentlemen have told us that we must put dry hay or straw over the top of the mow. We will say that a barn sixty feet long will contain ten mows of hay, five upon a side—twelve feet each. Experience has taught me that if the hay is not properly dried, there will be from one and a half to two feet on the top of each of those mows which the moisture has injured. Oftentimes portions of it will sour, and become almost worthless. That will amount to perhaps one ton upon each mow in the barn. In the whole barn, you would have, if you stored your hay when green, ten tons of hay upon the top of your mows completely spoiled; which at \$15 a ton, is \$150—more than would be the cost of curing your hay properly.

Suppose you put straw upon the top of your hay. The straw will accumulate moisture and be spoiled for any other purpose

except manure. That straw, if previously properly cured and stored in the barn, was worth at least \$10.00 a ton. So you have lost ten tons of straw, worth \$100.00. Is that economical? Would not the bestowal of more labor, in order to cure the hay, prove cheaper in the end? Most certainly it would.

Col. SWEET. According to the gentleman's figures, the straw to cover this hay will cost \$100.00. That is not the best way. We can buy a first-rate hay tedder for \$75.00, which will last a man his lifetime; and there are any number of manufacturers who will warrant their tedders to prepare your hay, in a good hay day, by going over it three times. The better way for any man whose ground is smooth enough for a mowing machine, is to use a tedder.

Adjourned to 7½ o'clock.

EVENING SESSION.

The Board was called to order by Vice President THING, at 7½ o'clock, who introduced as the lecturer, Prof. M. C. FERNALD, of the State College of Agriculture and the Mechanic Arts.

DISTRIBUTION OF RAINS.

BY PROF. FERNALD.

Mr. President, Ladies and Gentlemen:

It will be my endeavor, in the time allotted me this evening, to present the principal laws which control the distribution of moisture upon the globe, leaving the special application of those laws to our own State and to particular localities, and the relation between rainfall and fertility, to be brought out by the discussion which will undoubtedly follow. I cannot indulge the hope that what I am about to say will be entirely new to those present; but content myself with the reflection that it is often well to go over again principles and facts in nature that may have been familiar, and that we lose nothing by such review, especially when, as in the present case, we are considering a subject so intimately connected with all the interests of the farmer, for upon a proper deposition of moisture depends his success in horticultural and agricultural operations. With no more formal introduction, you will pardon me I trust, if I enter at once upon the development of the subject which is to engage our attention.

Evaporation takes place at all known temperatures, from below zero to the boiling point of water. From a mass of snow and

the process goes on slowly, and a small amount of vapor only is thrown into the air. From the surface of water at an elevated temperature, the process goes on rapidly, and consequently large quantities of vapor are thus precipitated into the atmosphere. The vapor which rises from water at a temperature of 212° , expands 1700 times; that is, it occupies a bulk 1700 times as great as the water from which it has been produced, while vapor from water at 40° expands to occupy a bulk 3000 times as great as the water from which it has generated. The altitude which vapor seeks in the atmosphere depends upon the temperature of the surface from which it has been generated. Vapor from water at 212° is capable of ascending to an elevation of about three miles, while vapor from water at 40° is capable of ascending to the height of five miles before coming into a stratum of air of corresponding density with itself. The vapor which rises at higher or lower temperatures will seek relatively higher or lower elevations, so that clouds are formed at all altitudes, from the surface of the earth to the height of seven or eight miles, this latter elevation being the height of the highest cirrus clouds.

There is nothing, ladies and gentlemen, that comes down from the clouds in the form of snow or rain, which has not first been carried up to the clouds in the form of vapor; consequently, the measure of the quantity of vapor that annually rises from the surface of the earth is, approximately, the measure of the rainfall for the globe during the year. The quantity of vapor that rises from the torrid zone, that highly heated belt 55° in width passing around the globe, is sufficient to cover that entire zone to the depth of nine and a half feet. The amount from the oceanic parts of the torrid zone is sufficient to cover the area from which it has risen to the depth of fifteen feet—so much greater is the quantity of vapor produced from water surfaces than the amount from land surfaces.

The quantity of vapor that rises from the temperate zones is estimated to be about three feet, and the amount from the frigid zones about two inches annually. The total weight of vapor which annually rises from the earth, as estimated by Mr. Wells of our own State, is in round numbers, sixty-five trillions of tons. To accomplish the work of raising this vast quantity of vapor to the clouds requires an expenditure of power equivalent to that of three trillions of horse-powers, working ten hours a day; and yet, this enormous quantity is raised to the clouds by a process so noise-

less and so perfect, that we are hardly conscious that the process is all the time going on around us; and more marvellous still, this entire quantity is let down again upon the earth so gently that injury is seldom done to the tenderest flower that blossoms upon its surface.

Inasmuch as evaporation depends upon temperature, it follows that the quantity of vapor which rises from a given surface during the warm months of the year, must be considerably greater than the quantity that rises during the cold months. At London, the amount of evaporation in the month of June is $3\frac{3}{4}$ inches; the amount in the month of January something less than half an inch. I am not aware that the quantity is accurately known for our own State, or for any special locality of the State, for the entire year.

It was determined for a few months at Orono last year. The amount of evaporation at the State College, &c., from May 20th to October 27th, extending over a period of a little more than five months, was 18.54 inches; and this was but a trifle less than the rain-fall during that period; the latter being only 90-100 of an inch in excess of the former. You will remember, however, that in that time is included the month of October, when the quantity of rain that fell in this State was nearly three times the monthly mean. The ordinary amount of rain-fall for a month in this State does not vary much from three and a half inches. The amount that fell in the month of October was very nearly ten inches.

Some idea of the difference in the amount of evaporation during the different months of the year may be obtained from the numbers which I propose to submit, indicating the pressure of vapor in the atmosphere at Orono during the year 1869; for the pressure depends upon the amount, and this in turn upon the rapidity of evaporation. When a large amount of vapor is in the air, it indicates that the process of evaporation has been going on rapidly. The pressure is indicated by the height of a column of mercury, which the vapor is capable of sustaining. You are aware that at the level of the sea, the mercury in the barometer stands on an average at the height of thirty inches, or in other words, a column of air extending to the height of forty-five or fifty miles is capable of balancing a column of mercury but thirty inches in height. The pressure of the vapor of the atmosphere for the month of January, 1869, in the locality referred to, was 0.092 of an inch, that is, the vapor in the air was capable of sustaining a column of mercury 0.092 of an inch in height. For the month of February,

0.094 of an inch; March, 0.099; April, 0.179; May, 0.279; June, 0.405; July, 0.495; August, 0.406; September, 0.415; October, 0.269; November, 0.162; December, 0.109. Thus we see that the quantity of vapor in the atmosphere in the month of July was about five times the quantity in the months of January, February, March or September.

Another point that we should consider before coming to the direct laws of the distribution of rain, is the relation between temperature and the capacity of air for moisture. As the temperature of a quantity of air is increased, its capacity for moisture is increased; and not only increased with the temperature, but at a more rapid rate than the temperature. To illustrate: (and I will use the numbers only in the way of illustration)—suppose a quantity of air at a temperature of fifty degrees is capable of containing 200 parts of moisture; at seventy-five degrees, it would be capable of containing 400 parts of moisture; at one hundred degrees, 800 parts of moisture;—the ratio of increase of capacity for moisture being greater than the ratio of increase in temperature.

Now, what results when such a quantity of air, charged with vapor, is cooled? When a reduction of temperature takes place, the air is no longer capable of retaining the moisture with which it has been charged, and a certain quantity must be thrown down in the form of rain or snow; in other words, precipitation takes place, and upon this simple principle depends the entire rain-fall for the globe.

The quantity of rain-fall for the globe is undoubtedly very nearly uniform from year to year. Its distribution over the earth's surface is, however, subject to great variation, but is dependent upon fixed and definite laws. The general law which we will first notice, is known as the law of latitude; that is, rain-fall is greatest at the equator, and diminishes from the equator to the poles. Rain-fall is greatest in the region where evaporation is greatest, and evaporation is greatest where the temperature is the highest. Hence, rainfall is greatest where there is the highest temperature, and, as we should expect would be the case, the quantity of rain that falls at the equator is in excess of that which falls in other parts of the globe, and as the temperature diminishes the quantity accordingly decreases from the equator to the poles. The annual rainfall at the equator is 104 inches; the amount of rainfall 10°

from the equator, 85 inches ; 20°, 70 inches ; 30°, 40 inches ; 40°, 30 inches ; 50°, 25 inches ; 60°, 20 inches. For our present purpose, we need not trace the rainfall into higher latitudes.

Now, were there no circumstance to modify the distribution of rain other than that of latitude, there would be a direct ratio between the quantity of rainfall and the latitude, which is not strictly the case, since there *are* certain modifying conditions which come in to control the distribution of rain, other than the condition of latitude. Before treating, however, of those modifying circumstances, permit me to state, by way of comparison, the quantity of rainfall in the different zones of the world, contrasting the old world with the new.

Within the tropics of the old world the annual rainfall is 76 inches ; within the tropics of the new world, 115 inches. The mean for the torrid zone is about 96 inches. The annual rainfall in the north temperate zone of the old world is 34 inches ; in the new world, 39 inches ; the mean being about 36½ inches. The annual rainfall for the frigid zone is estimated to be about 15 inches. You will remember that the amount of evaporation there is but two inches ; the rainfall therefore is very much in excess of the evaporation, and hence the vapor which supplies it must be drawn from lower latitudes.

The first modifying circumstance of the general law which has been given, is that of the prevailing winds ; that is, rainfall is influenced by the direction and character of the prevailing winds.

We have here a globe representing the earth, which, for the moment, we will suppose to be stationary. Now, while the sun is pouring down his warm rays upon the equatorial parts of the earth, the temperature here is raised higher than the temperature at any other portion of the globe. The result is an ascensional amount of hot air is produced in the region of the equator, which ascends and falls back towards the pole, one part going toward the north pole, the other toward the south pole. If the earth were a stationary body, at the same time with the rising and falling back of the heated air, cold currents would come in from the north and from the south to supply its place, and were it not for the constituents which intercept and deflect these currents, the only winds we should experience upon the globe would be the surface winds from the north and from the south.

Now, the earth has a motion upon its axis from west to east. At the equator that motion is something more than a thousand miles

per hour ; at the poles, the amount of motion is zero ; and between the poles and the equator, every degree of velocity between zero and a thousand miles per hour is represented. The cold currents of air starting from the poles and moving equatorward, as they come up over those portions of the earth moving at a rapid velocity, unable to keep pace with that velocity, fall back, and the consequence is, in the northern hemisphere, the wind blowing down from the north, instead of keeping pace with the earth's acceleration in its lower latitudes, falls back, and gives us a wind from the northeast, known as the northeast trade wind. How is it in the southern hemisphere ? The wind blowing from the south towards the equator, unable to keep pace with the motion of the earth, as it comes up into those regions where the motion is rapid, falls back in a similar manner, and gives us a wind from the southeast, known as the southeast trade wind. Thus we have two winds, the northeast trade wind in the northern hemisphere, and the southeast trade wind in the southern hemisphere. These winds prevail from about 30° north to 30° south of the equator.

As these winds come together at the equator and mingle, there is formed what is called the equatorial calm belt—that belt from which the heated currents of air rise. This is not a fixed belt, extending around the globe at the equator, but moves north and south with the sun. When the sun passes north of the equator, this belt moves north ; when the sun goes south, it moves south also ; and thus it sways backward and forward by a gradual movement throughout the entire year.

These trade winds constitute what are known as “periodical winds.” And while speaking of these, I may as well notice another set of periodical winds, which, unlike those that blow in the same direction throughout the entire year, prevail in one direction during one half, and in the other direction during the other half of the year. I refer to the monsoons of the Indian Ocean. During the summer months, when the sun is north of the equator, the lands forming the southern portion of Asia become very highly heated, and the winds from the Indian Ocean prevail in the direction of the heated belts of air thus produced. As the heated air rises the colder air of the ocean rushes in to take its place. The result is, that from the month of April to October, the prevailing wind in the Indian Ocean is from the southwest. During the remaining portion of the year, the southern part of Africa becomes highly heated, and ascensional currents of warm air are produced ;

the colder winds of the Indian Ocean come in to take the place of the heated currents; and thus a wind prevails from the month of October to the month of April from the northeast. Thus we have the monsoons—a northeast wind prevailing during one-half of the year, and a southwest wind during the other half of the year. The continent of Australia and Arabia are two opposing masses of land which determine also the direction of currents of air; so there is a wind which prevails during one-half of the year toward Australia, and during the other half toward Arabia. But the principal winds of the Indian Ocean are the two first noticed—the southwest and northeast monsoons.

As the heated currents of air rise in the region of the equator and fall back toward the poles, they come down to the earth in latitude about 30° north and south; and here is a banking up of winds which gives rise to what are termed “the calms of Cancer” and “the calms of Capricorn.” As the return wind escapes from this belt in the northern hemisphere, it blows in a direction opposite to that of the trade wind; that is, it is a southwest wind, and prevails between latitude 30° and 60° . So the prevailing wind in the northern hemisphere, over the ocean, between latitudes 30° and 60° , is the southwest return trade. In the southern hemisphere, the prevailing wind is in like manner in a direction opposite to the trade wind in that hemisphere; that is, it is a southwest wind, and prevails between latitudes 30° and 60° , and is known as the southwest return trade.

These belts of wind, ranging from 30° to 60° north or south of the equator, are subject to great variations, from being affected by continents, mountains, chains of hills, and many other causes which come in to modify their course; so that they are known upon the land as variable winds, although they are quite constant upon the ocean. These are the winds which prevail in our own State. They are known as the “variable winds” of the mid latitudes.

The direction of the wind at the Agricultural College at Orono, last year, was—from the northwest and west, 41 per cent.; southwest and south, 29 per cent.; southeast and east, 14 per cent.; northeast and north, 16 per cent.; very variable, as you perceive, and unlike those in tropical regions, which prevail in the same direction throughout the entire year.

Now, what effect have these winds upon the production of moisture? Allow me to take an illustration from the western

coast of Europe. The prevailing wind there is the southwest return trade. This comes to the western coast of England charged with moisture. The result is, upon the western coast of that island, there falls 45 5-10 inches of rain annually; while the annual rainfall on the eastern coast is 27 4-10; the difference resulting from the fact that the western coast is in the path of the prevailing wind, which comes to it charged with moisture from the Atlantic ocean. On the western coast of Ireland, the annual rainfall is 47 4-10 inches; on the eastern coast, 29 7-10.

If we were to take an example from the new world, we should find no better one, perhaps, than is afforded by our new possessions in the northwest. At Sitka, which is exposed to the northwest return trades, charged with moisture from the Pacific Gulf Stream, there are poured down annually, 90 inches of rain. Go over to our eastern coast, at a corresponding latitude, 60° north, and we shall find a rainfall of less than 20 inches. Sitka on the western coast of America, is exposed to a wind which has received its character from the ocean; whereas at the same latitude on our eastern coast, the wind has passed over mountain regions, and although it may prevail in the same direction as before, is a dry wind, since it has been robbed of its moisture.

Were we to take examples illustrative of the path of the trade winds, we should find no better examples than on the eastern coast of South America. At Paramaribo, the capital of Dutch Guiana, the annual rainfall is 229 inches. At Guienne, the capital of French Guiana, 21 inches of rain have been known to fall in a single day. Compare these results with the rainfall in our own State. Last year, during the month of October, when the quantity was three times that which usually falls in the same period of time, less than two inches fell, while at Guienne, 21 inches fell in a day. Do the character and direction of the prevailing winds have nothing to do with the distribution of rain? At Maranhao, a little further down the coast, south of the mouth of the Amazon, the annual rainfall is 276 inches—about 23 feet; whereas, on the western coast, the rainfall is almost down to zero. When the southeast trade winds, charged with moisture, come to the eastern coast, they pour down a part of their treasures of rain, and as the clouds which are formed sweep over the eastern part of South America and reach the Andes, they pour down upon the eastern side of those mountains, the remaining moisture with which they are charged; and when they pass over the Andes, they are

consequently dry, and hence the rainfall is extremely limited upon the western coast.

The second modifying circumstance, is that of proximity to or remoteness from the ocean, which materially influences the quantity of rain. Allow me to take an illustration, as before, from the western coast of Europe. The annual rainfall along the western coast of Great Britain, France, Spain and Portugal, ranges between 30 and 50 inches. The amount at Coimbra, Portugal, is 111 inches. Now, go inland to the region of Poland and Russia, and we find the annual rainfall is only 15 inches. East of the Ural mountains, it is 13 inches, and further east, in Siberia, the amount is still less. These differences result from difference in location, in respect to large bodies of water. Those portions of a continent in the path of the prevailing winds, and near the coast, receive bounties of rain, while those portions that are interior are deprived of any large amount, from the fact, that the clouds are robbed of their moisture before the interior lands are reached.

In latitude 45° , on our eastern coast,—a latitude a little north of Bangor, in our own State—there is an annual rainfall of 40 inches. If we follow that parallel of latitude west, we find in Michigan, although that State seems to be almost surrounded by the waters of the great lakes, the annual rainfall to be but 30 inches. Further west, in Minnesota, on the same parallel, it is 25 inches; and in Dacotah, where the Missouri crosses that parallel, 15 inches. Further west, the amount is still less.

The number of rainy days diminishes in a corresponding proportion. On the western coast of France, the number of rainy days in the course of a year is 150. In the interior of France, 147—a slight reduction. On the plains of the Volga, the number of rainy days in a year is 90; and east of the Ural mountains, in Siberia, the number is 57. In like manner a large number of examples might be cited to illustrate the principle, that the quantity of rainfall is influenced by proximity to or remoteness from the coast, but those given, I trust, are sufficient for this purpose.

The third modifying circumstance which should be noticed is that of elevation. The quantity of rainfall is influenced by elevation above the level of the sea. At Berne, in Switzerland, at the foot of the Alps, there falls annually forty-three inches of rain. Eight thousand feet up the side of the mountain, at the Great Saint Bernard, the annual rainfall is sixty three inches. On the island of Gaudaloupe, one of the Caribbean islands, there is a

mountain about 5000 feet in height. At the base of that mountain the annual rainfall is one hundred and twenty-seven inches. On its summit there falls annually two hundred and ninety-two inches. We ordinarily say that this difference is due to the fact that the mountain acts as a condenser, but in the sense in which we ordinarily understand that a mountain acts as a condenser, this is not the case. Were the sides of that mountain of molten lava, the difference between the rainfall at the base and at the summit would be greater than it now is; were its sides of lava, when vapor-charged clouds should roll up its slopes, their temperature would be increased, and hence their capacity for moisture be increased; and since the capacity for moisture increases more rapidly than does the temperature, instead of pouring down rain at the base, no precipitation would follow, but they would ascend until they should come into a stratum of cold air, in which condensation would ensue, and then the large amount of moisture secured by their high temperature would be thrown down. The difference therefore, between the quantity at the base and at the summit would be greater, were the sides of the mountain molten lava, than would be the difference from their present condition. It is the cold of elevation that produces condensation of moisture and causes precipitation of rain, and not the mountain, in the sense in which we ordinarily understand mountains to act as condensers. It is undoubtedly true that the coldness of a mountain does serve to condense; but were the mountain warm the condensation would be greater when the clouds should have passed up into that stratum of air where the necessary chilling effect would be produced.

On the western coast of Hindostan is a range of mountains, at the top of which, near Bombay, there fall annually seventy-eight inches of rain. Forty-five hundred feet up the sides of the mountain the annual rainfall is two hundred and fifty-four inches—the large difference resulting principally from the cold of elevation. Just over the other side of the mountain, the amount is but twenty-three inches. The cause of this marked difference will be noticed before the conclusion of the lecture.

The largest amount of rainfall at any single point on the globe, is probably in the southern part of the Himalaya Mountains, about 3000 miles north of Calcutta. There, at an elevation of 4500 feet, are poured down annually six hundred and ten inches of rain. You have observed, undoubtedly, from what has been stated, that

excessive falls of rain take place only at certain elevations. In India, that elevation is 4500 feet. The rain clouds pass up to that altitude before the chill of condensation takes place, which secures the greatest amount of precipitation. When the clouds pass to a higher elevation, since they have been robbed of their moisture, the amount of rain that falls from a greater altitude is less than the amount at about that height. In India, as I have said, 4500 feet is the altitude of greatest precipitation. In England, it is only 1900 feet, and at that height in the atmosphere the largest amount of precipitation takes place.

The fourth modifying circumstance is proximity to mountains. Rainfall is influenced by proximity to mountains; not so much from the chill of elevation, not so much from the direct effect of mountains as condensers, as from these causes together with the movements of the air which the mountains themselves beget, by which their influence is extended beyond their base. At Vera Cruz, on the eastern coast of Mexico, just west of the Gulf, there is an annual rainfall of one hundred and eighty inches, which is about twice the mean quantity for the Gulf of Mexico. The cause of this is traced to the range of mountains just west of the city. The influence of the mountain is extended beyond its base to a distance of several miles around. The quantity of rainfall is greater moreover upon the windward than upon the leeward side of mountains. In the Scandinavian peninsula, at Bergen, Norway, the annual rainfall is 82 inches. Just over the other side of the peninsula, at Stockholm, it is 21 inches. The western coast of Norway, the windward side, is exposed to the prevailing southwest wind, and hence the much larger rainfall than that on the leeward side. We have an admirable illustration of this principle in South America, where is found the grandest river system in the world; the Amazon carrying down to the ocean, a burden of water more than three times as great as that conveyed by any other known river. We have here in this river system not only the Amazon, but the La Plata and the Orinoco, noble rivers supplied by the abundant rains on the eastern slopes of the Andes. Here the principal rainfall takes place on the eastern side of the mountains, very large quantities of rain falling on that side, while the amount on the western side is very small indeed; so small, that along the western coast of Peru, for the distance of 700 miles, the region is entirely destitute of rain, not a drop falling once in a century.

The fifth and last modifying condition which I shall notice, is the effect of the nature of the soil as cultivated or not cultivated, upon rainfall. The influence of the nature of the soil upon precipitation, and hence upon the climate of a country, depends upon its greater or less power to absorb and radiate heat, as also upon its power to transmit over its surface the water which may fall upon it, as rain, or be deposited as dew.

It would hardly seem to be in the power of man *so* to modify the action of physical forces *as* to determine the amount of heat and moisture for any considerable portion of the globe. It is undoubtedly true, however, that by changing the conditions under which the forces of nature act, he may modify the temperature, and hence the distribution of moisture over limited areas.

The effect of denuding land of trees and other vegetation is to expose it to the full action of the rays of the sun, by which its surface, in summer, acquires a temperature higher than that of the surrounding cultivated land or forest, and this warmth imparted to the stratum of atmosphere above, gives rise to ascensional currents of heated air. Now, when vapor-bearing winds mingle with this heated air, their temperature is elevated, condensation cannot follow, precipitation of rain cannot take place. Let the same winds pass over a forest; the surrounding air cooled by evaporation reduces their temperature, and immediate precipitation is the result.

Coulter has well said: "The ocean, winds and woods, may be regarded as the several parts of a grand distillatory apparatus. The sea is the boiler in which vapor is raised by solar heat; the winds are the guiding tubes which carry the vapor with them to the forest, where a lower temperature prevails. This naturally condenses the vapor, and showers of rain are thus distilled from the cloud masses which float in the atmosphere, by the woods beneath them."

The destructive effects of removing trees from large tracts of country and the beneficent results attending the replanting of trees, are matters of historical record. From Marsh's "Man and Nature," we learn that the terrible droughts which desolated the Cape Verde Islands, by which 30,000 persons perished, are attributed to the destruction of the forests; that the planting of 20,000,000 of trees by Mehemet Ali in Lower Egypt, has secured frequent rains throughout a region of country seldom thus visited before.

To enter upon a full discussion of this intricate but interesting

subject, viz: "The Influence of Forests upon Climate," would require more time than can be devoted to it, when incidentally treated as a single point in a lecture already too long protracted, and to do it is entirely foreign from our present purpose.

It should be stated, however, in a single brief sentence, that while forests may not sensibly effect the mean temperature of the globe or the total quantity of precipitation, they unquestionably do promote the frequency of showers and equalize the distribution of rain through the different seasons.

The subject of the proper distribution of forest trees, in their relation to climate, may well engage the attention of the agriculturist, for although, in the main, his success depends upon the action of forces which he cannot control, the distribution of moisture is dependent upon conditions which he may determine, to a limited extent, according to his will. It remains for us, ladies and gentlemen, to consider the surface of the globe with reference to the character of rainfall; and for this purpose the globe may be divided into regions of periodical rains, regions of frequent rains, and rainless regions.

The periodical rains prevail principally within the tropics, more accurately within the belt of the trade winds; and within this belt there is one rainy and one dry season in the course of the year, the rainy season prevailing in the northern hemisphere, when the sun is north of the equator, and the dry season in the northern hemisphere when the sun is south of the equator. Over certain portions, however, of the torrid zone, there are two rainy and two dry seasons. That portion known as the equatorial calm belt, is a region of almost constant precipitation. It sways north to 12° north of the equator, and south to 50° south of the equator. This belt is some 6° in width. As this moves north of the equator with the sun, it pours down volumes of rain upon the region over which it passes; and then returning with the sun, it pours down again its burden of rain, so that any locality over which it twice passes is twice visited by a rainy season, and hence has two rainy and two dry seasons. But, for the most part, in the torrid zone, there is a single rainy and a single dry season, and during the former, the entire rain for the year falls. The rainy season in the northern hemisphere extends over a period of about five months, commencing perhaps with April. The character of a tropical rainy day is entirely different from a rainy day in our latitude. In general, the sun rises clear in the morning; about ten o'clock

clouds begin to form; about twelve o'clock the rain begins to pour, and it continues to pour until four or five o'clock in the afternoon, when the clouds break away and the evenings are glorious, and during the night not a drop of rain falls. A similar succession of changes occurs throughout the days of the entire rainy season. How unlike the rainy days or rainy seasons of our own latitude. Indeed, our rainy season is throughout the entire year. It may rain here at any time, as we know. It may rain in the night or in the day, and a storm may continue one day or during a number of days. But in the tropics, all these phenomena of nature seem to be periodical in their character. The winds (constant) prevail there in one direction throughout the entire year, save in the Indian Ocean, where they prevail in two directions—as monsoons; but the character of the rainy days is the same from day to day and from year to year.

In the large peninsulas of southern Asia, there is one rainy and one dry season. During the time that the northeast monsoons prevail, the eastern coast of these peninsulas are flooded with rain, and the western coasts are nearly or entirely dry; while during the time of the southwest monsoons, the western coasts receive *their* bounty of rain, and the eastern coasts are dry. In the southern part of South America the rainfall is also periodical. You will observe (a large map was used) that the southern part of South America is in the path of the return trade winds, and since these winds come to the western coast charged with moisture, rain is precipitated during the winter months, when the land is colder than the surrounding water, and hence seems to produce condensation. Indeed, at the southern extremity of South America, rain is said to fall nearly all the time. In California also the rainfall has a periodical character; and here also the rainy season is during the winter months. Rain does not fall here in summer, for the reason that when vapor-bearing clouds, borne by the southwest return trades, reach the coast, the lands are more highly heated than the ocean, the temperature of the clouds is raised, their capacity for moisture increased, and hence no precipitation can take place; but during the winter months, when these warm clouds come in contact with the cold summits of the mountains, their moisture is precipitated and thrown down in the form of rain. Thus on the western side of the Sierra Nevadas is an abundant rainfall, while on the eastern side, between the Sierra Nevada and the Rocky Mountains, the region is dry and barren, since the

clouds visiting this region have before been robbed of their moisture.

The portions of the earth where rainfall is frequent are those portions over which the variable winds prevail, and hence embrace the temperate regions. Upon this division of my subject I need not dwell at length, for we are all acquainted with the character of the rainfall in our own latitude. We know, moreover, that we are largely dependent upon our southerly and northeasterly winds for rain. Why is this? These winds come to us charged with moisture from the Atlantic ocean, and hence the rain that accompanies them. How is it with our westerly winds? They come to us after having blown over a large extent of land, and consequently they are dry winds. So we look for a storm when the wind is from the northeast, east or south, but not when it is west. I was told by a gentleman to-day, that in a region he visited in the West, just a little east of the Rocky Mountains, a southerly wind does not bring rain. He thought it very strange when he first noticed the fact. He looked for a storm when the wind was south, and the weather was quite as likely to be dry as wet. For a very good reason, a southerly wind there must have blown over a very large extent of land before reaching that locality.

The rain of the southern part of the United States is due to moisture from the Gulf of Mexico, the southwest return trade winds serving as carriers for the vapor-bearing clouds.

The principal rainless region of the globe commences on the western coast of Africa, and extends 1200 miles in width, across the northern part of Africa, over the Red Sea, over Arabia and Persia, nearly to the Indies, and is continued north of the Himalaya mountains, over the highlands of Thibet, the Desert of Gobi, and part of Mongolia. On the western continent, the principal desert region is that of Atacama, west of the Andes, and is 700 miles in length. What is the reason that these regions are desert? The region north of the Himalaya is desert from the fact that when the southwest monsoon prevails and brings vapor-charged clouds to the mountains, those clouds are unable to pass over and still retain their moisture, but ascending the slopes they are chilled by the cold of elevation, and their condensed vapor is poured down the southern side. When the winds pass over, they are consequently dry winds, and of such a character they must ever remain on the north side of the Himalayas. The same is true of the desert region west of the Andes. The winds that come

to the Andes charged with the vapor of the southern Atlantic are robbed of their moisture on the eastern side of the mountains, and hence when they pass over to the western side, they are dry winds, and no rain can fall. The same conditions do not exist in the case of Sahara. There is no mountain wall shutting it in. Vapor-freighted winds reach that region, but it is a desert in consequence of the character of its soil. Made up largely of sand and rocks, it becomes very highly heated. The thermometer rises in certain parts of Sahara to 169°, and the currents of air that rise over that region are of so high a temperature that when vapor-laden clouds come over it their temperature is raised, and they are at once dissipated.

There are other portions of the globe not completely desert, which are visited by but very little rain. The central part of Australia, the central part of southern Africa, Central America, Mexico, and that portion of the United States included between the Sierra Nevada and the Rocky mountains, for reasons which have been assigned, receive but very little moisture. In view of what has been presented, the following questions naturally suggest themselves: Will the character of these desert regions ever be changed? Can they be changed? Is it in the power of man to do it? It may be answered as regards the desert region north of the Himalayas, that it seems doomed to perpetual barrenness. Sterility has been written upon it by the finger of the Almighty. He has reared those lofty mountain summits as perpetual tokens of His will, and by them, He says, "Thus far can the storm clouds come, but here shall their course be stayed. Down these southern slopes they shall pour their burden of rain forever." The same may be answered in regard to the desert of Atacama. *There* the Andes rise as perpetual monuments of God's eternal design, and *there* will the vapor-loaded clouds be stayed, and down the eastern slopes will be poured their treasures of rain, while their western slope must forever remain parched, barren and desolate. But is it so in regard to Sahara? We find that God has not raised any high mountain barrier around this region. The same physical reasons for the condition of desert do not exist here as exist in the case of the others. This region is visited by vapor-charged winds, and if the condition of the surface can be essentially changed, is there any good reason why that whole region may not one day be one of fertility? But how can this be done? I am unable to answer. We know, however, that trees may grow upon that

desert. They are found on the oases; and we know too, that every vestige of vegetation that now appears is cropped by the camels, or is trampled down by the caravans that pass over those regions.

Now, when man shall put his hand upon that region and stay those caravans, prevent the devastation of the camel, and allow every plant that appears to grow to the utmost, allow those oases to extend, and, in addition, plant trees with his own hand, for every tree that raises its foliage to the air invites rain, is it impossible that gradually the desert may be redeemed? If it be difficult to cultivate trees in the middle of the desert, it would seem that it might be done on the borders, and the belts increased from year to year, for the rainfall naturally would extend a little beyond the belts of trees. But if this plan shall not succeed, what then?

You have heard of the gigantic enterprise which has been proposed as regards this region, which is, to open a channel from the Red Sea, and allow its waters to come in and flood the desert. It is an experiment fearful in its character,—inasmuch as it involves climatic conditions that would effect Southern Europe, Western Asia, and Northern Africa. Whether or not this scheme will ever be successfully carried out, we need not now consider; but suppose a certain quantity of water should be admitted, so as to form a lake in the interior of the desert, what then? There would exist the means of large evaporation, and if before, trees could not be cultivated for want of moisture, there would now exist the source of an abundant supply. If forest trees could be cultivated, soon would follow fruit trees, and all kinds of vegetation. This may or may not be done in the manner indicated. However this may be, I hesitate not to venture the prediction that it is one of the achievements of the coming centuries, to redeem the character of that entire region, to bring it into a condition of fertility, and literally to “make the desert bud and blossom as the rose.”

Mr. PERLEY. When the moisture is taken up from the lakes, the rivers and the sea, carried in the air, and impinged upon the sides of the mountain, does mechanical force have anything to do with the discharge of the moisture upon the hills?

Prof. FERNALD. I think not at all.

Mr. PERLEY. Does the electrical condition of the atmosphere have anything to do with the discharge of the moisture from the cloud?

Prof. FERNALD. It probably does.

Mr. PERLEY. I proposed the question in regard to electricity because it has frequently been remarked, that after a violent clap of thunder, rain is apt to fall in larger quantity than before. Frequently, a very heavy shower follows a discharge of electricity. I do not know that one is the effect of the other, but we country people think it is.

Prof. FERNALD. Electricity is one form of force, and this force in the atmosphere that has been used up in the electric discharge has been at the expense of heat. Heat and electricity are frequently interchangeable. A force may develop itself as heat, which, with slight modification, may be developed as electricity. Electricity produces heat; heat produces electricity. Now, when there is an electrical discharge, there is an expenditure of power, heat is used up, a reduction of temperature of the surrounding air results, and rain consequently follows.

Mr. WILLIAMS. I have been very much interested in this lecture, and I regard this as a propitious moment for us farmers to improve. I would like to ask the Professor, how it is that our northeast wind gives us rain?

Prof. FERNALD. I will answer that with pleasure. I have not this evening taken up the subject of ocean currents at all. If you were near enough to see the arrows on this map, you would see here the warm Gulf Stream moving in the direction indicated by the arrows, and you would see also the Labrador current, a cold surface current, coming down from the north. The latter is charged with masses of ice, which float down into the warm Gulf Stream, and are there melted. Now, this cold ocean current passes inside of the Gulf Stream, next the coast, and hence, when we have a wind from the northeast, it comes to us charged with the vapor of this cold current. You all know how cold a northeast storm is, and you have here the philosophy of it. The wind has been charged from the vapor of a cold stratum of water. It is sometimes the case that sailors, when in this cold current, exposed to its severity, find the rigging of their vessel completely coated with ice, and they themselves become so benumbed with cold that they can scarcely control the vessel. What do they do? They sail directly down into the Gulf Stream, thaw out, and then are ready to go back and encounter again the perils of that current. This Labrador current accounts not only for the storms that we have when the wind is northeast, but for the character of those storms.

Mr. GILBERT. Will you please to carry the illustration far enough to show why the northwest and southwest winds are almost always dry?

Prof. FERNALD. They are not dry winds in certain parts of the globe. On the western coast of Europe, they are the moist winds. Here, the southwest wind is the wind which has passed over mountains and has lost its moisture. When the southwest return trade wind comes in contact with the Sierra Nevadas, it pours down its principal burden of rain on the western slopes of those mountains. Then, when it comes to the Rocky Mountain region, where the mountains are higher than those on the western coast, another fall of rain is produced, and by the time it passes over these mountains, if not before, its character is entirely changed, so that it is a dry wind, and it retains this character across the continent. If we come down a little further south, into the Gulf States, we find the southwest wind a moist wind from the Gulf. But in the northern part of the United States and in Canada, the character of this wind is necessarily dry. The same is true of the northwest wind, because it blows over a large extent of land.

Mr. GEO. E. BRACKETT of Waldo. Last fall there was a rain storm of six hours' duration, with the wind fresh from the westward. I have heard it spoken of by several persons. I kept a meteorological register for ten years in succession until the present year, and I never knew such an occurrence before; and judging from the facts stated by the Professor, it would hardly be supposed that there could be such a thing. It is an exception to all general rules, and perhaps indicates that some great changes are occurring in our climatic condition.

Prof. FERNALD. The storm referred to probably resulted from the action of two winds which uniting and propelling clouds gave them a direction which was the resultant of the two motions, not corresponding with either. While speaking, I wish to give a single illustration of the point, that where there is an expenditure of power, it is at the expense of heat. If you had an air-pump and a receiver from which you wished to exhaust the air, and should make a single stroke of the lever, you would see, if the receiver were between yourselves and the light, a slight deposition of mist within it. Why? You have removed a portion of air from the receiver, and the remaining portion expands. It exerts power; it performs work; and this, as has been stated, is attended with a reduction of temperature. It is actually, by the thermometer, colder

than it was before, and this chill has produced condensation, and hence a slight precipitation of mist. You may give a second stroke, and the same thing will occur again. I have, during the past season, had occasion to perform the experiment a number of times, and always with the same result.

As regards the variable quantity of rain that falls in different parts of New England, in the same storm, I wish to say a few words. From the modifying conditions that have been presented, viz: the effect of mountains, proximity to the coast, elevation and other circumstances, the quantity of rain that falls in different portions of our own State, or of New England, during the same storm, may be very different. I have in my hand a letter from James B. Francis, Esq., an eminent engineer of Lowell, Mass., inquiring as to the quantity of rain at the College in Orono, during the storm ending the 4th of October, and furnishing the quantity of rainfall at a number of different places in three, at least, of the New England States. During that storm, there fell at Providence, R. I., .83 of an inch; at Boston, 1.76; at Lake Cochituate, 4 inches; at Cambridge Observatory, 1.58; at Waltham, 1.56; at Lowell, 2.84 at one locality, and 3.02 at another; at Fitchburg, 7.53; at Worcester Lunatic Hospital, 4.75, and something more—the gauge overflowed; at Amherst College, 5.83, and there, too, the gauge overflowed; at Chicopee, Mass., 8.71; at Springfield Armory, 8.05; at Springfield, 7.50; at Wier's Landing, Lake Winnipissaukee, N. H., 6.40; at Lake Molage, 6.67; at Hartford, Conn., 8.43; at Orono, Maine, 2.13.

Mr. WILLIAMS. I formerly lived in Franklin county, which is mountainous, and I noticed a great many times that sudden showers rising among the mountains, would usually follow the river down. Perhaps it is easy to give the reason.

Prof. FERNALD. During the warm part of the year, water surfaces do not become so highly heated as land surfaces, and over that portion of the earth where there is water, the temperature of the air is consequently lower than over the surrounding portions where there is no water. Now, where will the chill of condensation take place? If there are vapor-bearing clouds passing over the entire region, condensation will take place where the cool belt is, and that cool belt is over the water. In winter the reverse would be true; but during the warm months of the year, water gives rise to a cooler stratum of air than is found on either side

over the land. In like manner you have doubtless noticed, when you have seen a cloud rising, with every indication that you were to be visited with a copious shower, that that cloud not unfrequently passed over a lake or belt of wood, and poured down its treasures of rain there, while upon the exposed portions of the land, where the temperature is elevated, no rain fell.

Adjourned.

FRIDAY, January 21, 1870.

The Board was called to order by Vice President THING.

UNDERDRAINING.

Sec. GOODALE. You are all aware that the subject of underdraining is one which has attracted considerable attention in this State, and that the attention given to it is steadily increasing as its importance becomes better appreciated. We have, in the State, a number of manufacturers of tiles, but there have been very few, if any, made in the style which is believed to be, by those most conversant with the subject, the best. It has been suggested by one of these manufacturers, that if the Board would recommend the form of tile which they regard as most useful, the manufacturers would very readily accede to it. Their machines are so constructed that by a little modification they can make various forms as well as different sizes. In view of this suggestion, a resolution has been prepared, which I will read:

Resolved, That in the opinion of this Board the cylindrical form of drain tile is preferable to any other now in use, and we hereby recommend the manufacturers in Maine to adopt this form.

I will merely say, that so far as I am aware, it is the universal opinion of those who have given the subject most attention, that the cylindrical tile, and especially if united by means of collars, is better adapted to the purpose than any other; that it can be laid with more certainty that it will remain in place; and as it can be made equally cheap, there is no reason why we should not have it rather than a poorer tile.

S. F. PERLEY, Esq., of Naples. I hope the resolution will not be passed without due consideration, and that every man who has an opinion on the subject will express it. I was led to consider the subject from the fact that last winter, at Augusta, Judge French argued this matter out very plainly, and showed us that the round tile was better than the egg-shaped. That was theory,

however. I have been in the habit of laying stone drains, but I thought it might be advisable to ascertain which was the most expensive, and I bought a thousand tiles having the egg-shaped cavity, as manufactured in Westbrook. I found that I could do it some ten cents cheaper per rod; but I found at the same time that Judge French's advice in regard to the use of the round tile, was very good. You will see that the oval tile is of such a form that we have to lay it edgewise. When we dig a trench, it is almost impossible to make the bottom perfectly flat, and of course the tiles will have a tendency to lean one way or the other, and there is a difficulty in keeping them in the true position. I remedied that by taking strips of birch bark and folding it over the tiles, so that if they moved either way they would have to break the bark, and then put the earth around them to hold them in position.

There is one other reason why the cylindrical form is to be preferred. Almost always, the tiles get sprung or warped a little in burning, so that the ends will be a little canted, and if you have a cylindrical tile you can roll it over and make an almost perfect joint. If you have an egg-shaped tile, you may have to crack off half an inch on one side, and you may have to try half a dozen tiles before you find one turned the other way, so as to make a joint.

Now, this is actual experience; there is nothing theoretical about it, and I, for one, feel very earnest that this recommendation should go out to the farmers of the State. The Superintendent of the State Reform School, in Cumberland county, where they manufacture tiles, told me that at an expense of twenty-five or thirty dollars, he could change his dies, and when once changed, he had much rather manufacture them circular than oval, for the reason, that they could be more easily handled, and were not so liable to break. He was satisfied that it would be better for them to change their dies and manufacture cylindrical tiles, but he did not want to do it until he knew the farming community wanted that kind of tile. I am satisfied that every man who tries it will be convinced that the cylindrical tiles must be the best.

COL. SWEET. Mr. Perley speaks of putting birch bark over the joints. Is it necessary to put anything over the joints, if a fit is made?

MR. PERLEY. Perhaps not absolutely necessary, but still I would do it, for the reason that it is very difficult to pack the earth round

these tiles with equal compactness in every place. You will see at once that if a tile rolls half an inch, it opens a seam, where the sand and gravel will wash in. It is much better to hold tiles in their true position by birch bark, or some other device. The English laugh at us for that. They have collars made for the purpose, so that there is no danger of their tiles getting out of place. Birch bark is a very convenient substitute, and lasts a good while.

The resolve was unanimously adopted.

Mr. GILBERT of Greene. I feel anxious to understand this matter, as much of my farm needs underdraining. It seems to me it would be very difficult to get the earth so firm underneath them that the round tiles would not be more likely to roll than the flat-bottomed oval ones.

Col. SWEET. I think there would be no trouble in the direction indicated. When you get the tiles covered, there is nothing to start them. If you put on birch bark, as Mr. Perley recommends, there will be no trouble. There is a work upon underdraining, by Geo. E. Waring, of Rhode Island, published in New York, which can be obtained easily, and which I would recommend to every man who drains extensively, or even if he does but little, for whether he does much or little, he should do it in the best manner.

Prof. PECKHAM. That work is the text book at the Agricultural College. The Draining Engineer of the Central Park, New York, where they laid several miles of underdrains, recommends the cylindrical tile, to the exclusion of all others. He recommends that they be laid with collars, as in England. This collar is a short piece of tile, a size larger than that which makes up the principal length of the drain, and holds the two ends firmly in their place.

Gov. BROWN. I wish to say a few words in relation to the works on this subject. Some fifteen years ago, Judge French of New Hampshire,—who is, by the way, one of the best farmers within my knowledge; a man who never cultivates an acre without making a profit from it,—took a farm in the town of Exeter, N. H., that was on the edge of a sandy plain, but descending to the south, until it came to what is called Exeter river. The land was so full of water, that by digging four feet anywhere, you would come to permanent water. And yet that land did not produce any grass. I think I could have walked over an acre and not trod on a spear of grass. He commenced draining that farm, and he did it so thoroughly, with tiles, that in three years after he commenced, I

saw the finest clover crops there I ever saw in my life, and the best crops of carrots. He did it, in the first place, by draining, and then by the application of clay and horse manure.

Judge French took so much interest in this work of reclaiming that farm, that he left his business and went to England, on purpose to study the whole theory and practice of draining, and there he spent a summer in visiting the best estates in that country. You are aware, probably, that draining in England is a national matter. It has even been sustained by act of Parliament. In years past, when the corn laws were repealed, and the farmers there were left to compete with all the world in the prices of wheat, draining saved the agricultural interests of the kingdom from bankruptcy. The people found out, long ago, that draining is the best thing that can be done; they make money out of it.

Now, Judge French has written a book on "Farm Drainage;" and he is one of the most pleasant writers in the world; his book is as interesting as a novel. It is the leading work on the subject in this country. It was written long before Mr. Waring wrote his book, and long before Mr. Klippart of Ohio, wrote his book, and entirely exhausts the subject. I advise everybody who wants to drain to obtain that book. He will find instead of the dollar and a half that it costs, it will be worth fifty dollars to him, if he has a farm of fifty or a hundred acres to be drained.

I have given some attention to this matter myself, and with the most satisfactory results. I will only state one experiment which I made. My house, in Concord, Mass., is twenty-three feet above the river, but on the slope of a hill, with a valley behind it, into which the water drains from the still higher land. I drained it according to Mr. French's instructions. The hassocks on a portion of the meadow were from three to ten inches high, so that we did not cut the grass with the mowing machine. The hay was worth about ten dollars a ton when harvested, and the meadow had been mowed, according to tradition, for more than a hundred years in succession, and never plowed. It was about the hardest ploughing I ever attempted; so difficult, that I had to alter the plough, by widening out the share three or four inches; and then, at every rod, a man had to follow with an axe and cut the furrow, or else it would not roll over. It was so springy with roots I could scarcely do anything with it. I did not plough the land, or seed it, or add a spoonful of manure to it of any kind; and four years afterwards, I went over a portion of the meadow with the

mowing machine. There was not a hassock on it, and when I got down fairly into the meadow, the Timothy was so high that I got off the machine and cut a bunch of the grass, and found it was over four feet high; the red-top was a foot and a half, and meadow grass on the bottom. The heads of the herds-grass measured from six to eight inches in length. Instead of hay which was formerly worth ten dollars a ton, I cut five tons at three cuttings, the third year, which was worth sixteen dollars a ton. Then fed it, and the grass was six inches high in the fall.

Now you can figure and see the advantage of draining that meadow. It cost me \$50 to drain and reclaim it completely, and I cut by estimation, five tons from the acre, worth \$16 a ton.

QUESTION. How far apart were your drains?

Gov. BROWN. I put the drains only twenty feet apart, and four feet deep. On one portion of it, on the easterly side, where the drains had little or no effect, the hassocks remained until last year, just as on the original meadow.

As was said yesterday, in the lecture on grass, drainage is the foundation of all progress in farming,—that is, where the land needs it. All lands do not need it, or, if they do, it is better to take lands that have a great surplus of water, than to take those that are comparatively dry. My advice would be to any young man who was entering upon farming, to commence draining at once. Any man can tell whether his land needs draining or not, because, where there is too much water, he will find grasses that he will never see on lands where the water is drained off.

The CHAIRMAN. Perhaps I ought not to interrupt this discussion, but some explanations are desired from Prof. Fernald on the subject of last evening's lecture.

Mr. C. CHAMBERLAIN. I will ask Prof. Fernald, if, in accounting for the thermal influence of trees,—which point appeared in the discussion in the forenoon of yesterday, and again in the evening,—there is not another element that he might then have overlooked?

Prof. FERNALD. Yesterday the fact was stated that on the western side of a forest, when the wind in the winter is prevailing from the west, the temperature is lower than in the central part of the forest, or on the eastern side. The question that arose at that time was in relation to the cause of this difference of temperature. It was stated that there are two causes to which this difference might be attributed; one is the direct influence of

trees, in imparting warmth to the surrounding air. During the winter season the temperature of trees, which are protected by an impervious covering, does not fall so low as the temperature of the surrounding air; consequently a small amount of heat is imparted to the air directly from the trees, which serve as condensers of heat from the ground. Another cause that was noticed is the friction resulting from the moving of winds through forests. A third cause, and one which perhaps exercises a greater influence than either or both of the others, is the condensation on the side where the compression takes place. You are all aware of the fact, that when air is compressed to any great extent a large amount of heat is evolved. When winds sweep down upon a forest, condensation of air takes place, by which an amount of heat is evolved or the temperature of the air elevated, and this heated air is swept along through the forest, and may be regarded a third cause of the elevation of temperature in the central part of the forest.

Mr. CHAMBERLAIN. There is another question which I would like to ask, and that is, if he did not omit to state an important physical fact in connection with his remark on the engineering project of letting water upon the Desert of Sahara?

Prof. FERNALD. That this can be done at all is due to the fact that the central portions of the desert are lower than the level of the Red Sea, and consequently, when the barrier around the desert can be cut through, the water will flow in of itself. If this shall ever be done, the water of the Nile will undoubtedly be changed in its course, and be made to contribute its fertilizing deposits to the desert.

Mr. CHAMBERLAIN. A remark was made by the lecturer on the possibility of reclaiming present desert places through human agency. I will ask him if he is able to state what has already been accomplished on the border of this same desert by French engineering in Algeria?

Prof. FERNALD. The French in Algeria have already carried on this process of reclamation, to a certain extent, by boring artesian wells. It is found that they do not have to bore to a very great depth before they come to an impervious layer in the earth, beneath which is a pervious stratum, and beneath this is still another impervious layer. They have but to penetrate this upper impervious stratum, and the waters supplied from the higher lands north of the desert to this pervious stratum, gush out. This process of irrigation has been carried on to a considerable extent by

the Arabs, who now have their huts built upon these irrigated portions, and attend to their cultivation. So that what I hinted at last night as possible or probable, is already being realized.

Mr. SEARS. Perhaps I may be allowed to state a fact and ask an explanation of the Professor. A few years ago I was upon high lands in a town northeast of here. Westward from me lay a valley of some 12 or 15 miles extent. Presently a small dense cloud arose in the west. When I observed it, it cast a shadow on a few acres of this basin. That little cloud came towards me, and before it reached me, I saw that rain was coming from it, and before I could remove my traps from the wagon, I was completely drenched. It was one of the heaviest showers upon record. The question is, from whence came that water?

Prof. FERNALD. Most of the variable winds that prevail over this continent, are to a greater or less degree charged with moisture. As was stated last evening, the prevailing southwesterly winds and the westerly winds, blow over a large extent of land, and hence are constantly losing moisture; for any circumstances which shall produce condensation, or a reduction of the temperature, will cause a deposition of it. It is sometimes the case, that a wind blowing from the south coming in contact with elevated portions of land is deflected from its course, and moves on, as a rain wind in a direction contrary to the prevailing wind, and thus we may occasionally have rains when the wind is from a very different quarter from that from which rains generally come. It was mentioned last night by Mr. Brackett that there was a storm last season when the wind was from the northwest, and doubtless this was due to some such circumstance.

Mr. SEARS. Do you suppose that the water was held in the atmosphere, and that the cooling of the atmosphere condensed the moisture and caused the shower?

Prof. FERNALD. I do. Vapor is held in the atmosphere in an invisible state until by condensation a cloud is formed. The little vesicles, when first formed, are very minute indeed, but increase in size until they possess sufficient weight to fall. There is a curious fact in connection with the falling of rain, which was not noticed last evening, although the general fact was stated that the velocity of rainfall is so regulated that it seldom does injury to vegetation. Rain drops descend with an accelerated motion, until they have acquired a velocity at which the resistance of the air is just equal to the downward pull of gravity; thereafter they de-

scend through the atmosphere at a uniform rate; and this rate of motion is not in general so great as to cause injury when they reach the earth.

QUESTION. I would like to inquire of the Professor if the indications of the barometer are sufficiently accurate as to make it advisable for a farmer to depend upon them?

Prof. FERNALD. The indications of the barometer are doubtless very much more reliable upon the ocean than upon the land, since the winds are so variable upon the land. Then the fact of elevation comes in to modify the height of the barometer, so that the ordinary reading of a barometer, "fair," or "rainy," etc., amount to nothing, unless it is adapted to the elevation at which the barometer is used. Ordinarily the barometer cannot be relied on as an accurate guide as regards prospective rainfall, and the meteorologist depends quite as much upon facts furnished by the hygrometer, an instrument which is used to indicate the amount of moisture in the air. There is a simple instrument called the hygrodeik, which costs, perhaps, not more than eight or ten dollars, which any one can use to determine the condition of the air. This hygrodeik, or hygrometer, has a wet and a dry bulb, the latter of which indicates the temperature of the atmosphere. The wet bulb is covered with muslin, which is kept constantly wet. When the atmosphere is in a dry condition, there is a difference of a number of degrees between the indications of the wet and dry bulb. From what cause? The wet bulb, being covered with cloth, which is wet, evaporation takes place from it, and when the atmosphere is dry this process goes on rapidly, and the difference between the two temperatures is considerable, ranging from zero to 20 or more degrees. With data furnished by this instrument, using tables which have been computed for this purpose, one can determine the exact per centage of moisture in the air. The drier the air is, the greater will be the difference between the reading of the dry and wet bulb. If the observer finds the difference is very slight; if for instance one is 70° and the other 69° , he would know that the air is charged with perhaps 95 per cent. of all the moisture it is capable of containing, and would be likely to expect, especially if his barometer were falling, that there would be rain very soon. The hygrometer may be depended upon more than the barometer, and the two together may serve as very good indicators of the weather. Rain seldom falls until the dry bulb and the wet bulb exhibit the same height of mercury, when the

air contains 100 per cent. of moisture, or is saturated. When this is the case, the slightest reduction of temperature will cause a discharge of rain. But if the difference between the indications of the two bulbs is several degrees, a change must take place in the condition of the atmosphere before rain can fall.

In this connection, the following fact, however, should be remembered: The condition of the air upon the surface of the earth is not always the same as the condition in a stratum above the earth, so that sometimes it may be raining from a cloud above, when the indications are that the per centage of moisture in the air is but 90 or 95 per cent. A hygrometer half a mile above the earth, would then show that the air there is saturated with moisture. It rains, therefore, sometimes when the hygrometer does not indicate 100 per cent. of moisture in the air, but it seldom rains unless it indicates pretty nearly 100 per cent. at the surface of the earth.

MR. C. CHAMBERLAIN. I would like to inquire of Prof. Fernald, if we may not reasonably charge something to the electrical condition of the atmosphere to account for the formation of showers and the distribution of moisture as it occurs in this country.

Prof. FERNALD. Undoubtedly.

MR. FARLEY of Winthrop. I will state that I have had a barometer for perhaps ten years, and have watched it very closely, especially in haying time. I find that, nine times out of ten, at one o'clock in the afternoon, I can tell whether we shall have a shower that afternoon. If the barometer does not begin to fall by one o'clock, we are pretty sure to be free from showers. But its indications are such, that so far as storms are concerned, we cannot rely upon it alone.

Prof. FERNALD. I am glad to hear so good a reputation given to the barometer. I hardly ventured to give it all the credit to which I deem it entitled. Many people are apt to regard the barometer as infallible, and other people think it good for nothing. Both are doubtless wrong. There are certain things that can be told by it. It gives the pressure of the atmosphere, and always reports upon this correctly. We may not, however, correctly interpret its indications. It is safe to say, however, if the barometer will do for the gentleman the good service he has indicated, with the hygrometer also, he would be pretty well prepared to predict changes of weather for some little time in advance.

CUTTING AND CURING HAY.

The discussion regarding the time for cutting, and the mode of curing hay, was resumed.

Mr. TAYLOR of North Wayne. I shall only attempt to give some experience. Some five years ago, I became satisfied that we dried our hay too much, and made some trials. My first experiment was to put my hay into the barn after drying it about half as much as usual, and it came out well. Since then, I have further experimented, and now my practice is to cut at 9 o'clock in the morning, if the day appears to be favorable. In the afternoon, I turn it over, for the purpose of getting the dew and dampness all out of it. By that time, the hay will be, not dried, but heated. I then put that hay up as fast as possible, and if the prospect is that there will be a storm, I get it into the barn; if not, I let it stand over until the next day. Then I turn over the cocks—I do not spread them, but simply turn them over, so that if any dampness has collected at the bottom, it shall have a chance to evaporate. Then, at the earliest moment I can, after the ground is warm, I commence carting and put it in the barn, and tread as solid as possible. In one instance, I had a very heavy man with me, and I told him to tread the hay as closely as possible. I thought if it could be trodden down hard enough to have it rot, I wanted to know it; and I have to say, that when I came to feed that hay out, it was as bright as the moment it was cut by the scythe. It was exactly right.

My experience is, that if you have water in your hay, you must dry it out, but if there is no water in it, you can put it into as large a mow as you please, and tread it as closely as you please, and it is perfectly safe. I am now feeding hay that I put in last season, and my neighbors thought I was crazy. I would like to have any gentleman come and look at that hay; it is as perfect as can be, and in my estimation, is worth 25 per cent. more than hay dried in the way I was taught when a boy.

The CHAIRMAN. It has been said that a good deal of the hay on top of the mow would spoil.

Mr. TAYLOR. That is not my experience. I never cover mine with straw, old hay, or anything of the kind. On the top of the mow, after it begins to sweat, it will be very wet, and perhaps two or three inches on top will be a little colored. The talk about rotting is all humbug. I have never lost a pound. I have never

found any that cattle will not eat readily. I do not apprehend any danger, but still, if you want to be sure to save all your hay, put on six or eight inches of straw, and then it will be perfectly good up to the straw; the straw will absorb all the moisture.

There are men in Franklin county, who have carried this practice still further. They let the horse-rake follow the mowing machine, and cart it in perfectly green. I have never tried that; but if you should meet Mr. F. B. Stewart, you will see him with a wad of hay in his pocket, which came from a lot that he got into the barn under these circumstances. He cut some five tons last year, beginning to mow at 9 o'clock, and as it looked likely to rain, he went to work and had it all in his barn at 5 o'clock. The wad he had in his pocket was perfectly clean and bright when I saw it.

When I cut hay to put into the barn, I want it matured. If we cut it too soon, there is too much moisture in it. I am not particular about the "first blossom," or the "second blossom," but I want to have the grass mature, and the seed set. Then cut it down, and put it in as soon as you please, if it is dry. If there is no wet on it, you may depend upon it, it is perfectly safe.

Mr. PERLEY. Will you please fix the time which you consider the proper one to cut herds-grass?

Mr. TAYLOR. I have noticed that herds-grass has the appearance of blossoming a second time, and if I could get my hay just when I would like to, I should cut it at the time of the second blossoming. After the grass has blossomed once, the bloom disappears, and after a day or two, you will find that other blossoms appear, just like the first ones, except that they are darker.

Gov. BROWN. You say you would have the seeds set before cutting. Do you mean by that, that you would cut the grass as soon as you noticed that the seeds were formed, or would you have the process go further?

Mr. TAYLOR. As soon as the first blossom has disappeared, I think you will find that the seed has set. It is in what I would call the milk, if it was grain; and then is the time for us to cut the grass. Sometimes it is impossible to cut it all at the right time. Some lots need to be cut earlier than others; so if we watch closely, we can generally hit about the right time; and my observation is, that if the grass is cut after it is so far matured, it is worth more than if cut sooner.

One gentleman spoke of cutting herds-grass when the heads

were half length. I have not tried that, but I should think it would be too green for working oxen.

Mr. DOE of Saco. Suppose you put three tons of hay into your mow to-day, and bad weather intervenes, so that you do not put in any more for four or five days, does the hay you first put in have any effect upon the last?

Mr. TAYLOR. Not at all. I put my hay upon the mow whenever the weather will answer. I put in as much as possible every day, and make it as compact as I can. I liked the remark made by one gentleman, that we need as good a man on the mow as anywhere. If I could tread my hay with oxen, I would do it.

QUESTION. Are you in the habit of putting salt on your green hay?

Mr. TAYLOR. Never. I always salt my cattle.

Dr. GARCELON. Many of us have fields where clover lodges before it has matured, and we think it is necessary to cut it. My method is to cut the hay, put it up and cap it, and let it stand for two or three days; then turn it over, and cap it again. Instead of drying it, I *cure* it, and then I get hay that is good for something. You would not feel safe in introducing into your barn hay cut in a green state, like that which I have mentioned, until it is cured?

Mr. TAYLOR. Not until it is *cured*.

Dr. GARCELON. So your rule would apply only to hay that is ripe and matured?

Mr. TAYLOR. Yes, sir. If I could have my way about it, I would have it nearly mature, but not wholly.

Mr. SEARS. I have found that when I broached this method of stowing away hay, it startled many farmers; they said we could not make hay too much. Mr. Stewart of Farmington, has practiced this method for many years, I understand, with perfect success.

Mr. NICKERSON of Readfield. I would like to inquire if any one has tried the experiment of pressing green clover hay into a tight hogshead, and heading it up without any curing?

Some one stated that it had been tried, and was an utter failure; the clover was rotten when the hogshead was opened.

Mr. NICKERSON. I tried the experiment ten years ago, and unheaded the hogshead in the middle of winter. I found the hay perfectly sweet, and the smell resembled that of green clover in

the field. It amounted to nothing because it is too much labor and expense to preserve hay in that way.

Mr. FARLEY. My brother tried that experiment, filling a hog's-head and treading it down; and the result was that it rotted.

Dr. GARCELON. I would ask if the hog's-head was air-tight.

Mr. FARLEY. I cannot tell you.

Dr. GARCELON. That is probably the explanation of the result. In one case the hog's-head was impervious to air; in the other it was not.

Mr. FARLEY. Very little has been said of the effect that cutting early has upon the next year's crop. I have practiced cutting what is called early—the first days of July—and immediately the grass springs up again and covers the roots, and the next year I have another crop. I can mow the same piece for twenty years, cutting early, and never cutting but once, but letting the grass die down in the fall for a mulching. If you cut late and cut close, the grass will be likely to be winter-killed. I did that once and when the snow came nearly all the grass perished, although the land was in good heart. Another thing; if you mow too close you kill the roots. I had half an acre, mostly herdsgrass, that was cut by a mowing machine, to try it, and the man cut as low as he could. The consequence was, that next year there was scarcely a spear of grass on that half acre, except near the wall where he could not cut it with the machine, and there it was as good as before.

Mr. NICKERSON. That was my experience exactly, with the first machine that went on my farm.

Mr. FARLEY. The grand desideratum in putting in green hay is to pack it close, and exclude the air. The old-fashioned idea was, to open your barn doors when you got all your hay in. Now I shut my barn as tight as possible.

Mr. NICKERSON. I have experimented more than twenty years with herdsgrass. For instance, I have taken my knife and cut off every spear that came from one root below the lower joint, next to the bulb, and near that, I have cut off every spear rising from one root a little above that joint; invariably, the root where I cut the grass below that joint died, and the other root lived.

Mr. RIDGOUT of New Gloucester. I built a new barn five years ago. A man happened there, just before I commenced haying, from Canada, who told me that we farmers put our hay in too dry, and advised me to cut and put it in the same day. He told me

the greatest stock grower they had in Canada built him a tight barn, and put his hay in the same day he cut it, and he had the fattest cattle of any man in Canada in the spring of the year. I followed his advice. I partitioned off bins in my barn on the hay side and on the scaffold. When I commenced haying I would mow in the forenoon, waiting until the dew was off, and if there was any cut before the dew was off, I had my man turn that hay over about eleven o'clock. I set my horse to raking about two o'clock, and the teams to hauling. I didn't let the hay lie out after four o'clock, or five certainly. One day I cut down eight acres, and hauled it all in the same day. I got all my hay in about fifteen days. One of my hired men said, "Rideout's hay will be all rotten. In a month you can go on the mow and put a shovel down through it." They had the story about town that Rideout's hay was all spoilt, but I gave myself no uneasiness on that score. I did not cover it with any thing, but I began with one bin and filled that up, treading it as hard as possible; and on the scaffold side, in the fall of the year, my man got up and pulled out a handfull as black as your hat. He said, "It is spoilt." When I came to feed it, it was as white as any hay—the blackness was all gone.

I made a compost heap of ashes in the spring after planting,—a horse load of manure to a horse load of leached ashes—and covered the heap with loam. In August I pitched that over and worked it until perfectly fine, and the next spring I put the compost on that ten acres, and I have mowed the land for five years. Two years ago, one afternoon when it looked likely to storm, I hauled in twenty-two loads of hay and put it into the bays, and trod it as hard as I could. Two of the loads I put on the scaffold over my horses. The hay that I put in the bays was as bright when I fed it out as when I put it in, but that which I put over the horses was not fit to be eaten.

I have intended, ever since I built my barn, to box up one bin air-tight, and I mean to do it if I live. I think if you build a barn and have every bin boxed up, cut your grass after the dew is off, put the hay in after dinner, and tread it down, it will come out as bright as when you put it in.

Hay for milch cows should be cut in June; for working oxen, it may be cut later.

Mr. WHITE of Bowdoinham. My experience is, that I have not got hay made too much in the field. I want two good sunny days

to make hay. I begin in the morning after breakfast; sometimes the grass is wet, sometimes not. I mow until noon, and have it spread. I rake after dinner, put it up, and let it stay until next day. After it has got well heated, open it, and soon after get it in. I find, when I can have two good drying days, I can get good hay.

Mr. THING. There is a farm in my neighborhood, one of the best in the county of Kennebec, upon which the hay has been invariably cut late. The owner is usually two weeks later than his neighbors, but he has as good hay, and his farm carries as much stock per acre, as other farms, and his stock looks well. It has been a puzzle to me for a good while, as it conflicts with all my ideas of cutting hay, and I never understood it until last winter. There is another farm in the same neighborhood, on which there formerly lived one of the slackest men that ever cursed the profession of farming. The man who owned it died, and I bought it a year ago last summer. For want of sufficient help, it was impossible for me to touch it until after I got through haying at home,—about two weeks and a half. I then went on, and was surprised at what I saw. The land is of about the same character as mine. That grass, I verily believe, was as green as mine was when I commenced cutting it, more than two weeks before. My theory is, that the man, by being uniformly so late, had made his grass later, and for that reason he cut his hay in as good season as the rest of us.

In regard to salting hay for the sake of salting stock, you will be altogether likely to get on too much salt, if you undertake to do that, and if you salt your cattle every Sunday morning, or every Monday morning, as is most convenient, more than half of them will get too much salt. Now, I want salt kept by them every day in the pasture, and every night in the barn-yard, and, in the winter all the time, and then they will eat it frequently, but never too much.

Mr. MARTIN of Auburn. I agree with my friend, that it is proper, when the grass is matured, to cut and put it in as he does, but if you cut it when it is green, as some have said here, (and that is the right time, in my opinion,) you must not do so; it will ruin your hay. What then? Never cut a spear of grass until the dew is off, then as quick as it is wilted, whether it be in half an hour or two hours, (as quick as the sap ceases to move, it wilts,) rake it up and put it in cocks as quick as possible, let it remain there

until the next day, then pitch it over lightly, and in the course of two or three hours put it into the barn, and tread it as solidly as you can. If you have three tons to the acre of clover or herds-grass, put it up and let it remain two or three days in dry weather, and if there are two days of moist weather, then re-lay it—no spreading and no shaking—then put it in, and tread it down so as to exclude the air.

A motion was then adopted to discuss the preparation of the soil for a grass crop.

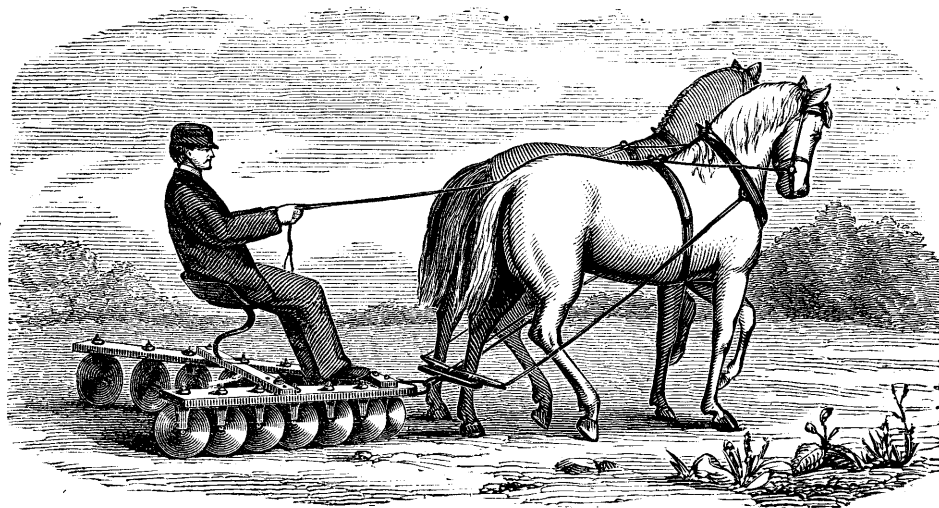
Sec. GOODALE. I would be glad, in this connection, to make an inquiry. It is well known that in Maine we have large breadths of land, naturally well adapted to grass, and decidedly better for grass than for tillage. In the rotation usually practiced much of this land is plowed, and planted with corn or potatoes for a year or two and then sown with grain and grass seeds. This one year or two years of culture involves a great amount of labor, especially on the heavier class of soils. To go over as much surface in this way as is usually found on farms in so low a condition as to demand some improving treatment also involves a demand for more manure than is at hand. So much as is under the plow and hoe should be liberally manured in order to get remunerating crops, and if we plow no more than can be sufficiently manured, there usually remains considerable surface which yields only a light burden of hay. In some sections the practice obtains of sowing grass seeds upon the inverted turf without any intervening hoed crops, or any culture beyond pulverizing the surface soil, and sometimes spreading manure, if any can be furnished, or if no barnyard manure, a dressing of ashes, leached or unleached, or plaster. Sometimes nothing is applied, and in any case the reliance is chiefly upon the sod, which, as it decays, furnishes food for the young plants. Consequently much better success attends this practice if adopted before the land has become poor than if it is badly run down.

If any one will estimate the amount of vegetable matter contained in an acre of turf and the results he might reasonably expect from its use in preparing a compost, it will be apparent that the plant food thus placed at the disposal of the new grass crop, is very considerable in addition to what may be rendered available through natural agencies from the freshly exposed soil. The leading idea of this practice is to depend largely upon rotting sod with

which to fertilize the land for grass crops. We have a great deal of good grass land which responds promptly to the action of plaster, and plaster, where it does do well, is the cheapest manure we can buy. Then, again, there is a good deal of land on which plaster is as worthless as sand. It has been found by experience during many years, that grass (I refer now to the grasses proper) succeeds better when clover is sown with it than when sown alone; but it is only recently that we were able to understand how this comes to be the case. It is due to the fact that clover can and does obtain supplies of food from sources inaccessible to the grasses, and, in its turn, through decaying leaves and roots gives up these supplies to the grass.

An estimate was given yesterday with regard to the value of clover hay for manure. I suppose the statement to be sufficiently accurate; and yet, unless we save all the liquid excrement, we cannot realize anything like that amount. In fact, the one prominent reason why clover has been of no more repute among farmers for its value for manure, is that we have not preserved the liquid manures as we ought to have done. With herds-grass, the solid portion of the excrement would be of more value than the liquid; with clover, it is the reverse. If you want the whole benefit of clover hay, in its manurial quality, you must save the liquid excrement by some absorbent.

In common parlance we speak of both clover and herds-grass as grasses, and they have this in common—both are used for fodder; but botanically they are quite unlike, and their requirements upon the soil, and their characters as shown by analysis, are very different. Clover has the power, somehow or other, of obtaining a large amount of nitrogen; it has, also, the power to obtain from the soil a great deal else of food material which other plants cannot get. For instance, there is usually considerable potash in the soil, but far the greater part of it is usually in an insoluble state, and plants cannot appropriate it, except in small amounts, and by slow degrees, as it is liberated by the effects of weathering. If you turn up your soil and harrow it, you expose it to the dew and the rains, the rain water contains a little carbonic acid, and that helps liberate the potash in the soil. Now, herds-grass and Timothy cannot get the potash as easily as clover does, and what it gets it stores up. So it is with regard to nitrogen, which it obtains from somewhere and somehow. Nobody knows where or how it gets it, but it does get it, in large amounts, and that is what the



Nishwitz's Pulverizing Harrow.

grasses require most ; it is that element which wheat is most likely to lack, and which I believe can be supplied by clover, to the extent of its ability, a great deal cheaper than in any other way.

But I have wandered from the purpose for which I rose. It was simply to elicit the experience of those who have tried rotting turf as a principal manure for grass. My attention was first called to it, ten or twelve years ago, during a trip in Somerset county. I think Mr. S. W. Coburn of Bloomfield, informed me that he had practised it very successfully. Since then, I have made frequent inquiries, and have not found the practice to prevail to any great extent, but those who have tried it tell me it is an excellent method, and gives highly satisfactory results. If it is as good as I think it is, and as it has proved in many cases, it might save a great deal of hard labor, and give us larger crops.

Dr. GARCELON. As no one responds directly to the inquiry of the Secretary, I will state my own mode of preparing the soil for a grass crop.

Gentlemen who have been here during the summer, know very well, that to a great extent, we have a clay soil in this vicinity, and it is a very important point with us to know how best to prepare that soil so to secure the largest amount of grass. Five or six years ago, I commenced on a farm which had been taken up about a hundred years ago, cultivated for thirty or forty years, and then suffered to run down. A large surface grew up to bushes, pines, birches, &c. I cut off that growth, and have been engaged in getting the land into cultivation as best I could. My method has been this: As soon as the stumps were far enough decayed to pull out readily, I removed them, and plowed the land. I then spread upon the turf, before harrowing, or after running over it with a common spike harrow, just to level off the surface, so that I can drive more easily over it, a liberal coating of stable manure—say about twenty common ox-cart loads to the acre. Having spread this upon the surface of the ground, I then take a Share's harrow and pulverize and mix the soil with the manure, as thoroughly as possible. Having done that, I next spread upon the surface, a hundred bushels of leached ashes to the acre. I then go over the ground with a Nishwitz harrow, an instrument which I cannot too highly recommend, for it will cut up the little sods, the lumps of manure and the lumps of clay, in a manner that I never saw equalled by any other implement. I drive over the ground with this harrow until it is in a suitable condition to raise

a crop of turnips, or beets, or carrots. I usually raise the first year, potatoes, mangel-wurzels, or something of that kind. In the fall, if possible, I plow again. In the spring, spread another coating of manure, broadcast, and if able to obtain another coating of ashes, I put on the same amount. I then sow barley, which is the best crop we can grow here, and grass-seed with it; and my experience has been, that somewhere from the 20th of June to the 1st of July, according to the season, I am forced to cut my first crop of clover, because it is so heavy that if I let it stand longer, it drops down and rots on the ground.

Gov. BROWN. How much seed do you use to the acre, with the barley?

Dr. GARCELON. About 12 pounds of clover and a peck of herdsgrass, preferring rather more than less, and usually about a bushel and three pecks of barley to an acre. One piece that was prepared in this way last year, yielded 54 bushels of barley to the acre, with as fine a catch of grass as any one need desire. The year after, about the last of June or first of July, I am compelled to cut the grass, and between the middle and latter part of August, have usually taken off a second crop of about a ton or ton and a half to the acre. Whether that is good policy or not, I do not pretend to say. I only say that such has been my practice; I have five or six acres that were laid down five years ago that are now yielding an excellent crop.

My purpose has been, to make a grass farm, for I propose to sell milk and raise grass for my cows. I desired to make this ground smooth enough to drive a mowing machine, even where the clover has lodged; and when that ground begins to fail, I intend to put on a top-dressing, either of leached ashes, finely pulverized stable manure, or muck mixed with salt and quick lime, or plaster, as I find my land requires one or the other of these articles. While I admit that stable manure is of the utmost importance, I am convinced that we can obtain manures which are cheaper and better adapted to the wants of those farmers who have to buy. Farmers who live six, eight, or ten miles from this village, frequently go to livery stables, where they bed their horses on the coarsest kind of bedding, even sawdust, and pay four or five dollars a cord for this mixture, and cart it all the way home.

It is commendable to manure, but the question is, can we not do it in a better way? I think we can. By the use of plaster,

and leached and unleached ashes, quick lime and salt, and by gathering up the debris from our farms, the leaves from the forest, muck from the muck beds, the surface soil that has been washed in by the side of the road, and mixing them in suitable proportions, we can get a better, cheaper and more efficacious manure than the stable manure which farmers buy so dearly.

Clover is one of our cheapest and best manures, for it has the power of absorbing some of those elements from the atmosphere and from the soil, in some way which may not be explicable, which produces the most favorable results upon the growth of grass. Why, then, should we spend so largely for stable manure when we can buy clover seed for a shilling or twenty cents a pound, as we usually can? If there is any reliance to be placed in human testimony, you can get thus that condition of soil which will make your grass stouter and larger than you can get it in any other way as cheaply.

One word further in regard to the crop of the first year. After having prepared my ground in the manner just described, I decide upon my crop. I usually assign one piece to potatoes, another to beans, mangel-wurzels, carrots and parsnips. For each and all, I adopt the same method. First, furrow the land, and if I plant potatoes, mix about half lime and half ashes, and sometimes a third each of lime, plaster and ashes, or two-thirds ashes, as the case may be, only be sure to put on a liberal supply of that kind of dressing; I then have a man drop that in the furrow, a handful at a time, about a foot apart, the man who drops the seed follows, and then another man covers it; so that the land really gets, the first year, another quantity of dressing put in the hill. With corn or beans, the same is done, except that I use Billings' Corn-Planter that drops the seed and the fertilizer together.

Mr. SWEET. I will state my experience in reclaiming what we call run-down mowing, without plowing. The soil is rocky loam, which has been pretty well cleared of stone; the surface is smooth enough for a mowing machine, but I have some land which produces but a small crop of hay. I have come to the conclusion that the cheapest way for me is to top dress. I don't believe in buying stable manure, consisting of sawdust and shavings, and paying for bulk instead of value. Ashes have been the best dressing for me, in proportion to the cost. The next is barnyard manure, well pulverized; put it on in the fall, just before the snow comes. I have had wonderful effects from that.

I tell my brother farmers that I would pay half a dollar a bushel for leached ashes if I could not get them for less. Some men may say, "There isn't grass seed enough; it don't come up quick enough." My experience is otherwise. I had an acre and a half that I mowed two or three years, and I got less than 600 pounds to the acre, and only a June grass. Bought sixteen dollars worth of leached ashes and spread it on this acre and a half in the fall. There was scarcely any clover, but the next year it was a solid mat of clover, both red and white. I cut that year over a ton to the acre. The second year I got a ton and a half. I have mowed it now five years, and this last year, I had over a ton to the acre of good hay. That is all I did to it. I have tried barnyard manure, but never have realized so much advantage from it, in proportion to the cost, as from leached ashes.

Sec. GOODALE. When clover is spoken of as a manurial agent for the renovation of grass land, or the preparation of land for wheat, the idea is very often advanced that it should be plowed in green. I am aware that this method is extensively practiced in New York, and often with the happiest results; but I have known instances here where it has had a very injurious effect, and I wish to offer a caution, in case you turn in clover, not to do so when it is very green, nor in very hot weather. Two or three instances of the character to which I have referred, have occurred near where I reside. The men had heard of the wonderful effect of clover when turned in for manure; and having heavy crops which were badly lodged, they thought it a grand chance to test the efficacy of clover for manure, and so that enormous burden was turned under green, in very hot weather, and the consequence was that the land was greatly worse for some years. As they expressed it, "the clover fermented so violently that it soured and poisoned the land." The fact is undoubted that following the turning in of that heavy crop of clover, in hot weather, the land was seriously injured. If the crop had been left for a month or six weeks, and then turned in, the result, I believe, would have been entirely different.

Now that we are speaking of clover, I will remark that those of you who have obtained a copy of our last Report, will find in its latter pages, an article by Dr. Voelcker, the well known chemist of the Royal Agricultural Society of England, and who is perhaps the most prominent man in his profession in the world. He has made an exhaustive examination of this subject, and you will find

the results there in full. The article is entitled, "Clover as a preparatory crop for wheat." It is well to bear in mind that the requirements of the wheat crop are almost precisely the same, as far as manure is concerned, as the grasses proper. Remember that all the facts he gives you are as pertinent to the subject of grass as of wheat.

Mr. SEARS. Secretary Goodale is undoubtedly right in what he says about plowing in clover. When I was a younger man than I am now, I attempted to raise wheat in a rotation with clover. I commenced by sowing clover in the spring with the wheat, turning in the clover in the fall. I found my wheat crop deteriorated. I then changed my plans and let the clover grow until the next July, and turned it under when in full blossom. My wheat crop deteriorated under that management. Since then, I have learned that I plowed the clover under too early, when it was too green and succulent; that I should have let it remain until it ripened.

About eight years ago the farmers in Winthrop commenced the practice of top-dressing. It looked to me like throwing away the manure, to spread it on the surface and let it evaporate. I have watched the process, however, and have seen prodigious results produced by this practice. I will state some of the conditions under which top-dressing will be most profitable. understand that the ground should be in English grass, and that the grass should not be run out, although it may have become reduced. Top-dressing will affect English grass more advantageously than low lands producing swale grass. Another thing is, that farmers can top-dress to good advantage the lower and stronger grass land, reserving their finer soils, that they can cultivate more easily, for tillage. Still another advantage is, that by top-dressing the labor on their farms can be very much reduced. He can curtail his plowing and hoeing by applying a portion of his manure to his grass land; consequently he will have to pay less for hired labor.

What kind of manure should be used for top-dressing? It has been supposed that it should be old and fine, but I have a neighbor who has successfully used new, long manure. He spreads it in the fall, and by the next spring it is out of the way of the haying operations. He finds that long manure may be as profitably applied as that which is fine.

Mr. PUTNAM of Aroostook county. I had a piece of land of nine acres, where I pastured a cow and a horse. I could not very

well plow it, and so began to top-dress. I spread 150 loads of manure on five acres of this land, and got a good crop of hay the next year. One acre I plowed and dressed pretty thoroughly with ashes and manure for two years. It was then laid down, and I have mowed it now nine years, and have just it into good grass. That which I did not plow has yielded good grass all the time. I prefer to top-dress upon snow, for the reason that when the snow goes off the grass is ready to come up through the dressing, and the manure will cause the snow to go off some days earlier than it otherwise would.

The idea is an erroneous one, that we must plow to prepare land for grass. After it has once been levelled it should not be broken up again, but when it fails put on the dressing.

Mr. WRIGHT of Lewiston. I would inquire the relative value of leached and unleached ashes.

Mr. SWEET. In my experiments I could not see any difference. I would give as much for leached ashes as for unleached, for top-dressing.

Mr. WRIGHT. I understand there is a large quantity of potash in unleached ashes, which the soap-makers get out, and I suppose that part to be of great value to the soil.

Secretary GOODALE. It is true that unleached ashes contain a considerable per centage of potash, which the leached ashes do not, and perhaps also some other salts that may be of value. Soluble potash for agricultural purposes, where it is needed, is worth more than farmers generally suppose; I will not say how much, but if I had it, I would not sell it for six nor eight cents a pound. At the same time, experience shows that leached ashes answer as good a purpose, *on some soils*, as unleached. This only shows that the soluble potash was not required in those cases. It does not show, by any means, that unleached ashes would not be better on another soil. There are cases where unleached ashes are worth twice or thrice as much as leached ashes, and this, because on those soils, the soluble potash is wanted. Where leached ashes succeed so well, the indication is, that the phosphates, which constitute their chief value, are more needed than potash is.

Mr. SWEET. Different soils require different treatment. Some years ago, I was near the seashore, and saw men applying muscle mud to their fields. I found that it produced an abundant crop of hay, and had the curiosity to try it on my farm in Paris, about

forty-five miles from the seashore. So I procured some, and when it came, I spread it on a piece of run down mowing, and watched it year after year, and I never could see that it added one spear of grass.

Four years ago, there was considerable said about superphosphate of lime for mowing land. I tried that, at the rate of about 300 pounds to the acre, setting up stakes where I sowed it; were it not for the stakes, I should not know where I put it.

Mr. MARTIN. I have had all sorts of experience with superphosphate. Some years ago we used Coe's (or Bradley's). At first that did well, but it soon run down, so as to be good for nothing. Then the Cumberland came along, and I tried that, or thought I did. That proved worthless also, and I said some hard things about it. When I told my friend Goodale about it, he soon satisfied me that I had been imposed upon in buying something else, and not the genuine. Then I tried again, and I also procured some of Croasdale's and some of Wilson's, and some flour of bone. The Croasdale's did something, and the Wilson's did rather better. From the flour of bone, I saw no effect at all. But the Cumberland, which I had condemned and was prejudiced against, was very far ahead of the other three. It made the potatoes grow, and the beans, and the corn, and the weeds too. I got a noble crop of corn where I applied the Cumberland superphosphate. I was very particular to see that each had exact justice done—the same amount of each to the same amount of surface. When people talk about superphosphate, they sometimes give their experience with a good article and sometimes with what is worthless.

Mr. LAWRENCE of Bucksport. We all know the value of ashes as a top-dressing for grass, but it is not every one who can get ashes. We need not, however, despair on that account, for we can make a mixture of lime with top soil that will be as good as ashes, and not cost half the money. Take one bushel of lime to three of top soil, compost them together, and let the heap be until it is "cooked," as we farmers say, and you will have a preparation that will answer as good, and even a better purpose, than leached ashes. At least, such has been my experience.

Secretary GOODALE. What is the character of your land?

Mr. LAWRENCE. I put it on what we call clayey marl. If I was going to bring up a piece of land that was full of bogs, roots, &c., I should use caustic lime, and in large quantity; but in using lime as manure, we use a smaller amount.

I am here as a representative of the Bucksport Farmers' Club. I have come 125 miles to attend this meeting, and I must say that I have been richly repaid for coming. I have written down many things, and have treasured up very many other things, which I shall report to the Club, when I next meet them, and shall give a very favorable report in relation to this meeting.

Mr. L. CHAMBERLAIN. I wish to say a few words in regard to one or two points which have come up in the discussion. While a gentleman was speaking this forenoon, the question was asked him, "Do you believe grass blossoms twice?" His reply was, "I have always thought so." The gentleman who asked the question, said, "I have always thought so, too." They have thought so—why? Somebody told them so, years ago, they took it for granted, asked no questions about it, and are still travelling through the world with their eyes shut.

Another question was asked: "Did you ever discover any difference in the color of the first and second blossoms?" "Certainly; the first are a pale blue, the others darker." If you will keep your eyes open, you will frequently find two heads standing side by side, one light blue, the other dark blue. Why is that? Is one in the first blossom and the other in the second? If so, one is ready to cut, and you must wait a week or two for the other.

One gentleman remarked, that we frequently see herds-grass in full bloom, and the next day see no blossoms at all, and in a day or two after, we see them full again. That is true; I see that every year. But he gives that as a reason for his opinion, that there is a first and second blossoming. I suppose you are all aware, or, if you are not, if you will open your eyes next summer, you can see that the herds-grass blossoms come in the night. You see them in the morning, but as soon as the dew is gone, those blossoms wilt, and a very slight wind blows every one to the ground. If the wind continues blowing through the next night, you will see none the next morning, but the first calm night that comes, they will show again. But let every night be calm, and you will see them the same every morning, until every blossom is gone.

I want to say another word. It was remarked this forenoon by one speaker, that he liked early cut hay for cows giving milk, but he wanted later cut hay for working oxen. If there is any reason for that, I would like to know what it is. I cannot see it. The

constituents of the grasses, so far as regards all the soluble ingredients that are fitted for making milk, fat, bone and muscle, increase at the same time, and when they contain the constituents that are required for making milk in the greatest degree, they contain the elements suited to make bone and muscle in the greatest degree.

Gov. BROWN. The first question propounded when we came in this afternoon I believe was something like this, "How can we obtain the largest and best crops of grass in the most profitable way?" That is a very interesting question, and a great many interesting facts have been stated here in relation to it. When we can all settle down upon one conclusion in regard to that question, then your hay crop in the State of Maine will probably be trebled in the course of two or three years. But we shall never arrive at that, because we are a free thinking and acting people, and do pretty much as we please; and it is hard bringing our opinions into accord.

Down here in the State of Maine, you have everything to do with. I was never among such a people. Talk about using 100 bushels of ashes to the acre! We should almost as soon think of using 100 bushels of gold dust. We cannot get ashes except at very high prices indeed. I have no doubt they produced all the results which have been stated by Dr. Garcelon and other gentlemen here. We know they can be used to great advantage on almost any soil or crop. The practice in Massachusetts is very common of laying down lands to grass in the fall, after we have taken off a crop of anything we can get early, so as to plow the land by the first of September; but it is preferable to do it the last of August. We plow the land, manure it, cover the manure only two or three inches, and then sow grass seed and nothing else. That is the way most of our land is laid down to grass. Some people hoe the corn crop flat, and lay the land down to grass in that way, and succeed admirably. There are various ways of getting at the same thing.

Your Secretary has alluded to the matter of clearing and preparing the soil for other crops, especially wheat. The cultivation of clover not only gives us the best fodder, in my opinion, that grows, for stock of all kinds, especially for milch cows, but it enriches the land beyond anything that most of us have had any idea of until a very short time. A gentleman living in the town of Lexington, six miles below me, who made some very careful

experiments, found that the roots of clover penetrated more than two feet, and he estimated that the amount of roots in an acre was four times as much as the crop of clover taken off the surface. If that is the operation of clover, if it permeates the soil in that way, no wonder it prepares the ground for the wheat crop and other crops. There is every encouragement, then, for us to resort to clover as a means of restoring our worn-out lands. We can get a small crop, even the first year, by applying a little capital to the land, in the labor of our teams and our hands. Then we can plow it under, being careful to avoid the error to which the Secretary has referred, of plowing it in when it is too green.

In regard to top-dressing, the trouble generally is that we do not begin to top-dress so long as we get a fair crop. When we get reduced to a very small crop, we begin to top-dress. There would be just as much propriety in sending for the doctor just as your child was dying, as to top-dress in that way. We must begin to top-dress while the plant has roots and they are fastened in the ground; then I do not see why we cannot keep our mowing land in good condition for a hundred years.

Resolutions were then passed tendering the thanks of the Board to the municipal authorities of Lewiston, to the agents of the Androscoggin and Bates Manufacturing Companies, to the Hon. J. B. Ham, J. G. Coburn, Esq., and to Mr. J. S. Barrell, for numerous favors and courteous attentions bestowed upon the Board and upon its members personally, after which the Board finally adjourned.

ON THE CHEMISTRY OF THE FEEDING OF ANIMALS FOR
THE PRODUCTION OF MEAT AND MANURE.

BY MR. J. B. LAWES.

Read before the Royal Dublin Society.*

The breeding and feeding of stock must always constitute an important branch of the agricultural practice of this Island. With a climate rarely so hot and dry in summer, or so cold in winter, as to materially arrest vegetation, Ireland may not less truly than poetically be styled the Emerald Isle. A succession of seasons more than usually unfavorable for grain crops has greatly reduced the profits, and even the capital, of many of our farmers. It is natural, therefore, that there should be, at the present time, more attention directed to the production of meat, and less to the growth of corn; more especially as with the declining price of grain that of meat has considerably advanced, and has probably not yet reached its highest point.

Although the application of science to agriculture is not generally regarded with much favor by practical farmers, there are still very many who feel how advantageous it would be to know more of the rationale of their operations than they do at present. The scientific principles involved even in old-established practices are frequently but little understood; whilst farming is every year becoming less and less of a mere routine business than it was formerly; new foods, new manures, improved descriptions of stock and seed, and new mechanical appliances are constantly being introduced, requiring more knowledge and discrimination in their selection and use.

The particular branch of agriculture upon which I have the honor to address you this evening is that of the production of *meat* and *manure*. We all know that when fattening animals are supplied with a sufficient amount of proper food they increase in weight, a portion of the food being fixed or stored up in the body; that other portions are rejected by the animal in the liquid and solid form, and serve as manure; and that others are expended or lost in the processes of respiration and cutaneous exhalation.

* From the Journal of the Royal Dublin Society.

Experience also teaches us that some foods have higher feeding values than others, and it is generally supposed that with a difference in feeding properties there will also be a difference in the value of the manure.

It is the province of agricultural chemistry to determine what proportion of the several constituents of the food consumed will be stored up in the form of meat, and how much will remain as manure, according to the description of animal, and the kind of food employed, and so to provide the means of estimating the value of the respective products of the feeding operation. To this end, it is necessary to determine, by means of careful analysis, the composition of the foods consumed, of animals in the store or lean and in the fat condition, and of the manurial matters voided. Such an undertaking is, however, by no means a light one, and it can only be carried out with any prospect of success by the joint aid of experiments on a large scale in the feeding-shed, and of investigations in the laboratory, involving a great amount of analytical labor, and requiring the observance of all the refinements of method which modern science permits.

I propose to bring before you a condensed summary of some of the results which have been obtained in experiments made at different times during the last twenty years, at my farm and laboratory, at Rothamsted, in Hertfordshire. There are, it is true, many points which are not as yet satisfactorily cleared up, and some of these are still under investigation. The figures given in the tables, in most cases, however, represent the results obtained in careful experiments with large numbers of animals of each of the descriptions indicated, and they may be taken as showing what should be the average result obtained in ordinary farm practice, when animals of fair quality are fed liberally for the butcher.

Composition of Oxen, Sheep and Pigs, in the Store and Fat Condition.

For the purpose of my illustration, I shall assume that an ox or a sheep will increase in weight by about one-half, and that a pig will double its weight during the so-called fattening period. Accordingly I shall direct your attention to the composition of each of these descriptions of animal when in the lean or store, and also when in the fat condition, after it has increased in the proportion above supposed. I shall then show the average amount of food required to produce 100 lbs. increase in live weight, and also the

composition of the food, of the increase, and to some extent of the manure also; and in doing so I shall assume that the animals are liberally supplied with good fattening food; for it should be borne in mind that, as a large amount of the food is expended to maintain the respiration of the animal, the proportion of this expenditure or loss to the amount of saleable increase obtained will be the greater the longer the period required for the production of the increase, and hence it will be the greater if the food be inferior in quality, or stinted in amount.

With these preliminary remarks, I will now direct attention to the tables.

TABLE I.—*Composition, per cent., of Oxen, Sheep, and Pigs, in the Store and in the Fat Condition.*

	Oxen.		Sheep.		Pigs.	
	Store.	Fat.	Store.	Fat.	Store	Fat.
Nitrogenous substance.....	18·0	15·0	15·0	12·5	14·0	10·5
Non-nitrogenous substance (fat).....	16·0	30·0	18·0	33·0	22·0	44·0
Mineral matter.....	5·2	4·0	3·5	3·0	2·8	1·8
Total dry substance.....	39·2	49·0	36·5	48·5	38·8	56·3
Water.....	60·8	51·0	63·5	51·5	61·2	43·7
Total.....	100·0	100·0	100·0	100·0	100·0	100·0

Table I. shows the composition, per cent., of oxen, sheep and pigs, both in the store and in the fat condition, the constituents given being the nitrogenous substance (lean), the non-nitrogenous substance or fat, the mineral or incombustible matter, the sum of these or total dry substance, and the water.

Taking first the nitrogenous substance, it is seen that in each description of animal there are several per cent. less of it in the fat than in the store condition. Of fat, on the other hand, there is in the case of both the oxen and the sheep nearly, and in that of pigs fully, twice as much in 100 lbs. live weight of the fat, as in the same weight of the store animals. The mineral matter, again, like the nitrogenous substance, is found in less proportion in the fat than in the store animal. Lastly, the proportion of total dry substance is seen to be considerably increased, and that of the water diminished, as the animal passes from the lean to the fat condition.

In fact, the fattening process may be said to consist mainly in the diminution of the proportion of water, and the increase of that

of fat. The actual amounts of both the nitrogenous and the mineral matter do, indeed, augment during the fattening process, as will be seen presently, when I come to speak more directly of the composition of the increase itself; but as they do so in so much less proportion than the fat, it results that their proportion in a given live weight becomes less and less, whilst that of the fat increases as the animal matures.

The quality of the meat depends, however, much upon the distribution and the character of the fat deposited as well as upon its amount. Different breeds store up their fat very differently—some more outside upon the carcass, some more around the internal organs, some in more intimate mixture with the nitrogenous or fleshy portion of the meat, and so on. Then, again, complaints are sometimes heard of the fat, particularly of pork, boiling away. Such faulty deposition is generally attributable to the character of the food, and is found to result when too much oily matter is given, or when pigs are fed freely with roots or other succulent food.

Proportion of Parts, in Animals of different Descriptions, and in different Conditions of Maturity.

Passing from the question of the chemical composition of oxen, sheep and pigs, it will be desirable, before considering the relation of the increase and manure produced to that of the food consumed, briefly to point out some characteristic differences of structure or relative proportion of certain of their internal organs, as in these will be found the key to the difference in the character and amount of food which the three descriptions of animal respectively require. Table II. illustrates this part of the subject.

It is seen that whilst 100 lbs. live weight of the ox comprises about $11\frac{1}{2}$ lbs. of stomach and contents, that of the sheep contains only $7\frac{1}{2}$, and that of the pig only $1\frac{1}{2}$ lbs. Of intestines and contents, on the other hand, the ox contains only $2\frac{3}{4}$, the sheep $3\frac{1}{2}$, and the pig $6\frac{1}{4}$ per cent. Again, of stomachs and intestines (and their respective contents), taken together, the ox contains about $14\frac{1}{4}$, sheep about 11, and pigs $7\frac{1}{2}$ per cent. Thus, of the receptacles and first laboratories of the food, the oxen contain by far the largest, and pigs by far the smallest proportion, which would appear to indicate a great difference in the requirement for bulk of food, such, indeed, as we know in reality exists. Oxen require a larger proportion of woody fibre in their food than sheep, and

TABLE II.—*Proportion of Parts in Animals of different Descriptions, and in different Conditions of Maturity.*

	Per Cent.					
	In different Animals.			In Sheep in different Conditions.		
	Oxen.	Sheep.	Pigs.	Store.	Fat.	V'ry fat
Average of	16	24.9	5.9	5	10.0	4.5
Stomachs and contents.....	11.6	7.5	1.3	9.1	7.0	5.6
Intestines and contents.....	2.7	3.6	6.2	5.3	3.8	2.8
Internal loose fat.....	14.3	11.1	7.5	14.4	10.8	8.4
Heart, aorta, lungs, windpipe, liver, gall-bladder and contents, pancreas, spleen, and blood.....	4.6	6.9	1.6	4.5	6.0	7.5
Other offal parts.....	7.0	7.3	6.6	8.4	7.7	6.5
Total offal parts.....	13.0	15.0	1.0	17.9	16.1	13.1
Carcass.....	38.9	40.3	16.7	45.2	40.6	35.5
Loss by evaporation, &c.....	59.3	59.2	82.6	53.4	58.7	64.1
	1.8	0.5	0.7	1.4	0.7	0.4
Total.....	100.0	100.0	100.0	100.0	100.0	100.0

sheep much more than pigs. On the other hand, the food of pig contains much more starch, or allied digestible matter, than that of the sheep, and that of sheep more than that of oxen, reckoned in relation to the weight of the animal; and it is known that starch undergoes its primary change (into sugar) almost throughout the length of the intestinal canal. Accordingly, we observe that the pig has a larger proportion of intestines than the sheep, and the sheep more than the ox.

Of the further elaborating, or what may be called the skilled labor organs of the body, and their fluids—the heart, liver, lungs, blood, &c.—the proportion is seen to be nearly the same in the three descriptions of animal.

The proportion of internal or loose fat is greater in the sheep than in the oxen; but it should be observed, that a large proportion of the sheep contributing to the average result given in the table were in a more advanced state of fatness than the oxen. The comparatively small proportion of internal fat in the pig is accounted for by the peculiarities of the animal. The proportion of its internal organs is comparatively small, and its speciality is to lay on fat in a greater proportion outside the frame.

The second portion of the table shows the varying proportion of the different parts in one and the same description of animal, ac-

ording to its degree of maturity. The animals selected for illustration of this point are sheep. Records not given in the table show that, as the animals grew and fattened, the actual amount, per head, of stomachs and contents increased considerably; that the intestines and contents did so in a much less degree; that the internal loose fat was more than trebled; and that the other internal parts, and their fluids, collectively, increased in nearly the same proportion as the stomachs and contents. The general result was, that the total offal parts increased in actual amount from the store to the very fat condition in the proportion of about 1 to $1\frac{3}{4}$; but the total carcass parts augmented from 1 to nearly $2\frac{1}{2}$ —much more, therefore, than the total offal parts.

Turning now to the figures in the table, it is seen that the per cent., or proportion in 100 parts, of all the internal organs and parts, excepting the loose fat, diminished very considerably as the animals matured and fattened. Whilst the total offal parts diminished from 45·2 in the store to 40·6 in the fat, and to 35·5 per cent. in the very fat condition, the carcass parts increased from 53·4 in the store, to 58·7 in the fat, and to 64·1 per cent. in the very fat condition. That is to say, the so-called offal parts, which are chiefly composed of the organs of reception, elaboration, and transmission of the food constituents, increase in very much less proportion than those parts which it is the object of the feeder should be produced from the food consumed.

Relation of the Increase, Manure, and Loss by Respiration, to the Food consumed by different Animals.

We now come to the question of the description and amount of food consumed by the different animals to produce a given amount of increase, and to the collateral questions of the relation of the constituents in the increase and in the manure to those in the food consumed.

Table III. shows the amounts of certain foods assumed to be required for the production of 100 lbs. of increase in live weight—of oxen, sheep and pigs, respectively. The amounts will, of course, vary, according to the quality of the animal, the stage of its development, the external conditions to which it is subjected, the description and quality of the food, and so on; but the quantities assumed are approximately those which will be required, taking the average of large numbers of animals over the whole period of fattening, and supposing foods of the descriptions indi-

TABLE III.—*Food, Increase, Manure, &c., of Fattening Animals.*

OXEN.								
	250 lbs. Oil-cake 600 lbs. Clover chaff } Produce 3500 lbs. Swedes } 100 lbs. and supply— } Increase,				100 Total Dry substance of Food supply—			Amount of each constituent stored up, for 100 of it consumed.
In food.	In 100 lbs. In- crease.	In Manure.	In Re- spira- tion, &c.	In in- crease.	In Manure.	In Re- spira- tion, &c.		
Nitrogenous substance, .	lbs. 218	lbs. 9.0	lbs. 323.0	lbs. 636	0.8 5.2	29.1 7.4	57.3	4.1 7.2
Non nitrogenous substance	808	58.0	81.4	—	0.2	—	—	1.9
Mineral matter,	83	1.6	—	—	—	—	—	—
Total dry substance . .	1109	68.6	404.4	636	6.2	36.5	57.3	—

SHEEP.								
	250 lbs. Oil-cake 300 lbs. Clover chaff } Produce 4000 lbs. Swedes } 100 lbs. and supply— } Increase,				100 Total Dry Substance of Food supply—			Amount of each constituent stored up, for 100 of it consumed.
In food.	In 100 lbs. In- crease.	In Manure.	In Re- spira- tion, &c.	In In- crease.	In Manure.	In Re- spira- tion, &c.		
Nitrogenous substance, .	lbs. 177	lbs. 7.5	lbs. 229	lbs. 548.5	0.8 7.0	25.1 6.8	60.1	4.2 9.4
Non nitrogenous substance	671	63.0	62	—	0.2	—	—	3.1
Mineral matter,	64	2.0	—	—	—	—	—	—
Total dry substance, . .	912	72.5	291	548.5	8.0	31.9	60.1	—

PIGS.								
	500 lbs. Barley Meal produce 100 lbs. Increase, and supply—				100 Total Dry Substance of Food supply—			Amount of each constituent stored up, for 100 of it consumed.
In food.	In 100 lbs. In- crease.	In Manure.	In Re- spira- tion, &c.	In In- crease.	In Manure.	In Re- spira- tion, &c.		
Nitrogenous substance, .	lbs. 52	lbs. 7.0	lbs. 59.8	lbs. 276.2	1.7 15.7	14.3 2.4	65.7	13.5 18.5
Non nitrogenous substance	357	66.0	10.2	—	0.2	—	—	7.3
Mineral matter,	11	0.8	—	—	—	—	—	—
Total dry substance, . .	420	73.8	70.0	276.2	17.6	16.7	65.7	—

cated, and of good quality, are employed, and that other conditions are moderately favorable.

The quantities of the different foods recorded in the table have been adopted after a very careful consideration of the results of numerous experiments on feeding on the large scale; and after the illustrations, which have been given of the different proportions of the organs in the different descriptions of animal, it will be seen how consistent are the variations in the quantity and quality

of the food recorded as required by the different animals. Thus, to produce the same amount of increase, oxen consume a much larger proportion of hay, containing so much indigestible matter, than sheep; whilst pigs are fattened on a diet as concentrated and containing as little indigestible substance as corn alone. The actual amounts of food assumed to be required for the production of 100 lbs. increase in live weight are—for oxen, 250 lbs. of oil-cake, 600 lbs. of hay-chaff, and 3500 lbs. of Swedes; for sheep, 250 lbs. of oil-cake, 300 lbs. of hay-chaff, and 4000 lbs. of Swedes; and for pigs, 500 lbs. of barley meal.

It will be remembered that, when speaking of the composition of the animals themselves, their constituents were grouped under the heads of nitrogenous substance, non-nitrogenous substance, mineral matter, and total dry substance, and the same classification is, for convenience of comparison, adopted in reference to the composition of the food, increase, and manure, of the different animals as recorded in Table III. As the food of the pig is the most simple, I will direct your attention to the figures relating to it in the first place. These will be found in the lowest division of the table.

The 500 lbs. of barley meal consumed in increasing the weight of the pig from 100 to 200 lbs. contained 420 lbs. of dry substance, and the 100 lbs. increase in live weight produced by it not quite 74 lbs.; about 70 lbs. remain in the manure, and 276 out of the 420 lbs. consumed were expended in respiration, and other exhalations from the body. Nearly two-thirds of the whole dry substance consumed have, therefore, been expended in keeping in working order the living meat and manure-making machine.

Looking to the column showing the composition of the 100 lbs. of increase, it is seen that it contains only 7 lbs. of nitrogenous substance, and 66 lbs., or more than 9 times as much non-nitrogenous substance or fat, whilst the mineral matter does not amount to 1 per cent. The general result is, then, that nearly two-thirds of the fattening increase in live weight were pure fat itself, and only about one-fourteenth of it nitrogenous substance or lean meat.

But to produce the 7 lbs. of nitrogenous substance in increase, 52 lbs. were consumed in food; by far the greater part of the remainder being found in the manure. To produce the 66 lbs. of fat, 357 lbs. of non-nitrogenous substance were consumed; but as it existed in the food almost entirely in the form of starch, and as

it requires about $2\frac{1}{2}$ parts of starch to form 1 of fat, it may be said that at least 165 lbs. of the non-nitrogenous substance consumed contributed pretty directly to the formation of the 66 lbs. of fat. Lastly, in reference to the increase: of the 11 lbs. of mineral matter consumed, only about $\frac{3}{4}$ lb. were stored up in the increase of the animal.

It is observed, then, that a comparatively small proportion of either the nitrogenous substance or the mineral matter of the food, is retained in the increase; the manure, on the other hand, retains a very large proportion of the former, and nearly the whole of the latter.

Of 100 parts of gross dry substance consumed, 1.7 parts of nitrogenous substance, 15.7 of fat, and 0.2 of mineral matter—in all 17.6 parts—are stored up in the increase; 14.3 parts, consisting of highly nitrogenous organic matter, and 2.4 parts of mineral matter, making a total of 16.7 parts, are retained in the manure; and 65.7 parts, consisting chiefly of carbon, hydrogen and oxygen, are lost by respiration, &c. Or, if we reckon the proportion of each class of constituents consumed which is stored up in the increase, the last column of the table shows that of 100 of nitrogenous substance consumed, 13.5 parts; of 100 non-nitrogenous substance consumed, 18.5 parts; and of 100 mineral matter consumed, 7.3 parts are retained in the increase.

It will not be necessary to follow so closely the figures in the table relating to the sheep and oxen. It will suffice to direct attention to the chief differences of result obtained with the three descriptions of animal.

Whilst the pig required only 420 lbs., the sheep required 912 lbs., and the oxen 1109 lbs. of dry substance in food to produce 100 lbs. increase in live weight. In other words, the sheep consumed more than twice as much, and the oxen more than two and a half times as much, to produce a given amount of increase, as the pig. But the food of the pig was of a much higher character than that of the other animals. Whilst it consisted entirely of highly elaborated grain, closely resembling human food, the food of the other animals contained a large amount both of woody fibre and of crude succulent roots; the dietary of the ox containing the largest proportion of hay, with its high percentage of indigestible woody matter.

Turning to the columns giving the composition of 100 parts of the increase, they show that whilst that of the pig contained 73.8

parts of dry substance, that of the sheep contained rather less, and that of the oxen rather less still. The proportion of fat also was greater in the increase of the pig than in that of sheep, and greater in that of the sheep than in that of the oxen. The contrary was, however, the case with the proportion of nitrogenous substance, which was the greatest (9 per cent.) in the increase of the oxen, less (7.5 per cent.) in that of sheep, and less still (7 per cent.) in that of pigs. It will be observed, too, that the percentage of mineral matter in the increase of the ox and sheep is considerably higher than in that of the pig; and it is even rather higher in the case of sheep than oxen. Independently of any essential difference of structure in the different animals, this result is partly due to the fact that sheep and oxen, especially sheep, develop bony structure during the fattening process more than pigs. It is true that both sheep and pigs are, compared with oxen, fattened at an early stage of their development; but not only is the pig more naturally disposed to fatten instead of grow in frame very early in his career, if only liberally supplied with proper food, but the practice of feeders, to meet the demands of the market, is to encourage growth as well as fattening much more in the case of sheep than of pigs.

Comparing the constituents stored up in increase for a given amount of dry substance of food consumed in each case, the table shows that for 100 gross dry substance of food, the oxen and sheep stored up less than 1 per cent., and the pigs more than twice as much of nitrogenous substance; that of fat the oxen stored up only 5.2, the sheep 7, and the pigs 15.7 parts.

Or, looking at the subject from another point of view, the last column of the table shows that for 100 nitrogenous substance of food consumed, the oxen and sheep stored up little more than 4, but the pig about 13.5 parts; that for 100 non-nitrogenous substance in food, the oxen yielded 7.2, the sheep 9.4, and the pigs 18.5 parts of fat in increase; and that for 100 mineral matter consumed, the oxen stored up 1.9, the sheep 3.1, and the pigs 7.3 parts.

That a very much larger proportion of the constituents of the food of the pig than of that of oxen and sheep should be stored up as increase is, however, only what we should expect, when we consider that the former consists of matured grain, and the latter chiefly of comparatively immatured vegetable produce, containing a large proportion of indigestible and woody matter, and also a

larger amount of nitrogenous and mineral matter in proportion to its digestible and available non-nitrogenous constituents.

But whilst the pig, with his much higher character of food, gave so much more increase than the sheep for a given amount consumed, and the sheep more than the ox, the ox returned as manure 36·5 per cent. of the dry substance he consumed, the sheep not quite 32, and the pig only 16·7 per cent. The proportion of the consumed matter that was lost by respiration was, on the other hand, rather the lowest with the ox, namely, 57·3 per cent. ; whilst with the sheep it was 60·1, and with the pig it was 65·7 per cent. Or, reckoned in proportion to a given amount of increase produced, the oxen gave, for 100 lbs. of increase in live weight, 404 lbs., the sheep 291, and the pigs only 70 lbs., of dry substance in manure ; and for the same amount of increase, the oxen lost of dry substance, by respiration, &c., 636 lbs., the sheep 548·5 lbs., and the pigs 276·2 lbs.

There is another point from which it is desirable to view the difference of the result obtained with the different descriptions of animal. This is illustrated by the figures given in Table IV., which shows for oxen, sheep and pigs, respectively, the amounts of increase yielded, and of dry substance consumed in food, voided as manure, and lost by respiration, per 100 lbs. live weight per week.

TABLE IV.—*Amount of increase yielded, and of Dry Substance consumed in Food, recovered as Manure, and lost by Respiration, &c., per 100 lbs. live weight, per week.*

	Per 100 lbs. live Weight, per Week.			
	Increase yielded.	Dry Substance.		
		Consumed in food.	Recovered as Manure.	Lost by Respiration, &c.
	lbs.	lbs.	lbs.	lbs.
Oxen	1·13	12·5	4·56	7·16
Sheep	1·76	16·0	5·10	9·62
Pigs	6·43	27·0	4·51	17·74

The first column of this table shows that whilst the pig increases from 6 to $6\frac{1}{2}$ per cent. of its weight per week, the sheep increases only $1\frac{3}{4}$, and the ox little more than 1 per cent. No wonder, then (to say nothing of the difference in the character of the food), that the oxen and sheep, requiring so much longer time to add a given proportion to the weight of their bodies, should

consume so much food, void so much more as manure, and expend so much more in respiration, for a given amount of increase produced, as we have seen they do.

The other columns of the table show, however, that neither the amount of dry substance of food consumed, nor the amount lost by respiration, by a given weight of animal within a given time, is in excess with the pig in anything like the proportion that its increase exceeds that of the other animals. In other words, the much higher character of the food of the pig shows itself in the much greater rapidity, and the much greater proportion of its conversion into meat—the most valuable product of the feeding operation.

Lastly in regard to the results in this table, it is remarkable that, whilst, for a given weight of the body within a given time, the amounts of increase yielded, and of dry substance consumed in food, and lost by respiration, are so very different for the different animals, the amounts of dry substance voided in excrements are almost identical. I shall show further on that the limit of consumption is much regulated by the amount of non-nitrogenous substance contained in the food; and hence it would appear that the respiratory function had much to do with determining the amount of food consumed. It would also seem, from the equality of amount of dry substance voided by a given live weight of the different descriptions of animal within a given time, that the limit of consumption had also some connection with the amount of transformed and effete matter that the system could pass; and hence that the surplus available for increase was fixed by the necessary proportion of digestible and assimilable to effete matter in the appropriate food of the respective animals.

To sum up the points thus far illustrated, it may be said—

1. That during the fattening process the proportion, in a given weight of the body, of water, mineral matter, and nitrogenous compounds decreases, whilst that of the fat very considerably increases.
2. That the carcass parts, or saleable meat, increase more rapidly than the internal parts or offal.
3. That the amount of dry substance of food required to produce a given weight of increase is larger with the ox than with the sheep, and larger with the sheep than with the pig.
4. That the dry substance of the food of the ox contains a larger

proportion of indigestible matter than that of sheep, and that of sheep more than that of pigs.

5. That oxen require from 5 to 6, and sheep from 3 to 4 times as much time to add a given proportion to the weight of their bodies as pigs.

6. That the greater portion of the nitrogenous and mineral matters of the food is recovered in the manure; and that the greater part of the non-nitrogenous substance is lost by respiration and other exhalations—a much smaller proportion being retained in the increase, or voided in the manure.

7. That for a given amount of increase produced, oxen void considerably more substance as manure, and expend more in respiration, &c., than sheep, and sheep very much more than pigs.

8. That for a given weight of dry substance consumed, oxen void more as manure than sheep, and sheep much more than pigs; but oxen respire rather less than sheep, and sheep rather less than pigs.

9. That in proportion to a given weight of animal, within a given time, oxen both consume and respire less dry substance of food than sheep, and sheep very much less than pigs; but they void almost identical amounts of dry substance as manure.

Comparative Feeding Value of different Foods, according to their Composition.

Thus far I have endeavored to indicate the characteristic points of distinction between the food of the ox, the sheep, and the pig, and to show in what respects its constituents are differently disposed of by the different animals; and for the purposes of my illustration, I have supposed the animals to be fed on such foods as are recognized as appropriate to them, and in such proportion and amount as experience justifies. I now propose to say a few words on the relative feeding properties of different foods, according to their composition.

Leaving out of view, just now, the incombustible or mineral constituents, it will be convenient, as before, to consider the other constituents of food to be grouped under the heads of nitrogenous and non-nitrogenous substances.

Among the nitrogenous substances, the most important of those which enter into our stock foods are albumen, casein, legumin, and gluten; and chemists and physiologists are accustomed to

speak of these—the nitrogenous compounds—as the flesh-forming substances.

The non-nitrogenous constituents of our stock foods are starch, sugar, gum, pectin, oil, and cellulose, or woody fibre in different conditions of digestibility or induration. The non-nitrogenous compounds are spoken of as the respiratory or heat-producing, and fat-forming substances.

Now, writers on agricultural chemistry and physiology have generally assumed that it is chiefly the proportion of the nitrogenous or so-called flesh-forming substances contained in them, which determines the comparative value, for feeding purposes, of different foods.

The colored diagram before you will enable you to judge whether or not this supposition is justified by the practical experience of feeding. This diagram has been constructed by the animals themselves. They know nothing about nitrogenous or non-nitrogenous constituents, digestible or indigestible cellulose, and so on; but they are gifted with an unerring instinct, which enables them not only to distinguish between substances which are and are not food, but also to select from a variety of food stuffs those which are most suitable for the requirements of the system, and so to indicate to us the proper amounts and proportions of the different constituents.

In the experiments to which the diagram refers, as well as in many others, the plan has been to select foods containing very different proportions of nitrogenous and non-nitrogenous compounds; in fact, some containing two or three times as much nitrogen as others. We have then given to one set of animals a small fixed amount daily, of food containing a low percentage of nitrogen, and allowed them to take as much as they chose of food, different in composition in this respect. To another set we have given a limited amount of food, rich in nitrogenous compounds, and allowed the animals to take, *ad libitum*, of a different description of food, and so on. In this way they have been enabled to fix for themselves the limit of their consumption of nitrogenous and non-nitrogenous constituents, respectively, according to their wants.

The diagram shows the results of such experiments with pigs; and the foods employed were Indian corn meal, barley meal, bean meal, lentil meal, bran, and dried cod-fish, used alone, or in combination, as the case might be. Black being taken to represent

nitrogenous substance, red non-nitrogenous substance, and green total dry organic matter (nitrogenous and non-nitrogenous together), the diagram is constructed as follows:—The smallest quantity of nitrogenous, or non-nitrogenous, or total organic matter consumed in any one experiment is reckoned as 100; and the several lines above the base line, which is marked, 100, indicate larger amounts, corresponding to the figures given at the side of the diagram.

The upper portion shows the relative amounts of each constituent consumed in each experiment per 100 lbs. live weight per week; that is to say, by a given weight of animal within a given time. A glance shows you that the height to which the colors representing the non-nitrogenous, or the total organic substance reach is very much more uniform than that indicating the consumption of nitrogenous substance. In fact, it is perfectly clear that the animals were guided in the amount of food which they consumed by the amount of non-nitrogenous, and not by that of the nitrogenous constituents which it supplied.

But, according to current theories, the amount of nitrogenous substance ought at least to determine the amount of increase produced. The lower portion of the diagram shows what the animals have to say on this point. The arrangement is the same as before; but the results show, not how much of each class of constituents was consumed by a given weight of animal within a given time, but how much was consumed to produce a given weight (100 lbs.) of increase.

Here again we see that the amount of either non-nitrogenous or total organic substance consumed varied comparatively little, whilst that of the nitrogenous substance consumed for the production of a given amount of increase varied from 100 to over 300 parts.

It is obvious, therefore, that both the amount of food consumed by a given weight of animal within a given time, and that required to produce a given weight of increase, were determined by the amount of available non-nitrogenous substance which the food supplied. The quantities required would, doubtless, have varied within even narrower limits, had all the foods contained equal proportions of indigestible woody matter.

It may be observed that it is doubtful whether pigs are able to digest cellulose, or woody fibre, at all; but there is no doubt, as the investigations of ourselves and others on the point sufficiently

prove, that oxen and sheep are able to digest a considerable portion of such matter, when it is not in too indurated a condition.

It will, of course, be understood, that a certain amount and proportion of nitrogenous substance is essential in the food of animals ; and if I were asked to state in general terms what was the approximate proportion of the nitrogenous to the digestible non-nitrogenous substances, below which they should not exist in the food of our stock, I should say (though with reservations), about such as we find them in the cereal grains ; and since few of our stock foods are below, and many above, this in their proportion of nitrogenous substance, it results that we are more likely to give an excess than a deficiency of such constituents, so far as the requirements of the animal are concerned. The value of the manure depends however, very much on the amount of the nitrogen which the food contains ; but to this point I shall recur after directing attention to a few more points in connection with the comparative values of different foods as such.

Some years ago we published the results of some experiments on the equivalency of starch and sugar in food, pigs being the subject of the trial. Several lots having each a fixed and limited quantity of lentil-meal and bran allowed, one was permitted to take as much starch, another as much sugar, and another as much of the mixture of the two as they chose ; whilst in another experiment the animals were allowed to select at discretion from lentils ; bran, sugar or starch, each placed separately within their reach. The result was, that sugar and starch were found to have, weight for weight, practically the same value as constituents of food.

These results would, *a priori*, lead to an answer in the negative to the much agitated question, whether there is any advantage in malting barley for feeding purposes. The chief effect of the malting process is to convert starch into sugar—not, it is true, sugar of exactly the same description as that used in our experiments ; but there is good reason for supposing that malt sugar would have a lower value than cane sugar as a food constituent ; and direct experiments, made many years ago at Rothamsted, have shown that a given amount of malt, mixed with other food, gave less rather than more increase than the amount of barley from which it was produced. It is obvious, too, that as the conversion of barley into malt is a manufacturing process, attended with considerable cost, as well as actual loss of substance, the remission of

the duty on malt employed for feeding purposes would not be likely to be of benefit to the farmer, unless either a given amount of malt sugar proved to be of considerably higher feeding value than the starch from which it was produced, or the other constituents were rendered more digestible and assimilable by the process.

This leads me, before leaving the subject of foods, to make a few remarks on some other manufactured foods for stock. Many complaints are made, and justly made, of the adulteration of oil-cakes; and it is sometimes asserted that cheaper and better foods than the average of cakes now in use could be manufactured with advantage both to the maker and to the feeder. Linseed and other cakes are themselves, in one sense, manufactured foods. But the object of the manufacturer is not the production of cake, but of oil. If the farmer did not use the cake at all, it would still be made, and the oil would be sold for a higher price. As it is, the manufacturer makes the cake as a bye-product, and the price he gets for it enables him to sell his oil so much the cheaper.

But if manufactories were set up for the special purpose of preparing foods for stock, the whole cost of the undertakings must be charged upon the food. Lentils, beans, peas, Indian meal, barley meal, linseed, and other good staple foods must be used; and although it might be possible so to combine foods together that a given weight of the mixture would possess a somewhat higher feeding value than the component parts used singly, there is every reason to suppose that the increased cost would more than counterbalance any slight benefit that could be derived in that way. Nor do I anticipate that the progress of science will aid us much in this direction. Condimental foods have been tried and found wanting; and I have little doubt that a similar result will attend the manufacture and use of simpler food mixtures. Our hopes as feeders must be in increased and cheap supplies of ordinary cattle foods of a good quality, rather than in submitting those we have to costly processes of manufacture.

The results arrived at in regard to this portion of the subject may be briefly summed up as follows:—

1. The comparative feeding value of our current stock foods depends more upon the proportion of the digestible non-nitrogenous substances they contain than upon their richness in nitrogenous compounds; but the richer the food in nitrogen, the more valuable will be the manure.

2. Of the non-nitrogenous constituents of food, starch and cane sugar have, weight for weight, nearly equal feeding values ; malt sugar has probably rather a lower value than either cane sugar or starch ; digestible cellulose, in moderate proportion, has, for ruminant animals, probably nearly the same value as starch ; and fat or oil have probably about two and a half times the value of starch for the purposes of respiration, or the storing up of fat in the body.

3. Some advantage results, in a feeding point of view, from the judicious mixture of a variety of ordinary stock foods ; but the benefit to be derived in this way is not such as to compensate for the extra cost of a special manufacturing process to attain it.

Connection between the Value of the Manure and the Composition of the Food consumed.

The next and last branch of the subject relates to the comparative value of the different constituents in the liquid and solid voidings of the animals, and to the connection between the value of the manure and the composition of the food from which it is produced.

I have already pointed out that the greater portion of the carbon, hydrogen and oxygen of the food either passes into the increase or off in respiration, and that comparatively little of any of them is recovered in manure. By far the larger portion of the nitrogen, and nearly the whole of the mineral matter consumed are, however, so recovered.

To show the economic connection between the feeding of stock for the production of meat and manure, and the growth of corn, I propose to adduce a few results obtained in experiments on the growth of wheat by different manures. In the experiments in question, wheat has been grown for twenty successive seasons on the same land.

In Table V. are given the average annual produce of corn and straw, and the estimated yield of carbon, per acre, over the last twelve years, respectively without manure, with mineral manure alone, with mineral and nitrogenous manure (ammonia salts), and with farm-yard manure.

Where the farm-yard manure was employed, more carbon, as well as more of every other constituent, was annually applied in manure than removed in the crop. In the other cases no carbon whatever was supplied in the manure ; and yet it will be observed that where the mineral manure and ammonia salts were employed

TABLE V.—Average Annual Produce of Wheat, and estimated Yield of Carbon per Acre, over 12 years.

Manures per Acre per Annum.	Average Annual Produce per Acre.			
	Dressed Corn.	Total Corn.	Straw.	Carbon.
	Bushels	lbs.	lbs.	lbs.
Unmanured	15½	964	1662	1062
Mineral manure alone	18½	1157	1897	1234
Mineral manure and 400 lbs. ammonia salts.....	36½	2275	4212	2625
14 tons farm-yard manure.....	35½	2232	3869	2467

(the latter containing a large amount of nitrogen) the yield of carbon was greater than where a large amount of that substance was supplied by means of farm-yard manure. This carbon must have been derived from the atmosphere. In several experiments in this field last year, from 1½ to 1¾ tons of carbon per acre were removed in the crop, without any being supplied in manure; but in these cases large quantities of nitrogen were supplied.

The quantity of carbonic acid required to yield 1½ tons of carbon to the crop is about as much as would be given off into the atmosphere in a year by twenty-two individuals of a mixed population of both sexes and all ages, and it will be seen that it is under the influence of ammoniacal or nitrogenous manure that this large amount of carbon has been fixed in the plant from the carbonic acid of the atmosphere.

The results given in Table III. showed how small was the proportion of the nitrogen consumed by an animal in its food that was stored up in its increase, and sent to market as meat. If there were none of the nitrogen of the food lost in the various exhalations from the body the whole of that not stored up in increase would be found in the manure. But the investigations of ourselves and others show that a certain portion of the nitrogen is so lost. Our own experiments to determine the limit of this loss, and the circumstances under which it is greater or less, were commenced as far back as 1847, and have been resumed occasionally from that time to the present; and during the last few years we have collected a great deal of experimental data on the subject; but as the whole of the analytical work is not yet concluded, I do not feel that I am in a position to give any numerical statement of the results obtained. It may, however, be stated as beyond a doubt, that by far the larger portion of the nitrogen consumed in food is rejected by the animals in their liquid and solid voidings;

and that the higher the proportion of nitrogen in food, the richer will be the excrements in that important constituent of manures.

Some years ago I published a Table, showing the estimated value of the manure obtained from the consumption of one ton of different articles of food used in ordinary farm practice. The valuation was founded upon a knowledge of the average composition of the different descriptions of food, and upon information, arrived at in the course of the experiments just referred to, as to the probable average amount of the constituents of food valuable for manure which will be obtained in the solid and liquid excrements of the animals.

Stating the results of these valuations in very general terms, it may be said that the estimated value of the manure from one ton of oil-cake was considerably more than that from the same quantity of linseed, lentils, tares, beans, or peas; from two to three times as much as that from one ton of oats, wheat, Indian corn, barley, or hay; from seven to ten times as much as from the same weight of oat, wheat, or barley straw; and about twenty times as much as from one ton of roots.

It is obvious, therefore, that in the selection of purchased foods for stock, it is very important to consider their manuring as well as their feeding value. One illustration on this point will suffice. A ton of locust beans will certainly not yield nitrogen in the manure of the animals consuming it equal to more than, if to as much as, $\frac{1}{4}$ cwt., or 28 lbs. of ammonia; but a ton of rape-cake will yield 1 cwt., or four times as much. If, therefore, we take the ammonia in the manure at 7*d.* per lb., the amount of it obtained from the consumption of a ton of locust beans will be worth only 16*s.* 4*d.*; whilst that from the ton of rape-cake will be £3 5*s.* 4*d.*

There is, in fact far greater difference in the manuring than in the feeding value of most of the ordinary stock foods in the market.

In illustrating the comparative value of the manure obtained from different foods, by reference merely to the amounts of nitrogen or ammonia-yielding matter which they supply, it will not be understood that I in any way ignore or underrate the value of the mineral constituents associated with the nitrogenous matter in the excrements. But, inasmuch as the amount of mineral constituents voided is generally in excess of that required for the due effect as manure of the nitrogen with which they are accompanied,

it results that the amount of the nitrogen or ammonia-yielding matter is practically the best index to the value of the manure.

Appropriateness of Animal Food in the Diet of Man.

It will be obvious that the importance of the subject which I have brought before you this evening rests upon the assumption that animal food is an important element in the diet of man. There are, indeed, some who maintain that a purely vegetable diet would be more suitable and natural than the mixed vegetable and animal one so generally preferred. If their view were adopted we need no longer trouble ourselves about the connection between the food, the increase, and the manure of fattening oxen, sheep and pigs. There are, however, various circumstances, economical and physiological, pointing to the appropriateness of admitting a certain proportion of animal food into the diet of man. To one or two of these I will briefly refer.

Walking is for man undoubtedly a very natural means of progression. Still, it is often very advantageous to ride, and so to employ the legs of a quadruped instead of our own. In eating meat we may be said to employ the stomachs of other animals to do that which we could not so well do with our own. As a few ounces of gold are separated from many tons of rock, by the combined aid of mechanical and chemical processes, so the animals feeding upon crude, and often to us indigestible, vegetable matter, eliminate from it, and store up in their bodies some of its constituents in a form at once much more concentrated than that in which they consumed them, and much more easily appropriated by the human economy. A given amount of nitrogenous compounds in the form of meat is undoubtedly more easily digested and assimilated by man than if the same amount were supplied in the form of beans. Then, again, the animals convert starch, sugar, &c., (and probably some of them cellulose, which we could not digest at all) into fat, which has twice and a half the respiratory and fat-storing capacity of the substances from which they produce it. It is, doubtless, true that man can produce fat, and keep up his respiratory function from starch and sugar; but it can hardly be doubted that there is some economy to his system in having a portion of fat supplied to him ready made.

Apart from the strong testimony of common experience on the subject, there is evidence in the comparative structure of man that

he is adapted for a concentrated form of food. One illustration, in passing, may be adduced on this point. Table VI. shows the proportion of the stomach, by weight, in a given live weight of oxen, sheep, pigs, and man :—

TABLE VI.—*Proportion of Stomach in different Animals.*

Stomach in 100 lbs. live weight :—	
Oxen.....	.51 ounces.
Pigs.....	14 “
Sheep.....	39 “
Man.....	6 “

Relative weight does not, of course, necessarily represent with numerical exactness relative capacity or size. But there is little doubt that there is a gradation in the capacity of the stomach relatively to a given weight of the body in the animals enumerated, in the order, and to a great extent in the degree indicated by the figures given in the Table. Admitting this to be the case, we have seen that the sheep, with its less proportion of stomach than the ox, takes a somewhat more concentrated food; and that the pig, with its much less proportion of stomach than the sheep, requires a much more concentrated food than the latter. May we not conclude that man in his turn, with his less proportion of stomach than the pig, will also appropriately take a more concentrated food than his useful friend?

The food of man is, indeed, very closely allied, in a chemical point of view, to that of the pig. The staple of the food of both the fattening pig, and man, is cereal grain. The pig, it is true, consumes the husk as well as the farinal portion, whilst man does not; but we know that this proportion of indigestible woody matter is very nearly the limit of that which is appropriate for the fattening pig, and that on the addition of a small quantity of bran the proportion of increase diminishes, and that of the dry substance of the food voided as excrement increases. The only other essential difference is, that the pig takes, as a rule, the whole of his nitrogenous compounds in the form of vegetable products, and a much larger proportion of starch, and other non-nitrogenous compounds, more bulky in relation to their respiratory and fat-forming capacity than fat itself. Not, indeed, that the pig is at all unapt or unwilling to adopt even still more closely the diet of man; for he will take animal flesh and fat when he can get them, and, what is more, he likes them better cooked than raw.

Were it not, then, that man separates the husk from the flour, and that he gets lower animals to eliminate in an easily digestible form a portion of his nitrogenous aliment, from foods which he could not himself readily digest, and that he gets them also to provide him with a portion of his respiratory and fat-storing food in the concentrated form of fat itself, we could hardly account for the less proportion to a given weight of the body of the stomach—the receptacle and first laboratory of the food—in his case than in that of the pig. We know, indeed, that in the cases where man is reduced to depend for nearly the whole of the non-nitrogenous constituents of his food upon starch, in the form of potatoes or rice, there is a disposition to an enlargement of the abdominal organs, and to a diminution in physical and mental energy.

To conclude on this point, there can be no doubt whatever that the food of the laboring man is improved when he can add to his bread a portion of fat bacon, or butter, or fat in some other form, and it is better still if he can substitute or supplement a little butcher's meat. Indeed, that which common experience recognises as high quality of diet is, within certain limits, high proportion of animal to vegetable food, and with it high proportion of fat to starch and other non-nitrogenous compounds.

But not only do the animals which we fatten for our own food convert vegetable produce which we either could not digest at all, or could do much less easily than they, into concentrated and easily digestible and assimilable material for our use, but in doing this they supply carbonic acid to the atmosphere, and return the most important manurial constituents of their food in their excrements, thus providing, to both the soil and the atmosphere, from crude vegetable products, that which is necessary for the luxuriant growth of cereal grain, and other vegetable produce suited for the direct use as food for man.

Were it not for such compensations, by the increase of man and other animals upon the surface of the earth (if it could take place at all), by the enormous quantities of carbonic acid evolved into the atmosphere from the combustion of coal and from other sources, and by the gradual destruction of forests, which are the chief natural agents for restoring the balance, the purity of the atmosphere would become affected. But the grasses, which supply so large a proportion of the food of beasts, and the cereals and the other plants of the same great family, which supply food

to man in almost every climate, serve to re-use the carbon given into the atmosphere in the form of carbonic acid. It may seem at first sight strange that the humble grasses, and the corn crops, reaching only a few feet from the surface of the ground, should be able to take up more carbonic acid, and evolve more oxygen, over an acre of land than an acre covered with forest trees. Still, there can be little doubt that more carbon is fixed in an acre of luxuriant wheat than over the same area of woodland; and there can be as little that an acre of sugar cane would fix more than an equal area of the most luxuriant tropical forest.

Conclusion.

With a few general remarks of a practical nature, I will conclude my discourse. The great change which has taken place in the practice of feeding stock in modern times has consisted in bringing the animals much earlier to maturity, by means of careful breeding, and more liberal feeding. Scales and weights were seldom used in agricultural experiments until comparatively recently; but there are some few records of the results of feeding as practiced at the latter end of the last century, which will serve us in instituting a comparison between the results then obtained and those which are possible, or even common, at the present day.

In 1794, the Duke of Bedford made some experiments to determine the comparative feeding qualities of South Down, Leicester, Worcester, and Wiltshire sheep. Twenty of each were selected and weighed on November 19, 1794. To each lot were allotted 16 acres of pasture, and in the winter some turnips were thrown upon the pasture, and a small quantity of hay was also provided. On February 16, 1796, after a period of sixty-five weeks of feeding, the experiment was concluded, and the sheep sent to market.

Over the whole period the sheep gave an average increase of between 40 and 50 lbs. per head; and as their original weight was nearly 100 lbs. per head, they increased nearly 50 per cent. from the store or lean to the fat condition, which is the same proportion as that assumed in the illustrations to which Table III. refers.

Some years ago, I tried a set of experiments upon the comparative fattening qualities of South Downs, Hampshire Downs, Cotswolds, Leicesters, and cross-bred wethers, and cross-bred ewes, each lot consisting of between 40 and 50 sheep. They

were put up in November, when their weights were very nearly the same as those of the Duke of Bedford's sheep; and when fat, they had increased in about the same degree, namely, to an average of about 150 lbs. each. The Duke of Bedford's sheep were about 65 weeks in adding 50 lbs. to their weight, and mine in some cases 20, and in others a little more, or about one-third the time. It is somewhat singular that in May—the period at which my sheep were consumed as mutton—the Duke of Bedford's were weighed for the first time since the commencement of the experiment, and were found to have increased only about 6 lbs. per head.

The difference of result in these two cases was almost entirely due to the difference in the mode of feeding. Formerly, sheep received perhaps a few turnips on their pasture, and but little dry food, and that not of high feeding quality; and the consequence was, that during the colder months of the year they either lost weight or increased but little. Now they have a liberal allowance of good food, and are frequently protected from the inclemency of the weather. In my own experiments, just referred to, the sheep were allowed from $\frac{3}{4}$ lb. to 1 lb. of oil-cake per head per day, according to their weight, about the same amount of clover chaff, and as many Swedes as they chose to eat, and they gave an average increase of nearly 2 per cent. upon their weight per week.

There is no doubt that in rapidly fattening stock at an early age, quality of meat is to some extent sacrificed to quantity. But it is only by means of the modern system of liberal feeding and early maturity that meat can be brought within the reach of the masses of the population. The farmer, too, must look to that system which will pay him the best; and the difference between the price which the consumer will give for a pound of four-year-old and one-year-old mutton will, only under very exceptional circumstances of locality, remunerate him for the extra cost of production.

In conclusion, I have only now to thank you for the very kind attention with which you have followed me through what I fear may be thought by many of you somewhat tedious detail. The subject of the chemistry of feeding is, however, essentially an intricate one; and I think you will have learnt from my lecture, if you did not know it before, that there still remains much to be determined by careful investigation respecting it. But if I have in any degree succeeded in indicating the proper points of view

from which this, at once practical and scientific question should be studied, and in impressing upon your minds some prominent and important facts regarding it, so as to lead to improvement in practice by a better knowledge of principle, or to further inquiry, and so to an extension of our knowledge, I shall feel that the objects of my desire and endeavor in addressing you have been fully attained.

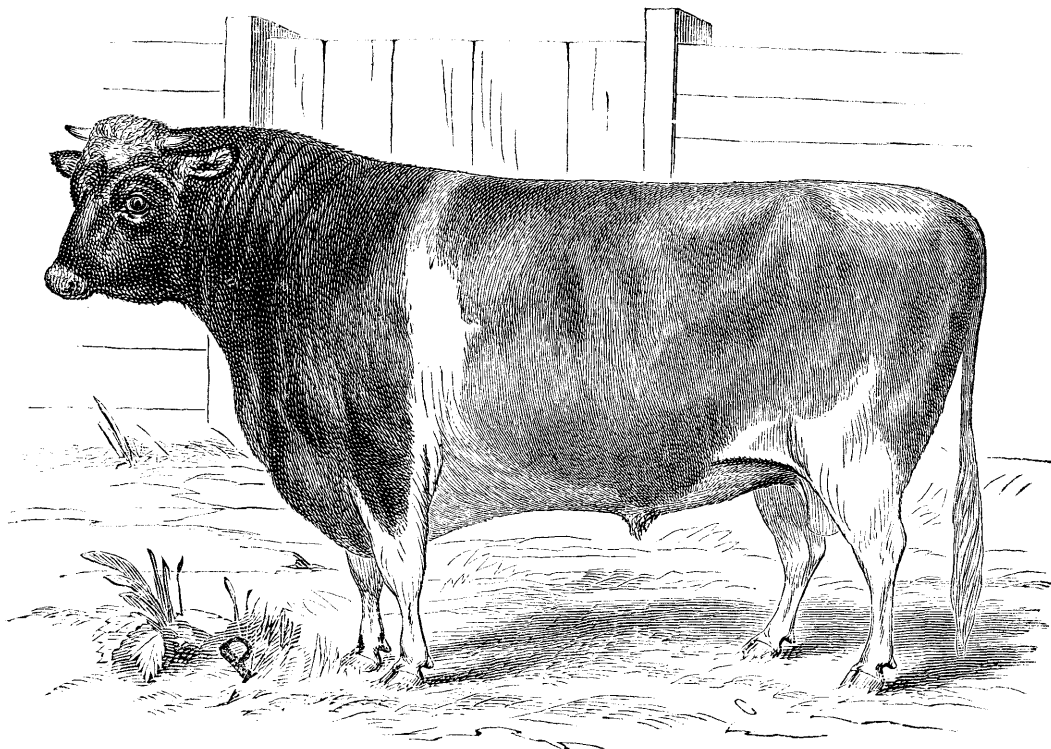
The Chairman said he was sure they all felt very much obliged to Mr. Lawes for the very clear and satisfactory account he had given them of the present condition of science with regard to the feeding of stock and the production of manure. The paper which Mr. Lawes had read was based upon investigations which had very peculiar merit. They had not been undertaken as matters of mere scientific curiosity in the laboratory; they were not merely the paste-and-scissors compilations which a great deal of the literature of agricultural science unfortunately consisted of at the present day; but they were the well reasoned and carefully ascertained results of labor, and he must say honest investigation, conducted under circumstances unusually favorable, and with a degree of cautious care which was the most valuable part of the career by which Mr. Lawes had earned the well-merited and general repute which he had acquired. Some years ago he had the pleasure of visiting Mr. Lawes' establishment, and of seeing the plans of investigation which were there put in operation for the benefit of agricultural science; and he did venture to say—and he had some experience of chemical investigations—that there did not exist in Europe so worthy a national monument of agricultural progress as the establishment which, under Mr. Lawes' care, and by his conscientious industry, had been carried on in the neighborhood of London.

Dr. Cameron rose to express his opinion of the value of the paper which they had heard read, and to bear testimony to the great services which Mr. Lawes had rendered to agricultural science, and to agriculture generally. He was a scientific and practical man in his own person, and he knew of no one who was so capable as Mr. Lawes of clearing up the obscure things in agricultural science. The obscurity of scientific agriculture had been to a great extent cleared away by Mr. Lawes' paper, and many of his contributions to the philosophical transactions of the Royal Society had been of the greatest importance. He thought, with

the Chairman, that the great feature of Mr. Lawes' career was the remarkable accuracy in all his experiments. There was no doubt in the world as to the accuracy of his facts, nor was there any doubt as to the accuracy of his conclusions. With regard to the proportion of fat and flesh-forming substances in various kinds of food, he might observe that they had recently heard of Monte Video beef, which on analysis was only found to possess 5 per cent. of fat; the rest was fibre and albumen, the nutritive properties of which were doubtful. They had all been inclined to believe that the food of the people of this country was wanting in flesh-forming materials; that there was too much starch in the food of the Irish peasantry. Now, Mr. Lawes had clearly proved by several investigations that in consuming vegetable food, such as bread, they used a larger proportion of nitrogenous matter than if they consumed all flesh-food. They found no fat at all in the potato; but when the poor get a chance of anything else they selected fat bacon, dripping, or some thing that had fat in it, and did not go to stinky beef like that of Monte Video. Having entered somewhat into the details of the question, Dr. Cameron concluded by expressing his satisfaction at the paper which they had heard read.

Mr. Baldwin of Glasnevin, said that, with the view of promoting discussion and eliciting more information from Mr. Lawes, he wished to draw attention to a few matters which struck him as Mr. Lawes was explaining his elaborate tables. In one of these tables Mr. Lawes appeared to him to assume that the instinct of animals may be made the basis on which to judge of the kinds and quantities of plastic constituents which they require. Is this notion a mere hypothesis, or a deduction from actual experiments? In another table we are presented with facts which, if quite reliable, appear to me well calculated to enable us to judge of the relative profitableness of fattening cattle, sheep, and pigs. Taking the cattle, and assuming that 65 per cent. of the increased live weight was marketable beef, and valuing this at the price at which I saw beef sold this morning in the Dublin cattle market, and allowing (what Mr. Lawes calculated in another paper of his) that the value of the manure from a ton of turnips was worth 4s., and from a ton of cake upwards of £4, it appears to me this table assigns a high feeding value to turnips. I should like to have the opinion of some of the experienced agriculturists now present on this point, as well as on the facts which this table presented as to

the relative merits of cattle, sheep and pigs, as producers of meat and profit. Again, Mr. Lawes, if I followed him rightly, suggested that the ratio between the nitrogenized and non-nitrogenized constituents in cereals may be regarded as a fair criterion of what it should be in cattle food. I would have rather thought the ratio in grass, which is the natural food of cattle and sheep, may be rather better for those animals; and would like the opinion of Mr. Lawes on this point. If my memory serves me right, the nitrogenized is to the non-nitrogenized constituents in grain as 1 to 6; and in grass it is less. Adverting to Dr. Cameron's views on "jerked" beef, he thought his reasoning fallacious. We are told this beef contains too little carbonaceous and too much (?) nitrogenized matter. Now, it is notorious that the diet of the Irish laborer is deficient in nitrogenized matter. His potatoes contain too little nitrogenized in proportion to their carbonaceous matter; and I see no good reason why a cheap and concentrated nitrogenized substance like South American beef could not be united with his potatoes. He had learned from a South American gentleman who had been recently in Ireland that this beef forms the staple article in the diet of large numbers of our fellow-men; and through him I have got information on its cooking, &c., which enables me to say that the mode of using it is not well understood in this country. Furthermore, I beg to remind Dr. Cameron that he appears to forget that the requirements of a working animal are different from those of a fattening animal. We keep the latter as quiet, and cause as little waste of their tissues, as possible. In working animals—the horse, man, &c.—the tissues are necessarily wasted, and to supply this waste, we must supply food more largely than for fattening—a food like jerked beef, containing a large quantity of nitrogenized matter. In conclusion, Mr. Baldwin begged to add his testimony to the valuable services rendered to the cause of British agriculture by Mr. Lawes. Whoever reads the history of agriculture for the last twenty years will find prominently on its pages the name of J. B. Lawes. There is not, perhaps, from any one pen in the literature of any science during that period as great or valuable a number of papers as Mr. Lawes has contributed to the literature of British agriculture in the pages of the journal of that great institution, the Royal Agricultural Society of England.



Jersey Bull "Ivanhoe," the property of James C. Converse, Esq., Southboro', Mass.

AUTUMN SESSION OF THE BOARD.

A public meeting of the Board of Agriculture was held at the villages of Foxcroft and Dover, Piscataquis county, on Tuesday, Wednesday, Thursday and Friday, August 30th and 31st, and September 1st and 2d, which was attended by nearly all the members of the Board, together with the Faculty of the State College of Agriculture and the Mechanic Arts, and about thirty students of that institution. A considerable number of the farmers of the vicinity, and others interested, also came in. Much interest was manifested, and it is confidently believed that the meeting will be followed by good results, both local and general.

The session commenced on Tuesday at 10 o'clock A. M., at Mayo's Hall, and was opened by an address from CALVIN CHAMBERLAIN, Esq., of Foxcroft, as follows :

Mr. President and Gentlemen of the Maine Board of Agriculture :

As the resident member of your Committee of Arrangements, I have thought it appropriate for me in a few words to welcome you to the county of Piscataquis. It is pleasant to meet you here individually at any season of the year and welcome you to our homes. It is a great pleasure to see you here together, as the State Board of Agriculture, at this interesting season of the year. For myself, for the committee, and for the citizens of this county, I extend to you our cordial greeting.

We are here met this morning on the bank of one of our tributary rivers, located in what is often termed "Northern Maine." When you draw a tape-line across the map of the State, from its N. E. to its S. W. point, you will find this village to be in that right line, 31 inches or 155 miles from the N. E. point, and 32 inches or 160 miles from the S. W. point of the State. Draw the line from the S. E. angle of the State to its opposite N. W. angle, and we are again in the right line, 110 miles from the S. E. point, and 90 miles from the N. W.—being nearer the geographical centre of the State than is any other considerable village. Draw the

meridian line of this place and we are 65 miles nearer the ocean by that line than we are to the north line of the State. We are in Northern Maine, so far as we are included in the region where "winter lingers in the lap of spring." When summer has fully come, our late experience is, that we are far enough south for personal comfort. Were I to speak of the people here, I could only say we are poor, not over enterprising nor ambitious. We hardly expect our village to be selected as the future capital of the State. But when other points are coveting that honor, we may suggest that in the distance a geographical centre may be as good a claim to present as any other. Now that this central portion of the State is, by iron roads, opened to your inspection, so that you have reached this point in one day from the oldest counties; now that Maine is represented in its leading interest by your presence here to-day in this young county, we may with some propriety speak of local matters.

The settlement of all this region dates within the present century. In 1816, the cold season came near discouraging all who were here. Western emigration then commenced; and of all the fashions, habits, or eccentricities that have swayed this people, this mania for moving west has ruled the most persistent and the most constant. More people have emigrated from these towns than now remain within them. When I shall set out to visit my old neighbors, I shall find them scattered all the way from Boston to San Francisco. In towns such as these have been, with a sparse population, the burthens to be borne for public roads and bridges,* and for all educational and social privileges, are very heavy, and are a constant excitant to emigration. The many hardships and disadvantages incident to this location, of which you all may have some general idea, are sufficient to account for the low condition in which you find us. We have not yet had the hands and the means to fashion these lands to a condition to contribute largely to human comfort and sustenance. We claim to have done well

* Our circumstances in this regard are so unlike that of most new communities as to be worthy of note here. This river and its large tributary streams demand the erection of many bridges—necessarily expensive structures—all of which have been built and supported by these thinly peopled towns; while in most other places these are extra burthens, and are otherwise provided for. Then the main roads which lead out from tide waters of the Penobscot and the Kennebec, and through these towns—roads that carry the supplies for the lumber operations back of us—pass over much land of very bad character for the maintenance of such roads, bearing, as they do, these heavy teams mostly in the fall and spring seasons,—these subject the towns to heavier taxation than is ordinarily demanded for road purposes.

under the circumstances. We have worked hard enough, and have done constant battle with the circumstances. Our good Mother Nature has not made this a prairie land nor rich alluvial; yet her work has been done wisely and well. No prairie nor rich alluvial can bear the varied riches of the mineral and the vegetable world that we have here. Nature has here left enough for man to do to compel him to become a thinking and a working being. In this lies the greatest blessing we enjoy. Work enough has been done to show that those who have chosen to stay rather than to emigrate are not totally demented—to show you that lands here are honest and generous—that homes may here be made and maintained—that daily food, and the comforts and blessings attendant on a good degree of civilization, are here attainable.

The Board meeting the farmers here, and bringing together a delegation from all parts of the State, is a step that partakes a little still of the experimental. Under our present plan of organization, we have held two meetings, both in cities, both resulting in a degree of success equal, perhaps, to a reasonable expectation. Here for the first time you come out into the open country—to the farmers and the farms, beyond and outside of formal corporations. No Mayor or other dignitary to meet you on the boundary with attentions polite. We have but little to offer you—little to set before you. While we tender you the little we have, we do it in simple manner, without formality, for we are a plain people. We accord to you the largest liberty of action and of speech. We grant you the freedom of all the village we have, of all our farms, our work-shops, of our widest wood-lots, broadest lakes, and biggest rocks. Your coming here is an event with our people that we are proud to honor—one long to be remembered.

To you, Mr. President, and particularly to you Mr. Secretary, they have long been accustomed to look for their annual lessons in agriculture, till they have come to honor and to venerate you. Your associates in the Board, who are named after you because they have done this service through a less number of consecutive years, they look upon as men not here by blind chance; that you are here as men of character and worth in your several counties—competent at home and abroad to instruct in agriculture and the arts connected therewith. You bring with you delegates from Farmers' Clubs and Agricultural Societies, and leading farmers from distant parts of the State. You bring with you the leading practical teacher of our sister State of Connecticut—

he who has the ring of the pure metal, of the genuine coinage. You bring another important personage—the phonographic reporter—he who stands at the head of his profession in this country. To him will the world be indebted for your record when this meeting has passed. From the character and the prestige of the gentlemen here assembled, we expect an interesting and a profitable meeting.

The early day at which the meeting is held has given the farmer-members of the Board less than their usual time for preparation; but the scientific members—the professors of our scientific schools are here, and are supposed to be always ready with their parts. Then our State School of Agriculture and the Mechanic Arts is here in its active faculty and its several classes of students—an *institution realized*, for which we long hoped and prayed and worked.

It is not properly within my line to inquire or indicate what is to be the order or the scope of the business to be taken up at this meeting. It may be proper for me to say here in a public manner that I understand circumstances prevented the issue of a definite programme for the meeting. I think it not a matter of regret that it is so. Our State is of such extent, and of so varied elevation, as to present a considerable diversity in its climate as well as in the soil; and in the experience of the Board, we have sometimes found, while discussing one crop or product, that different members were talking about very different things. To illustrate, a hickory planted in Maine grows to the same hardy beauty that it is in Massachusetts or Michigan; and it is proper for every landowner here to note the fact. But when Mr. Goodale is asked here in my garden to name a currant that came from his grounds without a label, his practiced eye “gives it up”—and he says things grow so differently here from their habit at Saco as sometimes to defy identification. Some early variety of grape may succeed here admirably, and fail utterly on the banks of the Saco or the Hudson. So of many fruits, crops and products. You, Mr. President, have talked in your forcible style of agriculture as it is in the county of Hancock—of the crops—their successes and their failures—all matters of great importance to your people, but of less or very little practical value to us here, perhaps no more than as historical facts from a foreign land.

For many reasons, some of which I will try to present, I hope this meeting may partake less of the *general character* than former

ones—less of discussions on general subjects of broad application and more of things of local interest. The general principles of agriculture, and the science of husbandry in its growth and expansion, come to us in a constant flow, if we are receptive, without the intervention of such meetings as this. The locality needs in large share the aid, advice and encouragement of this assembled wisdom.

But there is a slight difficulty present, in the fact that the most of you, gentlemen, and these delegates from abroad, are strangers in the land ; and that no agricultural survey of this portion of the State has been made. We have had a preliminary geological survey that included this region, but was suspended before reaching practical results. Under these conditions I see no better way than for us to vacate this hall for one day and give ourselves up to a field excursion. Now that you have your farmer-boots on, Mr. President, and have penetrated to the interior of the State for the first time, we hope to see you thrust the heel of your boot into Piscataquis soil and turn it up to the view of these professors here, that they may say something about it before they go home. If they are not ready to do that, we may expect them to “make a note on't.” We want these students to look at the soil and the plants here. We want you, Mr. President, to return to Hancock—to your Blackstone and Greenlief, to your spherical Trigonometry and Nautical Almanac, a wiser man—and if you are not a better one, don't lay the blame to our example. We want you to go with us a little way out, to the top of a granite rock a mile in diameter (one not large enough for the geologists to see when they passed this way) and look over the acres of wood where we villagers hold our reserved fuel, so you may not wonder that one here should elect to ride such a hobby as that of planting and protecting forest trees. We want you to go past some of our farms and note some things that we have *not* done. To see few sheep and many colts in a scrub-race for life in rough pastures ; to see few cows, and they half starved because of the many grasshoppers and not enough of fodder-corn ; to see ill-favored swamps and barren plats at the door, and the farmer hauling manure a long way beyond, because the land is better a half mile away ; to see the home of the family in the bleakest aspect with no attempt to grow a screen of trees ; to see the best possible provision made to secure the biggest sort of snow drifts in the roads in winter. I leave the picture unfilled.

The lands hereabout are of some account in the State, or we all must admit that those who have abandoned them in disgust are the wiser people. Can you do the State better service than to qualify yourselves to give an opinion upon these local matters? If it is sound policy to encourage immigration from Scandinavia to people vacant lands in Aroostook, why not give some thought to unoccupied lands near the centre of the State? So much attention at least as is involved in the inquiry touching the general quality of the neighborhood lands. Piscataquis has a vital interest in this Convention, in the fact that it will be a long time before it comes here again. Hancock, Oxford—all the counties—even Aroostook, will be claiming their proximity to the college at Orono, and put in their invitations. Then these college boys will be pleading, perhaps, for a ride to Aroostook for a glance from the blue eyes of those imported damsels—and we will not blame them for that.

If this meeting shall result in converting the farmers here to a full belief in their locality and their business; if what they learn here from your discussions prompts them to more zeal in permanent improvements; if the meeting leads to a great many sensible practices, and directly introduces many good things—if it teaches one farmer to improve his pastures, another the use of bone fertilizers at a profit, encourages a third to displace a shocking bad barn, instructs a fourth in the cause for his cattle eating away the barn that shelters them, and the cure for that morbid appetite,—if it converts us all to the belief in modern associated dairying—if it reduces the number of colts that are “threatened with speed” (in the eye of their owners) and increases the number of cows, it will do enough for once.

Now as I intend to be very brief I wish to say only a few words by way of introducing to you some of our citizens whose voices are expected to be heard in the lectures and discussions here. I take pleasure in saying that the most prominent of our professional men in this county, who get their gains mainly by helping people *out of* (?) litigation, rank also amongst our best farmers. They have plenty of money to make their improvements thoroughly. Then, as a member of a Farmers' Club, a talking, practical, lawyer-farmer is in a way to make some amends for the sins that are apt to be ascribed to his profession. We have some others here beside lawyers who can talk to some good purpose—some

young farmers who have well stored their minds with agricultural literature, and we hope to hear from them.

I have designedly omitted some things, and probably overlooked many others that ought to be named in this connection, that I might leave some of the time your indulgence has allotted to me in which we may hear from others who can interest you beyond where my slender thread ends. And if the time is still mine, I will yield the floor first to the President of the Piscataquis Central Agricultural Society, Director in the Bangor & Piscataquis Railroad Company, &c., the Hon. A. M. Robinson of Dover; and after him will call out our County Attorney, A. G. Lebroke, Esq., of Foxcroft.

Mr. ROBINSON responded as follows:

Mr. President, Ladies and Gentlemen:—I have to address you this morning without the slightest preparation—I had postponed until to-day the time for arranging some few ideas, which I had thought might be of general interest, and unluckily, to-day, a crowd of unexpected business has occupied my whole time, till now. Beside this embarrassment, I notice a reporter here, an intimation that I am to go upon the record—“*a chiel's amang us takin' notes*”—a professional gentleman, of the class that we “up-country folks” have an instinctive dread. I notice, further, by the remarks of the gentleman who has preceded me, that I am sandwiched between two of the foremost men of our community.

I think it was Bacon who penned the aphorism, “That writing makes a exact man, reading a full man, and speaking a ready man.” The gentleman preceding me has written much which has attracted public attention; and the gentleman who by the programme is to follow, has a State reputation as a public speaker. Without pretending to be the third person in this Baconian trinity, I have still the pleasing duty, in behalf of the Piscataquis Central Agricultural and Horticultural Society—an intelligent, wealthy and vigorous organization, which I have the honor to represent—to tender you a warm, earnest, hearty and cordial welcome.

Presuming, gentleman of the Board, that many of you are strangers, I propose in the first place, a brief introduction to our immediate locality, and then to call your attention to the more general characteristics and resources of the county at large. In performing this duty, I have frankly to notify you in the outset,

that my claims will not be as modest as those of the gentleman who has just preceded me—who, in this particular, is, I think, quite too “'umble.”

We claim then, in the first place, that we have the most attractive, thrifty, wealthy and intelligent village in the State, and we hope and expect to make you accept this statement, as indisputable before leaving us. Our village is made up of the inhabitants in part of two towns; the northerly skirt of Dover and the southerly belt of Foxcroft, and contains a population of from 1700 to 2000 inhabitants. Your first impression, doubtless, was that it was larger—its buildings would indicate this; but unfortunately there is an unaccountable dearth of children here. But for the fact that so long as I have lived here, I could never make out to my own satisfaction the dividing line betwixt the towns, I would endeavor to explain its whereabouts to you.

You would naturally suppose the river was this line; but the river is not the line, nor is its thread or its bank. The eccentricity of this line seems to illustrate the catch-word in the “little joker,” “Now you see it, and now you don't.” It has an odd perversity about it, which sunders mills, divides stores, and runs through dwelling houses. One good lady, of my acquaintance, takes her tea in Dover and washes her tea dishes in Foxcroft.

Mythical, however, as this line is, it affords ample opportunity for splendid raids over the border, on the one side and the other—things we do and bravely survive—and however the casual “on-pleasantness” *inter se* we are always a unit against all outside encroachments.

The settled portion of our county is on its southern belt. This settlement extends from Medford to Greenville, on Moosehead lake, a distance by highways of about sixty miles; its average breadth is three townships, the third or northerly tier but sparsely settled; its population the last decade about 16,000, and the present census, I fear, will show no increase of population, while it will show a very large increase of valuation.

We claim that for agricultural pursuits, the soil of the Piscataquis valley is superior to any other in the State. Its only competitor we believe to be the Sandy River valley, and many persons who have examined both give ours the preference. Ours is the broadest timber land county in the State, or indeed, in New England. Aroostook has more settling land—not more timber land; our county lines embracing more than a hundred townships

of unsettled land, mainly timber lands—a vast resource of natural wealth. We have the broadest lake in New England, and with one exception, the loftiest mountain. We have strata of slate, skirting the settled portion of the county, more than forty miles in length, and averaging, probably, two to three miles in breadth, and extending, I suppose, to the centre of the earth in depth; though it has not yet been explored to that depth to my knowledge. These rich deposits are now being wrought, and many points “all along the line” from Brownville to Monson, with two exceptions only, the one Wales and the other a quarry in Pennsylvania, this slate is said by geologists to be superior to any known quarries in the world.

In addition to this we have numerous beds of iron ore, one of which for certain purposes is of superior quality, and has been extensively wrought. We have in the county more than fifty first-class water-powers, and numerous second and third-class powers, and uncounted amounts of small, valuable timber, in addition to our great pineries, such as brown ash, white birch, poplar, cedar, juniper, and the like.

If these statistics are substantially correct, and they will bear the test of criticism, then it follows that in natural resources we have the richest county in Maine, or indeed in New England. Heretofore, with all these resources, we have been a land-locked people, and hence the lack of development.

A few years ago, I recollect traveling along the sea coast from Camden to Newcastle, and on the route passing through towns that afforded evidence of wealth greatly exceeding our most favored sections; towns with great structures of brick and stone; warehouses, banks and elegant private dwellings. The thought struck me, where did all this wealth come from? I could not well imagine; I saw no timber forests, no remarkable agriculture; in fact, I had the curiosity to go upon the farms and examine the growing crops, and found them in no respect superior to those in our valley, and the question returned again, whence the origin of this wealth? At length I asked a friend. He pointed to the sea, and answered emphatically, “Our wealth came from *there*, we drew it from the sea.” In fact, gentlemen, this thrift and wealth was simply the product of *cheap transportation*.

Within the last two years, our people have strained every nerve to bring the sea to our own doors, and, comparatively speaking,

have succeeded. Formerly, we were thirty-six hours from tide water, at a cost of from seven to eight dollars per ton; we are now but three and a half hours, at a cost of from three to four dollars per ton. So great a balance in our favor in time and expense we confidently argue must work out great results. And this brings me directly to the question of the railroad; with which my friend who is to follow me and myself have had a good deal to do in one capacity or another since its inception.

A year ago last June, we struck midway at Lagrange, a line of railroad forty miles in length, extending from this point to Oldtown. In less than seventeen months afterward the iron horse stood upon the track at Dover and Foxcroft. The work was accomplished with greater speed than any similar one on any railroad of the same length in New England. *Behind this track, as feeders, are all the great resources* I have named, waiting only the hand of labor and the profitable investment of capital; waiting not long—both these elements are sure to appear—for the simple commercial reason that *they will pay*; and then our hitherto landlocked and undeveloped county will take a new departure on the highway to wealth and population.

The question may occur to you, why we take a circuitous instead of a direct route to tide water at Bangor? It is often asked; and at the risk of trespassing upon your time, I will endeavor to give an explanation. The direct line to Bangor as a road would perhaps be forty miles in length; our line by way of Oldtown to the same point, is about fifty-two miles. Railroad men understand that all things being equal, railroads should be built as the laden bee flies, homeward bound.

It was said that the Emperor Nicholas, not long since, abruptly terminated a consultation with his engineers on the feasibility of a certain route, by drawing a pencil mark on the map of the way, and emphatically uttering the word "there." On examining the mark the dismayed officers discovered that it indicated a straight line on the face of a country beset with great, and in their judgment, insurmountable natural obstacles; but the imperial mandate had issued, and nothing but obedience remained. Railroad corporations in this State are not yet imperial; and many considerations come in to influence and determine the line they shall pursue in constructing a road. The shorter from given points, the more convenient, of course, for travellers; but in a border county of a border State, passenger transportation forms, under the most

favorable circumstances, but an inconsiderable item of compensation. In such localities, the road seeks freight, and in order to get it must go where it is. This was one of the leading considerations governing the location of this road; another was *development*—and these two in a great measure determined its location.

Our population and settlements in this county, you have noticed, follow our river, and extend from east to west. Our breadth of settlement from north to south, which I have already explained, is narrow, crossing but three towns. The city of Bangor is from this place (the centre of the population of the county east and west) nearly south, so that a direct route from tide water would strike our population at a right angle, and in making its objective point here, open up our town only, and put it in competition with all the rest; and so accomplish little toward general development. Our slate deposits run in the same direction with our settlements, and hence if the road had made any one of the quarries its objective point it would have put the favored one in destructive competition with all the others, and such would have been the inevitable result of a direct line; and the projectors of this enterprise did not deem it just nor prudent to attempt to concentrate to any one point all the fruits of the resources and industries of this county. As the road now runs it follows the line of settlement in this county from the centre to its eastern boundary; and so instead of one town it penetrates and runs within convenient striking distances of ten towns; and at the same time and for the same reason all our slate quarries skirting upon our settlements, and all the water powers upon our river, are afforded like facilities. At the eastern boundary of our county the road makes its angle due south. By a fortunate circumstance the settlements on the line in Penobscot county extend from north to south, so that the direction of the road, along its whole line, accommodates the whole population, and consequently all the industries incident to population on which it feeds; and these considerations were regarded as a sufficient inducement and justification for its location on the line it follows.

Thus much in regard to the railroad, and with a brief glance at the Agricultural College, I will close these rather crude remarks. I am hopeful in regard to the future success of this institution, believing that if we have the pluck and courage to carry out the policy which has been initiated, and keep the institution steadily in the right direction, we are sooner or later to see important results

to the great leading interest of this state and country. Thought, science, investigation, labor, must all be pressed into active and intense service to accomplish great results; but with these active forces, all working in the right direction, all centred in the one desirable point of discovery in this age of discoveries, who will set bounds to the possible or even probable results? The great want of successful agriculture to-day is plant-food. Lands we have, cheap and abundant—improved implements, and all the physical forces for success; but our labors are circumscribed by this great want. The question now with the farmer is, how great a breadth can I find dressing for? This want has been measurably supplied by concentrated manures, superphosphates and the like, but only measurably supplied. A void remains unfilled even by these expedients.

I have a theory, or better said, perhaps, a hobby, upon this subject, which is, that chemical analysis is yet to discover this plant food now so earnestly demanded by our worn-out lands, and that this discovery is to come through investigations stimulated by these agricultural colleges. My reasoning is this,—that history and observation verify the great fact, that whatever is absolutely necessary for the sustenance, comfort and happiness of man, has either as the result of discovery or invention, always in due time appeared. To illustrate: when our forests were so far destroyed that they ceased to supply an absolute want, that of fuel, coal appeared; when the scattered remnants of the whales fled northward to the Polar Sea for protection—we bored into the earth for light and found it there. When hand labor became insufficient to supply the increased population with clothing, the spinning jenny and cotton gin came in, and later the sewing machine. Increased breadth of agriculture brought in the reaper and mower. The increased demands of trade and commerce, the steam engine, and the successful workings of these forces, created another demand—supplied by the electric telegraph. These examples, gentlemen, are sufficient to illustrate my theory. I argue from it that a kindred discovery is yet to be made to supply the absolute want of more plant food, within the reach of ordinary means.

If this theory has no other virtue, it presents an incentive to labor and investigation, for I need hardly remind the young gentlemen of the college present that whoever is the successful discoverer will be entitled to the gratitude of the country as a benefactor to his race. I am happy to learn that the prejudice

and indifference formerly entertained against this institution are rapidly dying out, and a general disposition is now manifested to give it at least a fair trial. With such a sentiment in its favor, in my judgment it has only to be true to itself, to achieve a brilliant success.

In conclusion, gentlemen, I have only to couple with my greeting the assurance that you are amongst a people intelligent enough to understand, and generous enough to appreciate your labors in behalf of the great interest you represent.

ADDRESS OF HON. A. G. LEBROKE.

Mr. President, Ladies and Gentleman:—When I heard my name announced by the first speaker with something of a flourish, and the compliment of the next speaker, and then when I ran through my mind the erudite and finished lecture by the first speaker, and the comprehensive, eloquent and forcible discourse of the second gentleman, these compliments reminded me of a horse jockey, who had one or two nice horses, which he exhibited and traded to great advantage; but it was observed that he always had a very scabby-looking animal in company with the other horses, which he did not trade. At length, somebody asked him the reason. He said, "Everything in this world goes by comparison. My other horses look to be very nice horses. It is by comparison. They look all the better by being compared with the scrub. I keep this scrub that a favorable comparison may be made between it and my other horses which I wish to trade." I concluded I was to be the "scrub" on this occasion.

I am entirely unprepared, and I am out of health, and more than usually so this morning, but, Mr. President, gentlemen and students, we are happy to meet you here. We believe in the progress which you are attempting to effect. In fact, it is a necessity of the world at the present day. Man exists upon the face of the earth in different localities, and wherever he exists he must have sustenance. If not obtained from the plants and grains indigenous to the soil on which he is located, it must come from somewhere; it must be furnished; and those who live in one locality, if they cannot furnish all the necessaries that they require in that locality, must have something else which they can exchange for those necessaries, which can be obtained from other localities; but they must be obtained from somewhere.

I did not know what I should say at all until my friend Robin-

son referred to the necessity of fertilizers or plant food. My friend Chamberlain is a shrewd man. He almost berated our new county here this morning, from the very fact that he wanted your disciplined judgment to make suggestions for the future improvement of this county. In fact, its true status, its true wealth, was more frankly, I will not say more honestly, but more frankly stated by the second speaker. I do not, however, attach any blame to my neighbor Chamberlain, who knows how to make the most out of everything.

The soil of Piscataquis poor and thin? Yes; drift soil, not alluvial soil, not the prairie. Yes, poor; not perhaps in the comparison, but poor. Do you know that the soil on the face of this globe is growing poor from year to year, and from generation to generation, with very few exceptions? Do you know that the question of food for the millions that are to inhabit this earth, if the population is to go on increasing, is a question of vital importance? If your colleges, as friend Robinson suggested, through their professors and the investigating minds of those who are, and who shall become students, shall discover no means, no resources by which to regenerate the earth where it has become poor and barren, and improve it, the population must become thin. The soil of Piscataquis poor! Is it not poor elsewhere? The great prairies of the West are yielding from year to year a less return per acre, and from generation to generation a less abundant harvest, with their modes of agriculture; the settled portions of the South have already been drained, in many instances, almost to barrenness; in many parts of New England, and even in Massachusetts, the wealthiest State in proportion to her population and her territory in this nation, the agricultural towns are becoming depopulated; and when you look across the water, although England may have fertile lands, she secures them by obtaining bones from the great battle-fields from the continent, and sustains the productiveness of her soil by every means that can be suggested, not only by home production, but by importations from abroad; the rich valley of the Nile is becoming submerged by the sands of Sahara, and is being narrowed from year to year; the mountains of Central Europe have been denuded of their forests, and the gravel, the hard earth and the rocks have been cast upon the plains, so as not only to make the mountains barren, but to lock up the soil of the valleys;—all these things, with the fact that the rains wash the mountains, and carry the soil into the tributary

streams, and the tributary streams carry it into the ocean, bearing with it immense manurial wealth, and the additional fact, that in all our large cities, vast quantities of fertilizing material are daily drained into the rivers and through the rivers into the ocean,—all these things, I say, although I do not pretend to be an agriculturist, I have thought of for years. When you can stem this current, when, as was suggested by my friend, you can make some discovery or invention which will supply this waste, you will have done a great deal.

It very often happens, however, that men seek some great boon at a distance, when it lies at their own doors. I see my friend Mr. Jefferds here. I was passing his house yesterday, and I remarked to my wife that there was a place from which a large granite rock has been taken, of very excellent quality. I have been informed (whether it is true or not I do not know) that Capt. Chamberlain, the father of the gentleman who has spoken to you here, brought the material with which his house and that in which Mr. Jefferds now resides was underpinned, from township No. 8, fifteen miles distant, when within twenty rods of his own door was granite of superior quality which might have been used. If the people had understood that our common boulder granite is well adapted to that purpose, he might have saved hauling that heavy material that great distance, over hills and across lakes and rivers. And, by the way, we have at the head of Sebec lake one of the best granite quarries, where granite may be taken out by its natural seams, as long as this building and as wide as you wish, and as true as the mason's tools could make it. I only allude to this to illustrate the statement I have made that we are apt to seek for treasures at a distance when perhaps they lie at our own door.

I have produced, from soils which were called by the two preceding owners entirely worthless, eighty bushels of shelled corn to the acre, within two years. I have produced fifty-six bushels of barley to the acre on two and a quarter acres within one year. I have produced upon an acre and a quarter 422 bushels of potatoes. There was not a great deal of mystery about it to me. I did not buy a large quantity of commercial fertilizers. I will say to my brother Robinson that I do not believe that these students have got to dig into the bowels of the earth as far as the English miners have penetrated, in order to find the material to fertilize our fields. I do not believe that any striking discovery must be made in order that we may have sufficient plant-food. You may think that I am

a very imprudent and a very bold man to make this assertion before men learned in that business as these gentlemen are, and I myself a mere novice. Although I was brought up a farmer, it was on the old plan of carrying on farming—clearing the soil and getting abundant crops for a few years.

I believe that the elements are within our reach to enrich this soil or any other soil. Look at the prairies of the West! Such a man raised 40,000 bushels of wheat, and the railroad facilities are such that he got a great price for it. But look at the census. How many bushels per acre did he get? Perhaps fifteen; usually not over fifteen, and from that down to twelve, ten, eight, seven and a half. That man had 5500 acres under cultivation. Ah! that is a poor country where a man has to cultivate 5500 acres to live. He may live like a lord, with all the splendor of the ancient English Baron, who had his hundreds of vassals, who were worse off, perhaps, in many respects, than the former slaves of the South. That is a poorer country for the world than this. It ought not to take as many acres as that to support one family and the retinue that usually attends a family here.

The soil is enriched, ordinarily, by the return of vegetable matter to the earth. According to the present theories, I believe it is understood that the growing plants absorb largely from the atmosphere; that from the process of combustion and from marshes, and from the decay of plants, a great deal of vegetable matter is thrown off into the atmosphere, in the form of carbonic acid gas, and the plants are fed in this way. What you want to do upon any farm is to return to the soil, in the most economical manner, all that comes from the soil and the atmosphere. From the atmosphere comes carbonic acid, in large quantities, and to a smaller extent nitrogen, and other elements that are necessary.

Now, gentleman, to return a moment. The remark I make is this, that if every farmer in the State of Maine would go to work this very fall and make a cellar under his barn, where his cattle and horses are kept, make it tight by stone or cement, or even hemlock plank, so that all the excrements that come from that stock shall be retained, and so that the urine shall be held with the solid excrement, and a proper application of gypsum and any other dry substance shall be made to these material from time to time,—if every man who has five acres of land and a cow and a horse, will make this experiment, we shall see more abundant harvests than have ever been reaped in this State before. I have

tried that experiment. That is the way I raised my crops. The first year, I tried it in quantity. It did not cost much to make this arrangement. The manure was removed from the stable in the spring, when we planted. From May up to haying time, there were three loads of manure obtained from the stock. At haying time, I had this manure cellar made. From haying time, up to the time I dug my potatoes, there were ten loads made with the same stock, and with the same bedding. By this process, one load of that which was produced in the cellar was worth three loads of that which had been dried in the sun, evaporated in the wind, and exposed to the weather.

Now, this is not agreeable, because it is some work to make this arrangement. You have also, gentleman, many of you, in your swamps, a large mass of muck, which may be made available. I do not care whether that muck is very rich or not. It is certain that, when properly dried, and the acidity removed from it—perhaps by lime; the chemists will tell you what—it is a good absorbent. I have my hog pen arranged so that the hogs will work up any amount of this muck. I know the hog has always been called a lazy animal, but it is not so. He might bring his suit for slander in any court and receive damages. I find him a diligent animal. He pays for his keeping, and comes out a very good hog besides. I keep two of them at work most of the time, and they work well.

Now, gentlemen, I do not pretend to instruct you. I have this idea, this hobby in my head, and it is about all I intended to say, and I should not have said that if my brother Robinson had not suggested that he hoped this great discovery would be made. From the little experiments I have tried, using, in addition to the manure of which I have spoken, dirty water, slops, &c., I have realized very abundant crops. With the use of this manure, I have raised, as I have said, 80 bushels of shelled corn to the acre, 422 bushels of potatoes on an acre and a quarter, and 55 bushels of barley and a fraction to the acre; and I never used any commercial manures except a small quantity which I had of my neighbor Chamberlain, which was used upon the corn.

Now as to Piscataquis soils being poor. If poor by nature, they have not lost so much by cultivation as the soils of the Western States. I will not mar the picture drawn by Mr. Robinson, of our slate unquestionably superior in quality, of the iron which is abundant beyond measure, of the forests, which the world is

thirsting for, but which I hope we shall hold on to, for they are the richest treasures we have to convert into money. I have been over the State a great deal, in seasons not so dry as the present; and I think we have suffered especially from the drought. One of the gentlemen from the college remarked to me last night that he thought the drought had been a little more severe here than below, and the grasshoppers have been very voracious. It is a hard time for us to exhibit the agricultural resources of the country; but in other seasons, I have found the corn as tall, and rich in color, and the grain fields as heavy and waving as luxuriantly in Piscataquis as in any other locality in the State; and the potatoes of Piscataquis county are not excelled by those of any other part of the world, and they may be produced in great abundance.

I say, then, that I will not attempt to add to the picture drawn by the gentleman of the resources of Piscataquis, nor am I going to criticise the rather poverty-stricken view of the matter which brother Chamberlain took, because I knew he presented it in order to obtain the benefit of your suggestions. Do not understand me as being dogmatical in this matter, thinking I am going to teach you. I have come here for the sole purpose of being instructed by you. You are welcome to instruct us. We are happy that you have come among us, and we shall listen most carefully to your teachings. I merely throw out these ideas, which are not new-fledged opinions, which have seized upon me this morning for the first time; I have entertained them for years. I see here a gentleman from the city of Brooklyn. The thought has occurred to me a great many times how much plant-food is wasted in that city, and in New York, and in all the large cities of the earth, most of which might be saved. Let us, who have any desire for the future welfare of the State, look to it that the earth is not impoverished, so that the people shall dwindle in stature, decrease in number, and the race finally become extinct through bad agriculture. There is not a man, woman or child, who has the slightest interest in the prosperity of the race, who will not feel his or her heart throb at the suggestion of any means by which we shall be enabled to transmit the mother earth on which we were placed to the generation that is to come after us, at least in as good a condition as that in which it was found when we received it.

You will excuse me ladies and gentlemen. I have spoken much longer than I thought, and I have spoken almost entirely on

one topic, from the fact that other subjects have been so ably covered.

The CHAIRMAN responded as follows :

Ladies and Gentlemen of the Valley of the Piscataquis:—I did not anticipate being called upon to respond to the very flattering and cordial words of welcome with which we have been greeted by the eloquent gentlemen who have addressed us in your behalf. We have been both interested and instructed by the facts, both local and general, set forth by the first speaker, and for one I feel flattered by his kindly words of welcome and commendation; for I know, from an acquaintance extending over more than a quarter of a century, that he is not in the habit of saying what he does not mean. Let me say to him, and to the honorable gentleman who succeeded him, that for your kind words and cordial greeting I tender you, and through you to the people of this quiet and beautiful valley, the cordial thanks of this Board, and assure you that it will be our most earnest effort while we sojourn with you to so conduct ourselves as to deserve the compliments you have bestowed upon us; and I trust that not only the members of the Board of Agriculture, but each and every one of us, will do our best to make this a mutually profitably season, so that it may be looked back upon in all our future life as one of the sunniest in the many green spots in our existence.

Probably there are other members of the Board who will farther respond to the very hearty welcome we have received. I will call upon Prof. Fernald of the State College at Orono.

Prof. FERNALD. I am unexpectedly called upon on this occasion. Yet will say, so far as relates to the institution with which I am connected, (the greater part of which is here with you—we came up thirty strong last evening,) that we feel very desirous to extend to the citizens of Dover and Foxcroft our sincere thanks for the interest which they have manifested in our behalf, and especially do I tender thanks in behalf of the students of the college. Under a law passed by the Legislature two years since, one session of the Board of Agriculture is to be holden in the vicinity of the college—at least, within such distance that the faculty and students can attend; and in order that the Board might meet in Dover, it was necessary that the citizens should guarantee free transit and entertainment to the students during the session, which they have very heartily done. Certainly we

should be wanting in gratitude if we did not appreciate this kindness on the part of the citizens here, and you may be sure that I express the feelings of those students when I tender to you their sincere thanks for this kindness and liberality.

While Mr. Lebroke was speaking, one thought occurred to me, which perhaps it may be well to bring out, in addition to what he said. I like very much the doctrine which he advanced in regard to the necessity of returning to the soil that which has been taken from it. Let us carry the idea a little further, and see if he does it. Undoubtedly, by his process, he carries back nine-tenths of the elements that have been taken up in the growth of the plant; but he will remember that while he is rearing stock on his farm, while his cows, oxen and horses are feeding on his pastures, a certain amount of the material of which plants are composed is being appropriated in such a manner that it cannot be returned in the fertilizers of which he has spoken, which he has safely secured in his barn-cellar. His animals grow, and in the growth of the bones, there is an appropriation of chemical elements, which, in returning the manures, he does not carry back to the soil.

Now, how are farms to be kept up, where such is the case? One class of the young men in the college has been pursuing the subject of agriculture to a certain extent. They took up, some time ago, a little text-book entitled, "Elements of Agriculture," and without answering the question myself, I propose—although it may be at some hazard—to call up some of these young men, to tell us in what way they will return to the soil what brother Lebroke fails to return.

Mr. WESTON, what are those chemical constituents which are taken up in the growth of bones which are not fully returned in the manures and urine from the barn-cellars?

Mr. WESTON. Chiefly phosphate of lime.

Prof. FERNALD. Then what, in addition to the manure of the barn cellar, should be given to the soils in order to maintain their strength for producing plant life?

Mr. WESTON. The bones of the animals, or an equivalent in some other substance containing phosphate of lime.

Prof. FERNALD. How may this be best obtained?

Mr. WESTON. In the form of superphosphate, or of ground bones.

Prof. FERNALD. Suppose the bones are applied to the soil without being ground; will they avail anything as plant food?

Mr. WESTON. No, sir; they will lie there a long time without being decomposed.

Prof. FERNALD. Is there any other way in which bones can be prepared so as to be useful when applied to the soil?

Mr. WESTON. The best method is first to grind them and then to treat them with sulphuric acid, thus making superphosphate; or they may be applied after being ground only, in which case they act more slowly; or whole bones may be treated with unleached ashes; first a layer of one and then of another, letting them remain together long enough for the bones to be decomposed and fall apart. This, however, requires a long time. It is much better to grind the bones first, or at least to break them as fine as possible. And where bones cannot be had in sufficient quantity, various other substances containing phosphate of lime may be used with advantage in their place.

On motion of Mr. GILBERT, the subject was laid on the table and the meeting adjourned.

AFTERNOON SESSION.

Secretary GOODALE. Before the commencement of the regular exercises of the afternoon, I desire to offer a single suggestion to the students present. Mr. Chamberlain has invited you to visit his grounds, and you will doubtless embrace some opportunity to do so. Now there is a wide difference between barely looking at objects and *carefully observing* them. The one may yield little profit, the other may be highly instructive. If you notice with care during your visit, you will see many trees, shrubs and plants which are not indigenous to this section, and which are rarely grown here or near here. You will find several nut-bearing trees, as the hickory, chestnut, several rare kinds of oaks, black walnut, and various others; and you can learn the varying degrees of success attending his care for each, under the existing conditions of soil, climate, etc. So, too, of fruits. I was forcibly struck with what I there learned regarding the grape. This place is 100 to 150 miles north of where I reside, and you would naturally expect to find the grape later in ripening here than there, but such I find is by no means uniformly the case, but even the contrary with several varieties. Another fact I learned with regard to the one known as the "Early Hudson." This grape I procured a dozen years ago or more, when it was first disseminated. With me it

would set only a very few full berries on a bunch, some others being only the size of shot, and seedless. After full trial, I discarded it utterly, but meantime had sent vines to several parties—among others to Mr. Chamberlain. Here it not only ripened earlier than any other grape, but the bunches are full, in fact so crowded that I observed some berries crushed by the pressure of those around them. I found some yesterday (August) nearly ripe, in fact would pass for fully ripe with many persons. On the whole, one which was worthless with me, has proved the most desirable here of all which have been tried.

By carefully observing what you see, you may not only strengthen habits of close observation and thus learn to see more and more, but you will ascertain numberless facts of experience of great local importance. You may avoid many errors in practice and profit by the successes of others.

The Chairman then introduced C. B. STETSON, Esq. of Lewiston, who delivered the following lecture on road making :

Mr. President and Gentlemen :—It is proper, perhaps, that I should offer a word of explanation and apology at this time. I worked in my boyhood more or less for a number of years upon the roads in the State of Maine, like nearly all boys, but I cannot call it a professional training or education in that connection. I am not an engineer, and have not made a study of roads in that direction, so as to be able to speak as a scientific man. Nevertheless, I have had occasion to make a study of road building and road transportation. For six or eight years, I was connected with the newspaper press in different parts of the country as editor, and I have also had other relations to the newspaper press, which have necessarily caused me to examine this matter, in connection with a great many other things appertaining to the agricultural interests of our State. I have had occasion, of course, as an editor, to write more or less upon the subject. I cannot say that I shall present anything new or instructive, unless you are wholly unacquainted with the subject, which of course is not true. My design is not so much to instruct as to stimulate; to create, if possible, a determination to improve the common country roads of the State of Maine. What I have learned from observation and from others I have for this occasion elaborated more fully than ever before, and have committed to writing, in consecutive form. I shall read what I have written, and endeavor to read it so that you may understand me. I am not accustomed to speak from

notes, nor, indeed, much in any form, unless it be upon educational matters, during the last year and a half.

COUNTRY ROADS :

THEIR CONSTRUCTION, MAINTENANCE AND VALUE.

There is no community, however happy in all other things, that does not find its fortunes bettered by cheap locomotion ; while, for many communities, the difference between good roads and poor roads is the difference between growth and decay—between life and death. In this State sundry causes have lead to the wide abandonment of lands which were once successfully tilled ; but poor roads must be counted among the most influential of these causes. It is safe to assert that, with good roads, hundreds of now deserted homesteads would be occupied, and greater thrift manifest itself everywhere. Not fifteen miles from the city of Lewiston, one may find excellent lands, heavily wooded, that can be bought to-day for twenty-five dollars an acre. Were the roads, however, such as they should be, such as they could readily be made, reducing the present cost of transportation one-half, the stumpage alone would be worth sixty dollars an acre ; and, after removal of the wood, the soil could be brought under profitable cultivation. This is but a single instance of what may be observed in many parts of the State. Verily, cheap locomotion is wealth.

But it is not an affair of wealth alone. Cheap, pleasant, quick locomotion is vastly more than this, for it contributes to vastly more than the physical wants of man. It is social intercourse ; it is intellectual activity ; it is religious development ; in a word, it is civilization. All this it becomes by enlarging, virtually, the neighborhood, by widening the school district, by expanding the territorial limits of the parish. It wars against provincialism and bigotry by giving greater breadth to the field of individual observation and experience. Says Macaulay, and without undue emphasis :

“ Of all inventions, the alphabet and printing press alone excepted, those inventions which abridge distance have done most for the civilization of our species. * * * Every improvement of the means of locomotion benefits mankind morally and intellectually, as well as materially.”

Such are the words of the great historian.

But not at all times do men give most thought to the affairs of most vital moment. Indeed they often turn aside from the things which confer the great blessings, while contending valiantly for the possession of a brass button. In this way it happens that our people seldom stop to consider the eminent utility of roads; to consider whether the great blessings they already confer can be wisely augmented, or whether these blessings can be more cheaply secured. Apparently content with what they now receive, and with the great price they pay for the same, our people ask few questions and bestir themselves not at all. Upon examination, however, it would soon be found that not even the expenditures made for our common schools show a return so inadequate as do the expenditures made for our country roads. Our school policy, with its many imperfections, is much more efficient than our road policy; and we more nearly obtain our money's worth from our schools than from our roads. But our schools would show a yet better return for what they cost, did they give the boys some wholesome instruction about the building of roads and their maintenance.

Present Road Policy.

Throughout the State, with here and there an exceptional town, the old feudal road policy, founded on personal service, still prevails. But the personal service, which is seldom rendered at the time it would be of greatest advantage to the road, but rather when most convenient for the laborer, is not the only bad feature about our road policy to-day. There is very little intelligent supervision of this personal service when it is rendered. In all the State it were hard, perhaps, finding two score men who know what a good road really is, how it can be most economically built and maintained; yet with so few equal to the task, the supervision of our roads is entrusted to four or five thousand men, who are annually chosen at hap-hazard, as though every person in the community were qualified for the intelligent discharge of the duties of road surveyor. It is indeed quite clear that nearly everyone esteems himself qualified; for it seldom happens that a man, when chosen road surveyor, institutes a searching inquiry as to how his work can be best done. His knowledge he regards as already adequate. Nor is there any plan of coöperation among adjacent neighborhoods, but each surveyor works in his own little district, as though it were an island lying aloof from all the rest of

the world, as though the roads in a district were for the sole use of the district. With the working of this road policy all are familiar. There is no need to give illustrative details, showing how stupid is the supervision, how slovenly is the execution, how seldom the right thing is done at the right moment and in the right way. A worse road policy for these times it were difficult to devise. It involves large expenditure with very inadequate returns. So says every man who is acquainted with scientific road construction and maintenance.

Europe has, in the main, discarded personal service, and, instead of ignorant, employs intelligent supervision. The same is true wherever good roads are found. But we continue in the old wasteful way, perhaps the only way which was at all practicable in the early settlement of the State; we continue to expend largely, yet have never a really good road to show in return, never a road which can be used equally well in all weathers and in all seasons. I have traveled, to some extent, in twelve of our sixteen counties, and I feel safe in saying that I have not traveled over a single continuous mile of country road, which could be honestly pronounced, in all particulars, in grade, drainage, surface, what it should be. But this is not the worst; I have been frequently told, and truly, I think, that our country roads are not so good as they were twenty or thirty years ago. With judicious management, however, they would have steadily improved, while the cost of their maintenance would have steadily decreased. At last the minimum of expenditure would be reached with the essentially perfect road. It is, indeed, only the good road that is at the same time a cheap road; it is cheap to maintain and affords cheap transportation. In building such a road, what things must be taken into consideration?

The Route.

First in order comes the route, which should be fixed upon only after careful examination, never arbitrarily. This is oftentimes the most difficult problem to be solved in road construction, for oftentimes there enter into the problem various antagonistic elements.

Is the land uneven, as it usually is in this State? Then its physical geography must be studied—its elevations, its depressions, its water courses—it being the first object, not to secure arbitrary directness of route, but a grade which shall not, at any

point, exceed 1 foot in 30, nor fall below 1 foot in 200. A straight road is frequently the worst, running across bogs and up steep ascents.

When a hill comes between two points which are to be connected by the road, then the question arises, whether the road should pass around or over the hill. On level ground a deflection of 100 feet from a straight line between two points 600 feet apart adds only 32 feet to the length of the road. With the two points one mile apart a deflection of one-fifth of a mile, or 1056 feet, increases the horizontal distance by only about 400 feet, which is frequently enough for the avoidance of hills or swamps that would greatly augment the cost of building the road and the after cost of keeping it up. It is a fundamental law that directness of route should be sacrificed to diminution of grade—to the extent always of 20 feet of distance to 1 foot of elevation. Rather than climb a hill 100 feet high, for example, it is at all times better to go a horizontal distance of 2000 feet further around; and it is frequently judicious to go 3000 feet, or 30 feet of horizontal distance to save 1 foot of rise. Thus the longest way round is the shortest way home, as the many experiments of scientific road-builders have demonstrated.

If, however, a hill cannot be flanked, but must be ascended, then the road should go over it in a course sufficiently zigzag to keep the grade down to 1 foot in 30. Only for very short distances should the longitudinal slope of a road exceed this figure. The great Holyhead road, running through a very mountainous district in Wales, has 1 in 30 for its maximum slope, except that one section has a slope of 1 in 22, and another, very short, a slope of 1 in 17. Again, the Simplon road, which crosses the Alps, reaching the height of one mile and a quarter above the sea, has an average slope of only 1 in 22 on the Italian side and 1 in 17 on the Swiss side, while there is but a single instance, when the road becomes so steep as 1 in 13. As a rule the grade of a road should never be so steep in any part that a horse cannot easily carry up the exceptional grade the load, which it usually draws on a level. While going up hill there should be no demand for excessive effort, except for the briefest interval, nor any necessity for holding back while descending. But what a vast deal of time and power is now wasted in the ascent and descent of hills traversed by our country roads! With a light carriage, the horse should be able to ascend and descend the worst hills in a "round trot,"

easily and safely. A grade of 1 foot in 30, giving the angle of repose on a hard, smooth road, permits this to be done.

Surely, then, grade is a vital element in the correct construction of roads; yet it has been but slightly heeded by the road-builders of our State. There have fallen under my observation only few instances, where, for the purpose of avoiding a heavy grade, roads have been carried around hills. Everywhere, however, hills are to be met with, whose difficult ascent might be readily avoided by a slight deflection of the road. Of zigzag roads over hills that cannot well be flanked, I think I have not seen a single example in my travels through the State; but I have noted many instances, where the roads should have taken a zigzag course over the hills. The increased land damage resulting from the increased length of road would have been a mere trifle, with no great additional cost in the construction of the road. The work of keeping in repair would have been much less than now, while the hills, so far as obstacles to locomotion, would have vanished to the great delight of both man and beast. Our people cannot, indeed, recognize too soon the eminent merits of the zigzag road, without resorting to which it will be impossible properly to improve the roads in many parts of the State.

Again, in fixing upon the route there must be an eye to proper and accessible material for the construction of the road, and for keeping it in repair. Very much of the material now used for these purposes is worse than worthless. Nor must it be forgotten that the road should be so laid out as to afford the best sites for the erection of farm houses. Here regard as well for health and beauty as for diminution of farm labor is to be kept in view. Many a farm in Maine would be worth double its present value did the road strike it somewhat differently. Nor must the route of the road, unless the demands of traffic are of an imperative nature, fail to conform, in some degree, to that line which will afford the finest views and the most delightful drives. With our people this is becoming more and more a matter of importance, as they increase in wealth and in a love for the amenities of life. As men seek profit for the pleasure it confers, it is certainly allowable, even in the matter of road-building, sometimes to seek pleasure for itself.

Drainage.

The road has been located and a suitable grade established; now comes the work of construction. After a suitable grade the

next fundamental requisite of a good road is thorough drainage. Without this all other things fail to give a decent, durable road, one that can be cheaply kept in order, and used equally well throughout the year. Not infrequently thorough drainage is enough to convert a miserable road into a road that is comparatively good; yet there is little or no systematic attempt at thorough drainage in any section of the State. Seldom or never is the spirit level used, in work upon our country roads, for the purpose of giving the ditches a uniform inclination.

Where the slope of the surface is considerable, and the soil not easily penetrated by water, the work of drainage can be readily accomplished. When the surface is level, or its inclination but slight, with a soil quickly saturated and softened by rain or melting snow, there should be, as a rule, upon each side of the road, a ditch at least three feet deep. Its width, at the bottom, should be perhaps one foot, while the slope of the sides is such as demanded by the nature of the soil. In order that the water may be rapidly conveyed away, the longitudinal slope of this ditch must be uniform, and at least one foot in 200. If the soil and the lay of the land are such that thorough drainage of the road-bed, saving from the effects of frost in winter and from mud during the wettest periods of the year, cannot be thus secured, then underdrains of stone or tile must be laid across the road at intervals of 10 to 40 feet, as circumstances require. The more porous the soil the less frequent these cross drains need be. One of the very best things, however, is an underdrain running lengthwise of the road and along its centre. By this the central portion of the road is relieved of all moisture, except that harmless amount which the soil retains by capillary attraction alone. A larger amount of moisture the road bed should never hold; if never holding more there would be no trouble from frost, no conversion of the road, at any season of the year, into "sloughs of despond," as so frequently happens now. A zigzag road, whose surface should always incline slightly towards the hill, requires a cross-ditch or culvert at every turn. Thus easily may we guard the zigzag road against the washing which makes such havoc with roads that go straight over the hills, and which cannot be prevented so long as the roads follow such straight line.

At Paris Hill I am told there may be seen an illustration of the admirable results that can be secured by even imperfect drainage. The streets in the village, and especially the long hill leading to

the village, were for many years renowned for their spring mud. But there came a change, gradually wrought, for the work of redemption was more than the district could do in a year. A central underdrain, made of ordinary stone, was laid along the village streets and down the hill. The result is that now, with the melting of the snow, the centre of the travelled way is dry and ready for immediate use. Doubtless the morals of the people, having occasion to travel up this hill, have also been improved. I have heard of a somewhat similar conquest of a long, bad hill in Winthrop, while I have met with sundry minor examples in different parts of the State. Indeed, so manifest are the virtues of road-drainage that it is truly remarkable so little labor has been expended in this direction. It is clear that neither our farmers nor our road-makers half appreciate the wonderful results which can be secured by thorough drainage of fields and highways—by keeping them, so far as water is concerned, in fit condition for perpetual service.

Three Kinds of Permanent Road.

Route, grade and drainage disposed of, next in order comes the covering of the road, which should be smooth, hard and water-proof. When these three things cannot be secured in perfection, then the nearest approach that circumstances will reasonably admit, should be always attempted. Now the covering has usually been made, in the construction of first-class, permanent roads, according to one of three somewhat different methods, each of which has been thoroughly tested by use.

Since every year should behold a measure of first-class, permanent road work done in different sections of our State—how done will be indicated hereafter—it is well, on this occasion, at least to glance at these methods for the purpose of learning their general features, learning what it is, in addition to a suitable route, grade and drainage, that constitutes a good road. Details may be readily found in the various books which have been written by the great scientific road builders; books with which all persons having charge of our roads should make themselves thoroughly familiar. It would, indeed, be well for each town to own such books, the roadmasters going to them at any time for instruction.

The three kinds of road covering are known as the Concrete, Macadam and Telford. The first resembles, in one particular, that of the marvelous roads which were constructed by the Romans,

especially in what is now France; the others are named from their inventors, two distinguished modern road-builders of England. In the Scottish Highlands alone Mr. Telford built some 800 miles of his road. It was over such roads as were built by Telford and Macadam that the driver of the renowned English coach, before the advent of the railway car, was able to make his one hundred miles and count it only a fair day's work. It was in the transportation of travelers over such roads, that the Aldgate widow, with her 700 horses constantly employed, and her 1400 beds in hotels along the way, achieved fame and fortune, demonstrating the ability of woman to manage successfully a vast and intricate business.

In making the concrete road covering, a layer of perfectly slaked lime, about six inches thick, is first provided; before this hardens a layer of pebbles, some three inches thick, is added, and, in due season, another similar layer of pebbles. Broken stone is much better; but, with the help of the lime in binding, natural pebbles and a certain amount of perfectly clean sand may be successfully used. Travel soon compacts the whole into one solid mass. This road should find favor along the coast, where lime can be so readily obtained and wave-screened pebbles abound. In many localities it would prove a cheap road.

In making a macadamized road covering broken stone is employed, for smooth pebbles, when thus used, will not bind. It is important that the pieces of stone be nearly cubical. All splinters are rejected. The rule is that the weight of the largest pieces should not exceed six ounces; for the smaller the fragments the more quickly they will bind. Yet the opposite extreme must be avoided; for, if the pieces of stone are very small, they will be sooner worn to dust. The tougher the stone the better; it may be broken finer, and so bind quicker, while it will wear longer. Of this broken stone, there is first put upon the road-bed a layer some three or four inches thick; after this layer has become partially compacted by travel or by the pressure of heavy rollers, a second similar layer is added, and sometimes a third, until the stone covering acquires a depth of seven to ten inches. In a short time, indeed very speedily, if rolled, this broken stone, with its many sharp angles, becomes thoroughly compacted and water-proof.

The telfordized covering differs from the macadamized in this important particular: The road-bed is first paved with wedge-

shaped stones. These stones are set upon their thick edges, averaging 5 by 10 inches, so that grooves are formed athwart the road between the upper edges, whose thickness should never exceed four inches. For ordinary roads the height of the stones may vary from three to seven inches—the height increasing uniformly from the side to the centre of the road. Upon this cuneiform, grooved “bottoming” there is placed, after the manner of the macadamized road, a 6-inch layer of broken stone. The telford road is usually of cheaper construction than the macadam, since stone of inferior quality may be used for the “bottoming;” the telford is also pretty certain to wear longer and better than the macadam, which makes it less expensive to maintain. But whether the preference should be given to the concrete, macadam or telford, must frequently depend on the material to be had for construction and on the travel to which the road is to be subjected.

A word more needs to be added to the description of these three kinds of permanent road. The width of the stone portion, if it is to be at all greater than required by one carriage, should be just sufficient for two carriages, when meeting, to pass, or it should be 23 feet, according to the result of careful investigation. The zigzag road should, of course, have greater width at the turns than where it runs direct. The Roman military road, whose covering of lime and stone was about three feet thick, had a width of 12 feet when straight, of 16 feet when crooked. Modern French engineers make roads of four different widths; the width of the stone or macadamized portion of their ordinary town road is 16 feet.

As for the slope of the road from its centre to its sides, whether the covering be made of stone or earth, it should be just sufficient, say one inch in 36, to turn the water into the ditches. Indeed the convexity of the road should be so slight that it can, with difficulty, be detected by the eye, as in the case of Mr. Telford's roads or the admirable highways of Sweden. If the convexity is great, the water runs so swiftly from the road as to damage it badly by washing; the load is often thrown heavily upon the wheels of one side of the carriage, making horrible ruts; and, furthermore, this lateral lurch of the load, by increasing the friction, largely increases the draught. It is certain that a poor road can never be made a good one by “crowning;” it is also certain that a good road is best without crowning, save in very slight degree. Yet,

BOARD OF AGRICULTURE.

were one to judge from what he sees, crowning is a favorite feature with our road-builders. Almost everywhere the roads are rendered excessively convex by scraping upon them whatever of loam, sand, clay or mud can be obtained at their sides. Frequently they are made, by piling up this unstable material, about as round as a log, hardly safe according to the requirement of the law.

Road Dynamics.

Let us now consider the load that can be drawn upon roads of different quality. From experiments which have been made with much care by scientific men, we learn several important facts about traction, or draught, upon roads. It is true that no conclusions, mathematically exact, have been reached, yet they are sufficiently exact for ordinary purposes.

It is assumed, by convention, that the horse performs an average day's work, on a hard, smooth, level road, when he exerts a force of 150 lbs. for 8 hours and travels 20 miles, or $2\frac{1}{2}$ miles an hour. This is equivalent to the horse power of Watts, or the elevation of 33,000 lbs., one foot in one minute. Careful experiments, however, show that this figure is too high for the ordinary horse; that 120 lbs., perhaps a smaller figure even, would come nearer the truth. But we will take 120 lbs., with a velocity of $2\frac{1}{2}$ miles an hour, for 8 hours, over a hard, smooth, level road, as the unit of ordinary horse-power.

Now, in an estimate of draught, all these things must be considered—gravity, friction, grade and velocity.

The gravity to be overcome, which is always the same, whether the road be rough or smooth, increases with increase of grade. With a grade of 1 in 100, a hundredth part of the load must be lifted; with a grade of 1 in 20, a twentieth part of the load must be lifted; and one-tenth, with a grade of 1 in 10. But further: While there must be, with increase of grade, a proportional increase of draught, due to increase of gravity, yet the horse cannot exert so great tractive force as when moving on a level. Not only must the animal lift its own body, and simply to lift this 12,000 feet constitutes a fair day's work, but, because of its anatomical structure, its drawing power is otherwise diminished when ascending a hill. On a level the horse can draw the load that is drawn by five men; up a step hill it cannot draw more than the load of three men. Thus there results, in two ways, a loss of animal

draught power, from increasing the grade of the road. It is a vast loss, when we consider that nearly all our roads are very hilly.

When the road has a good surface, the load which the horse can draw will decrease about as follows with increase of grade: If the grade is 1 foot in 100, or 52 feet to the mile, the horse can draw nine-tenths of what would constitute its load on a level; if the grade is 1 in 30, it can draw two-thirds of its load on a level; if 1 in 24, it can draw only one-half; if 1 in 10, then it can draw only one-fourth of its load on a level.

It is true that the horse, for very brief intervals, can draw five or six times its constant load on a level—can exert a tractive force of 600 or 800 lbs. Except for very short distances, however, it is not well to count upon more than double exertion, which is demanded when the road has a longitudinal inclination of 1 in 30 or 35. Hence the grade of all hills, with any considerable length of ascent, should be reduced to this figure, either by going around the hills, by cutting them down, or making zigzag roads over them.

The amount of force needful to overcome friction depends chiefly on the surface of the road. Were the roads in Maine level, with their present surface, the force required for draught would probably average about one-tenth of the load. The horse exerting a tractive power of 120 lbs., would draw a load of 1200 lbs., 20 miles, in 8 hours. But were the surface such as it ought to be, it would require a tractive power of one thirty-fifth of the load, and the horse would draw $120 \times 35 = 4200$ lbs. On an average level gravel road it may be said that the horse can draw, in round numbers, a load fifteen times its tractive power, or 1800 lbs.; and three times more than this, or 5400 lbs., on a good broken stone road; and eighteen times more, or 3200 lbs., on a good railway track. Such is the important relation of surface to the load which may be drawn by a horse for several consecutive hours.

From these conclusions of practical, scientific engineers, the result of numerous and careful experiments in road dynamics, it will be seen that the utility of roads is increased or diminished more than one would at first suppose, by slight variations, whether in grade or smoothness of surface.

But, again, the tractive power of the horse decreases rapidly with increase of speed, and decreases most rapidly on a rough road, or ascending grade. At the height of its speed the animal can only move itself. As a rule, the draught power of the horse,

moving on a good, level road, at four miles an hour, for eight consecutive hours, is reduced about one-half, or to sixty pounds; while a velocity of eight miles an hour brings the draught power down to one-fourth, or to thirty pounds.

How to Secure Good, Permanent Roads.

Having glanced at what constitutes a really good, permanent road, let us next consider how, without attempting a radical revolution, roads of this character may be gradually secured in the different parts of the State.

It is clear that our present expenditures ought to give us better roads; it is clear that our roads ought to improve year by year, becoming cheaper and cheaper of maintenance; but it is also clear that with only the old feudal policy of personal service as now, with the country divided into minute districts, and with no general, intelligent supervision, very little in the way of steady, durable improvement can be effected. What then should be done? What reasonably attempted in the line of legislation?

The political unit should always be large enough for the most efficient administration of public affairs—of those affairs which are really public, such as the construction and maintenance of roads. Now, the size of this political unit can never be constant, but must vary according to the work to be done; indeed, must often vary with different parts of the same work; for centralization is not an absolute, but a relative term, and what would be effective centralization in one instance, would be wasteful diffusion of executive power in another. That degree of centralization which leads to despotism and produces intellectual inertia among the people, should be, of course, always shunned. But the cry of centralization is often raised against a new thing, simply because there is an absolute dearth of all clearly defined, valid objections. In the natural world diffusion is the characteristic of decay and death; there is no life and growth without some degree of consolidation; it is much the same in the social and political world.

Now, the building of roads and their subsequent care demands a larger political unit than the ordinary "district" of to-day, with its fifteen or twenty families.

In the first place, there is not a district, whose roads are for the service and advantage of the district alone. They are for the service of all the adjacent neighborhoods, and oftentimes people living far away have a direct and constant interest in them. They

should, therefore, be built and cared for largely with reference to the general service they are to render—with reference to that system of roads to which they belong, which mainly tend to a common business centre—the county town perhaps. Again, the roads in different districts are subjected to very unequal service. How unreasonable, then, even if the wealth were equally distributed, to expend upon the roads of each district in the town an equal percentage of its valuation. How yet more unreasonable is this procedure, when, as now, the wealth is so unequally distributed. Of two districts, the one wealthy, the other poor, the former usually has the roads which are, by nature, best. District A, for example, has a valuation of \$50,000, district B, of \$10,000; the roads in A can be kept in good condition with half the labor required by the roads in B; and yet the expenditure upon the former is five times more than upon the latter. Yet the people of A may have occasion to use the roads in B more than they use their own, the poor district lying between the wealthy district and the general business centre. All must have seen illustrations of this. Now, it is clearly for the advantage of A to contribute to the roads in B; but under the district system it cannot do so. For this reason, the district should be at once supplanted by the town, a political unit which is now known, from the study of language, to have existed even in prehistoric times. Not only is the town the most ancient, the most enduring of political organizations, it is the most efficient for the management of the greater part of the public business. To this efficiency must, perhaps, be attributed its abiding hold upon popular favor. With the district supplanted by the town, the labor expended on the roads could be more largely expended where it would render the greatest service to locomotion.

In the second place, the building of roads and the care of them demands a larger political unit than the ordinary district, because they should be vigilantly watched at all times, and the labor upon them should be continuous throughout the year. When they are once built, the prime object should be to “keep up” the roads, not to repair them; that is to say, roads should never be allowed to get badly out of order in any season, as they often do, when the labor upon them is spasmodic, performed once or twice a year, at the convenience of the laborer. Of nothing can it be more truly said than of the care of roads, that “a stitch in time saves nine”—saves in repairs and sometimes in damages assessed by

the jury. The town, but not the district, is large enough to own whatever is needful for building and maintaining good roads. There would be needed horses and carts, a stone crusher, worked by steam, and breaking five or six cubic yards of stone each hour, a roller for compacting the broken stone, with a few other minor implements. The whole would cost some three thousand dollars, and might be paid for by devoting a portion of the road-tax to this end for three or four years. And, again, the town, but not the district, is large enough to keep constantly at work a number of men sufficiently great for the most advantageous performance of road labor with labor-saving machinery. An efficient road-master could, also, be secured and kept in office for years, that the public might profit by his experience. There is always enough to do at any season of the year. Beside the work which specially belongs to winter, stone can be broken at that season and drawn to the points where it will be required. In winter gravel can also be carted to the places where it is needed; and it should be well understood that gravel—if screened the better—can be profitably transported a long distance to mix with clay or loam instead of the usual scrapings from the side of the road.

This is the road policy pursued, with the happiest results, by the town of Waltham, Mass. The town is quite populous and has about sixty miles of road. For seven years prior to 1865, the average annual expenditure on her roads, under this policy, was only \$3,357, embracing the expenditure for sidewalks throughout a large village. In 1868 it cost the town \$6,000 for repairs of roads and clearing away the snow. She keeps ten to fifteen men steadily employed, working with the requisite labor-saving machinery. As a result of this policy, her roads are the best to be found in any country town of Massachusetts, and are continually growing better. The principal ones are macadamized. Nevertheless her road expenditures are below the average. Little wonder that other country towns of our mother State of Massachusetts have begun to imitate the example of Waltham. It would be well for us to go and do likewise.

In the third place, the political unit for the management of roads should be as large as the town, because a certain amount of the money—say one-quarter—expended on roads should be devoted to durable improvements, where the need of them is greatest. Every town has its hills, its bogs, its sandy plains, which should receive special attention. The district, to be sure, can do

something in the way of first-class, permanent work; but the town, for sundry reasons, can do far better than the district. The demand for such work is more pressing in some neighborhoods than in others; where the demand is most pressing, there the work should be first done, and it can be better done by concentration of forces upon a single point than by attempting to do somewhat, as under the district system, in a dozen or twenty different places at the same time. Again, it is easier finding one man in a whole town than one in each of the several districts, who is qualified to take charge of this permanent work, executing it after the most approved teachings of science and experience.

But it will be said, and correctly, I think, that the popular sentiment is against the abolition either of the district or of personal service. If, then, the durable improvements cannot be well made by the district, in what direction shall we look for better things? It strikes me that, if we cannot change our road policy by abolition of the district and of personal service, we can render it much more efficient by adding a little to what we already have. It is an addition that would be required, though not so urgently, if the petty district were abolished.

The county is organized with special reference to the business interest of the towns embraced within its limits. To the county the town holds much the same territorial relation that the district holds to the town. If the whole care of the roads, therefore, is left to the different towns, to say nothing of districts, then those interests of the county dependent on locomotion must frequently suffer. Take my own county, for example. Livermore finds her principal market at Lewiston and Auburn. Between Livermore and her market lies Turner. Now, it is for the interest of the people of Livermore that some of the roads in Turner—the ones traversed by themselves—should be of the best quality. Rather than these roads in Turner, it were far better for the people of Livermore, that some of the roads in their own town were neglected. In other words, the people of Livermore would help themselves decidedly by helping to put some of the hills, bogs and sandy reaches of Turner in good plight for locomotion. And it would only be just for them to do this. Hence, a certain amount of money—two or three mills on a dollar of valuation—could be justly and wisely expended in permanent improvements under the direction of the County Commissioners, who already have more or less to do with roads. Each year they could designate the points,

where, in their opinion, the general welfare would be best subserved by the expenditure of the common fund. This expenditure would keep in constant service a skillful engineer, with a quota of men sufficient for the execution of those more costly improvements, which the individual town cannot well undertake, which indeed, may not be for the special advantage of the town where they are made, but rather for the special advantage of towns lying beyond and further from the common business centre. There would also be sufficient means for the purchase of the best machinery in order to economize labor. Again, while the county engineer should execute his own special work, he could advise, when invited to do so, with the road-masters in the different towns or districts, as to the durable improvements to be made under their charge. The whole body politic would thus become gradually educated. This would be a great gain, for scientific engineers are not spend-thrifts, as so many imagine; but they study how to accomplish most with whatever expenditure is made under their direction. Town and district surveyors could not fail to profit by their suggestions. Now, it is but little legislation that is needed to add this new, just and efficient feature to our road policy of to-day. In twenty years, this, even without the abolition of the district, would work a great and beneficial change in the character of our country roads. Beyond the county we should not now enlarge the political area for the management of country roads; for, with the introduction of the railway, has disappeared the necessity, once urgent, of turnpikes running athwart the whole State. For the inspection of railways we have commissioners appointed by the State, and we need no other State officials to look after locomotion.

Here, then, is a policy for the management of roads, which should supersede the present relic of feudalism. Until a change has been made in this direction, and a certain amount of labor expended in durable, scientific work—expended by town or county, or by both—we cannot look for any steady general improvement of our country roads. And the policy thus proposed is not a policy to enlarge necessarily, but rather to diminish the cost of roads, while gradually giving us vastly better ones. It is not a policy for increasing but for making the most out of our present expenditures. The only thing which stands in the way of its adoption is petty, local jealousy, some times called love of independence, but

which is too often only a blind manifestation of narrow thought and narrower selfishness.

Work that Can be Done Now.

But cannot our roads be greatly improved while working under present conditions? Yes. Some districts now do much more commendable work than others. There is no reason, except lack of inclination—but that is a giant in the path—why all should not equal those who now do best, nor any sufficient reason why those who now do best should not do better still. Drainage can be easily made more efficient; excessive “crowning” can be discontinued; less of vegetable mold and sand and mud, and more of gravel, can be used; there can be more diligent removal from the road of pestiferous stones, both loose and embedded; more cutting away of trees and bushes that shade wet places and retard evaporation; there can be less building of useless fences along the roads for the increase of snow drifts; more cutting down of hills, going around them, or following a zigzag course over them; there can be more of continuous work upon roads, and they can be more intelligently laid out by County Commissioners and town officials. Even under the present policy we might secure, though at undue cost, yet not greater than now, quite decent gravel roads, of fair grade and fair drainage. These things might be, but will they ever be, when, under the present system, so many must be instructed before the work can be properly done?

As an example of what can be done now, let me refer to a district in the town of Durham, whose three miles of road I have recently had occasion to contrast with roads elsewhere. They are certainly the best three consecutive miles of rural road in my county, and I think the best I have seen in the State. They are, I know, much better than they were twenty years ago; and they have been made better without an increase of expenditure. A few details may not be without value. The land is far from level, there being frequent hard, gravel hills, with intervening stretches of clay and bog. Upon inquiry I was told that next to nothing had been scraped into the road from its sides during the last ten years, though previously the scraper was in constant use, and the road was excessively crowned with whatever could be most conveniently got. Scraping and crowning, which never or seldom give good results, have indeed been almost wholly ignored the last ten years. Instead, the hills, tough as they are with “pin

gravel," have been gradually cut down, and the gravel carted upon the wet levels intervening; the stones have been diligently removed, and something, though far from enough, has been done in the way of drainage. The result is that the grade of the road has been decidedly improved; throughout nearly the whole district the road has a hard, smooth surface of gravel, and the ancient depths of mud, which so vexed the travel of spring and autumn, have all disappeared. This has come mainly from the people of the district learning that one load of gravel on the road surface is worth more than the largest amount of sand or clay, or vegetable mold. But they have not yet learned the value of a zigzag road, else they would thus subjugate the worst hill in their district, up which the struggling ox and horse have toiled these three generations, with no better prospect for generations to come.

How often it is necessary, in the work of transportation, to load with reference to a single hill, or bog, or sandy stretch. But for this one obstacle a much greater load might be easily carried throughout the whole distance. Such obstacles should receive the special attention of all managers of roads. One dollar spent for their removal will do more good than five dollars spent on the average road.

The Worth of Good Roads.

I began by speaking of the value of good roads, and I will conclude as I began; for it does seem to me that they are not fully appreciated by our people. There can be little question that if our State had only good gravel roads, of proper grade and drainage, the cost of transportation, with her present meagre population and volume of business, would be reduced one-half. There would be saving of time, of labor and wear of men; there would be saving of animals and of carriages. Where it now takes eight hours to travel thirty miles, we should see the same distance traveled by the same horse in five hours; and where one thousand pounds now make a load, we should behold three thousand as easily drawn. And the roads would be fairly passable at all seasons and in the worst rainy weather. This would give a genuine increase of wealth for all concerned—for those at and for those away from the centres of business—for producer and consumer alike. How much would thus be saved cannot indeed be very well determined; but it seems to me it could not be less than two dollars to each inhabitant, or \$1,500,000 for the whole State, enough to pay five

per cent. interest on \$30,000,000, a sum which would go far toward telfordizing all the principal thoroughfares of the State. But not only would there result this direct saving from good gravel roads; our farmers thus enabled better to meet the competition of more fertile regions, lands now untilled would be brought under profitable cultivation; our railroads would become more prosperous than now, for it is of the utmost moment to them that the country roads be of good quality in the regions of which they are the great outlets. Then there is all the social and pleasure travel which would be rendered so much easier and more delightful, and which only barbarians can regard as of no importance.

But the great value of good roads, on a small scale, might be also inferred from the great results they have produced on a large scale; and in order to stimulate yet further our zeal for such roads, let us, for a moment, consider their past. There is little danger that our zeal will exceed the bounds of reason.

The Carthaginians were the first systematic road-builders. From them the Romans learned the art; but they so far improved upon their appropriated knowledge, and applied it so extensively that they became the most renowned of road-builders in all time, the Incas of Peru alone contesting with them the palm. Their main lines, straight almost as the flight of an arrow, with the surface firm almost as granite itself, composed of lime and stone three feet thick, extended from the shores of the Atlantic to the banks of the Euphrates, from the frozen regions of the north to the extreme limit of cultivation in Africa. Even in the far isle of Britain these indefatigable workers built 2500 miles of their stone road. Of these immense roads, which in part continue to this day, and whose ruins, centuries after the power and civilization of Imperial Rome had vanished from her outlying provinces, were regarded by the rude and superstitious inhabitants as the work of King Solomon, of genii or fabulous heroes;—of these immense roads the city of Rome was the great centre, and along them she sent, with then unequalled celerity, her legions and the muniments of war, to the very verge of the known world. To these roads, says John Stuart Mill, and to her policy of incorporating conquered provinces into the body of the Republic, afterwards into the body of the Empire, more than to the matchless discipline of her armies, Rome, through so many centuries, was indebted for the

dominion of the world ; and it was from neglecting roads and from making mere tributaries of conquered provinces that Greece failed of universal empire.

In our day, too, the influence of rapid communication upon the fortune of war has been quite as forcibly illustrated. But for the railroad and steamboat, with the telegraph to convey orders from one end of the Republic to the other, instrumentalities by us used for the first time in the world's history upon a broad field of warfare, the twenty odd millions of the North could not have been hurled, as they were, against the eight or ten millions of the South, and secession would have triumphed. Steam locomotion and the telegraph, however, brought the twenty millions face to face with the ten millions, without waste of time or energy in long marches or in the transportation of war material. A few days placed in the same camp in the valley of the Shenandoah, or on the banks of the Cumberland, the regiment from Maine and the regiment from Minnesota. The troops who had defeated Hood before Nashville were ready, almost in the twinkling of an eye, to move in the assault upon far away Fort Fisher. Hence in a complete calculation of forces, where each party was equally brave and equally resolved, the last result could not be doubtful even from the beginning. Two against one settled the question. But the South, having no ample precedents from which it could estimate the influence of steam locomotion and of the telegraph upon military operations, confidently counted upon waging the war of secession much as the Revolutionary Fathers waged the war of Independence against King George. If necessary they would retreat to the mountains, patiently wait and endure, while the North exhausted itself in long and weary marches. Never did it occur to them that the use of steam and electricity would prove equivalent to the reduction of the country to, perhaps, one-twentieth of its territorial size, with the military conditions of the Revolution—that both parties could be brought face to face with very little loss of original strength, even by the one who had come the farthest.

But, to return from our digression, the Romans did not stop with their great military avenues, nor with their great avenues specially constructed for the use of commerce ; nor should we, any more, stop with our railroads, as we appear inclined to do. The Romans bestowed equal care, perhaps, though of course not the same expense, upon their innumerable minor roads. Com-

merce and social life flowed, without impediment, not only along the great arteries, but through every by-way of the Roman body politic. And from all these roads came, in very great degree, Rome's power, wealth and civilization; while this power, this wealth, this civilization, and her roads disappeared together.

Upon this side of the Atlantic we also discover the same relationship existing between roads and civilization. The ancient empires of Mexico and Peru, as they were destitute of beasts of burden, carried their foot roads to a marvelous degree of perfection. Those of Peru extended for three thousand miles through one of the most mountainous countries on the globe. There were galleries, says Prescott, along the face of precipices, tunnels through living rocks, ravines bridged with masonry, and torrents crossed by suspension bridges made of ozier or the tough fibre of the aloe; all which was accomplished by a people ignorant of the use of iron. Such roads were built for the purposes of war and commerce, and without their aid these Indian empires never could have attained, as they did, to a civilization so greatly in advance of the barbarism of the thousand roadless tribes, who occupied the rest of America.

Again, in a large part of Asia, although beasts of burden were always abundant, we find that civilization was in harmony with the roads, miserable when the latter were miserable. Even now the roads of India are so poor that she secured very little profit from the new cotton market that was thrown open to her at the commencement of our civil war. Not much of her cotton could be got to the seaboard without consuming, in transportation, the great price it brought when once in the market of the world.

Again, with the revival of civilization in Europe, better roads were among the first signs indicative of that revival. The Crusades forced upon those who were called to lead vast armies, a conviction that good roads were absolutely necessary for the speedy movement of troops. Once more men began, after the manner of the old Romans, to build roads for war and conquest; then commerce proceeded gradually to use them and to build new ones. So it may be justly said that war, from oft furnishing the first incentive to the construction of good roads, has largely promoted the civilization of the world in one direction at least, though retarding it in other directions.

Thus does history, by its great examples, teach us the great value of roads; and the declaration of Lord Macaulay is fully

borne out, that, next to the alphabet and the printing press, those inventions which abridge distance have done most for the civilization of man. And what is true on a large scale, is just as true on a small scale. While railways care for the great interests, no town can give overmuch of intelligent consideration and labor to the building and improvement of its minor country roads. They are indeed little nerves, but absolutely essential for the animation of the whole body politic.

Since, then, the office of road surveyor is really one of so great importance, why should we not, as most civilized countries have done, make it among ourselves one of great honor by recognizing the value of roads, and demanding that those in authority over them should discharge their duties intelligently? If we will but take the trouble to trace the pedigree of road-builders, we shall discover noblemen and Kings in the long line of their ancestors. Even among the States of Greece, although they were not greatly distinguished for their roads, relying largely as they did upon water communication, yet road-making was so highly honored that the Lacedemonian Kings were, *ex-officio*, road surveyors; while the most illustrious of the long-haired Thebans sought and discharged the duties of that office. Even Epaminondas himself may have been a road surveyor. Among the Romans men of Prætorian dignity sought the post, and Emperors themselves deigned to become road surveyors. In France, under Henry IV, the distinguished Sully was a road surveyor, his sonorous title being that of Great Way Warden. One of the eminent causes of the French Revolution, which gave so much land and liberty to the peasants, was the despotism of the national road management; at every season of the year men were forced to perform road labor in any part of France, even the most distant from their homes. In more modern times a large number of road surveyors have come from the great schools of science—those schools which are doing so much, in many ways, for the advancement of the race. Thus the most eminent of the scientific men of France now have charge of her country roads, and in England new roads are built and old ones discontinued, under the direction of scientific engineers. A very large percentage of the wealth increase of England, France and the German States, during the last fifty years, is due to improved country roads. Doubtless the scientific school, which has been founded at Orono, will, in due time, do much towards pro-

viding Maine, if she asks for them, as Europe has been provided, with intelligent, skilled road-builders.

It is, indeed, high time that we ourselves ennoble the office of road surveyor, that we gave up the old feudal system, with its ignorance and its waste, that we began to manage roads in conformity to the dictates of science, approved practice and a sound political economy. In some things Maine has shown herself more enterprising than her sister States of New England; why should she not lead them also in the construction and maintenance of country roads?

The CHAIRMAN. The question is open, and it is hoped that a general and free discussion may take place.

Prof. FERNALD. I have listened with interest to the elaborate and instructive treatise upon road making which has been read by Mr. Stetson. It contains many exceedingly valuable suggestions, and the topic is one in which every man who has occasion to pass over our country roads is deeply interested.

There were two points in the lecture which seemed to me highly philosophical, and to embody suggestions of great importance. The first was that of *grade*. How frequently do we see roads laid out over a hill, when by increasing the distance a very little, the ascent might be avoided? It has been the policy of road-makers, quite largely, to make a straight road, even if they have to go over a hill. If the grade can be lessened, as has been shown, the amount of power to be expended in draft is very largely reduced; and here is a great point gained.

Some observations were made in regard to the very imperfect drainage of our roads. We know that in the spring and during the latter part of autumn, our roads are generally in a wretched condition, from imperfect drainage. If anything like a perfect system of drainage could be adopted, it would improve our roads to a wonderful degree, and I hail with joy any remarks or suggestions which may lead to this end, and I am very grateful to Mr. Stetson for taking up and so elaborately treating this subject.

Hon. A. M. ROBINSON. A very large amount of money is lost for want of engineering skill in the building of roads. That is one difficulty, lying at the base of the matter; but there is another one, which always struck me as more serious, and that is, the utter indifference with which the community view the subject. The general idea is, that anybody can build a road. That is the

first proposition. The second is, to select almost anybody who happens to turn up as road-master. Until last year, when the Legislature very wisely changed the law, the thing was done by nomination. As I understand the law now, (I have not examined it,) if a town fails to elect a road-master, the selectmen will appoint. The towns will fail to elect, so that practically, the power will be in the hands of the selectmen.

I do not think the Legislature could accomplish much in relation to this subject by simply putting a law on the statute book. I know that, three years ago, a prime remedy was offered by Mr. Stetson of Exeter, which he supposed would cure a great many, if not all the difficulties in the way of road-making, and keep the highways in a safe condition. He embodied his ideas in a statute, which provided that for five months in the year, each surveyor should go over his district, examine the roads thoroughly, and remove all obstructions from them. On paper, it was a very nice scheme—apparently practical, useful and safe. There is the legislation, and here is the fact before us, that the roads are universally in the same condition to-day that they were five years ago; so that that legislation did not amount to much.

The grand remedy is *general instruction*. Instead of legislative acts, you should build school-houses, and appropriate more money to educate your children. Whenever you have intelligence upon the subject of engineering, you will have good roads; I doubt if you will have them before.

That is the first great fault. The second is idleness. Formerly the man who best stood out his taxes was the best fellow in a great many districts. There was so much put on a man, and the thing was to get the surveyor to wipe it out. In a village where I lived, many years ago, I recollect they had a summary way of working out their taxes. They appointed their own man as surveyor, and they used to pay him in new rum for crossing out their taxes. There was little or no work done, year after year. I only mention this to show how utterly reckless men have been, and are still, in a measure, perhaps, to obligations of that kind.

Now it requires an engineer to build a road, and an engineer must be an educated man. He may not be graduated at a college; he may learn enough of engineering at a good school to make him a fit road-builder. I recollect riding last year with one of the most accomplished engineers in the State over a highway very much travelled, which a pretty intelligent lot of men had been at

work improving; and the report of their labor was, that they had got the hills a little higher and the roads a little narrower than before, and the bottoms remained as they were. That was the result of ignorance; and is also evidence of the indifference in the public mind in relation to this important matter.

Engineering should be studied much more than it is in common schools and in the higher schools. If I were going to educate boys practically, it strikes me that after teaching them to read, write and cipher, I would put them all on chemistry and engineering. I would teach them to analyze soils and manures, and to make highways.

Mr. PUTNAM of Houlton. For thirty-five or forty years I have made more or less road every year, but I have learned a great deal within the last hour in regard to the subject. I will state how I made a piece of road, within a year, through the woods. The road was laid out by the County Commissioners. The selectmen had not raised money to build it, but the county ordered it opened, and they directed me to have it opened. The selectmen said if I would take the tax bills to be paid with statute labor I should have any necessary amount. I told them I did not want to do it in that way, but rather than not have it made I would take it. In the first place I took out all the trees and roots that I could, so that there was little left to prevent the plow from going along. I then put on a team of six heavy horses and plowed, commencing in the centre and back-furrowing. I kept a gang of men to dig out the roots and stones, and if anything obstructed the plow, I ordered the team to stop and the men would take it out. In that way I cleared the road so that there was nothing left but earth, and scraped that to the width of 24 feet. I plowed four times, back-furrowing each time. After that I had nothing more to do except to bush it. I had two birches cut, as heavy as four horses could haul, and bushed the road. It is a smooth road from end to end, and the work was done for rather less than three dollars a rod.

I consider it very important to plow thoroughly and deep in building a road, so that when the road is made it will all settle alike, and be left with a smooth surface. I ought to add that after grubbing the road, I sought the proper place for culverts, and put them in to carry off the water from the ditches, so that none should stagnate in them; if it does, it will be a great injury. I never saw handsomer roads than I have seen made in New Bruns-

wick; but three days after they are made put a team on them and the wheels will go to the hubs. The centre of the road is not plowed at all. They grub through the woods and do not take out all the roots, although they do most of them, and then cover up, and the first rain that comes leaves the soft places very soft, and the hard places very hard, so that you find it as hard a road to travel on as though it had not been worked at all.

In repairing roads when once well made, we let the shoulders remain and fill inside with some hard substance. We are not able to pound stone to do it, but we use good gravel. If they are once formed properly level, not rounded up much, we make better roads a great deal by repairing them in that way than by plowing the shoulders and raising them up, so that when two teams meet the outside one must go in the ditch.

Mr. ROBINSON. Twenty-four feet from ditch to ditch?

Mr. PUTNAM. Yes sir.

Mr. ROBINSON. What would be the slope?

Mr. PUTNAM. The centre, I should think, two and a half feet higher than the ditch.

Mr. ROBINSON. Would there be any danger if you drove in the ditch with your carriage?

Mr. PUTNAM. Not at all.

QUESTION. What was the character of the soil?

Mr. PUTNAM. It was clayey loam; not very rocky. There were some stones.

QUESTION. Did not the water soak down naturally?

Mr. PUTNAM. No sir; we had to drain it off. I repair roads by carting on hard gravel; never by taking the sand out of the ditches that is washed into them from the road, because it will go right back again.

QUESTION. What depth do you allow the water to stand in your culverts?

Mr. PUTNAM. None at all. It should run off at once. If it stands it will make a hole under the road.

QUESTION. Have you had any experience in building roads through clay?

Mr. PUTNAM. Very little. There are roads in my neighborhood where I have seen teams set in the spring, with only three tons weight, the wheels down to the hub.

QUESTION. What is the remedy for that?

Mr. PUTNAM. Centre draining. In one case of that kind, I put

on a team and ploughed the road, scraped the dirt to each side, and then laid what we term a French drain in the centre, covered that with stone, and then with brick, and then threw the clay and loam back on the road, spread over it some gravel, and there has not been a day's work done on that road for fifteen years. The object is to let the water have a chance to get off. It cannot get off when shut in by clay, and it must burst up through.

Mr. LEBROKE. I was requested by my friend Mr. Chamberlain to say, that the town in which he and I live, have, so far as we could have the appointment of the road commissioners, in part adopted the system of making roads by the town with *money*—that is to say, in deference to a long-standing preference in favor of persons working out their own road tax, a portion of the tax has been worked out in that way, but we have expended considerable more money, which has been raised and put in the hands of the selectmen, (perhaps not strictly according to the statute) and we have realized great benefit from having a considerable portion of our tax in money, and having it expended by judicious men. And, by the way, I will say that we have succeeded, in our town, in finding very judicious men for this duty when we have sought for them.

I am glad that a man so able as Mr. Stetson has undertaken to write something on this subject, and changes will come in time, it may be. Our school system is being changed, perhaps for the better, against the prejudices of the people in some instances; and upon the whole, I am inclined to think that legislation may be had on this subject that will improve the existing state of things, somewhat in accordance with Mr. Stetson's views. If I understand him, his idea is, that legislation must be somewhat of a radical character as to the raising and expenditure of money. If I remember right, a town has a right to elect road commissioners instead of surveyors. As I have said, we in Foxcroft have not strictly followed the statute, but we have assumed the English common law power in this matter, and nobody has complained.

Now about the influence of roads upon the community. My mind is of so practical a turn that I can never reason upon a subject a great deal unless I see something practical pretty clearly defined in my own mind. Take my own town. The neighborhood in which I was brought up had twenty-five years ago, population enough to make a respectable school district. In that neighborhood were to be found some of the best lands in the town, with orch-

ards and fields, with pleasant hills, beautiful groves, brooks and streams, and everything to make home happy. Yet that portion of the town once populated by twenty families, and now within four miles of a railroad depot, is wholly abandoned, while other portions of the town, less fertile, less desirable, to which a convenient thoroughfare was constructed, are now the flourishing portions of the town; lands which looked forbidding twenty years ago have been reclaimed, and are prosperous neighborhoods; whereas the northern and central portions of the town have been abandoned, simply because of the want of suitable roads in that locality. The roads were originally over the most severe hills in the town, and down through the deepest valleys, making some of the steepest grades to be found anywhere, those who originally located the roads supposing that they must follow the town lines. Then the road was not continued so as to make it a thoroughfare; and from the very necessity of the case, for want of means of access to the place, that region has been abandoned; and now, with its large orchards and its fences partly gone to decay, it is devoted to pasturage, and is returning to forest. That is the effect of hard roads, within four miles of where I stand, in one of the best regions of the town of Foxcroft. I can see no other reason for the change.

These things can be remedied. In the first place the roads should have been located in a zigzag or semi-circular manner, so as to escape those hills, and then they should have been made by men who could hire the labor to be performed. No matter how good a gang of men you have, unless you have power to discharge those men, you cannot control this matter. So I say, every dollar that is to be raised should be raised in money. I do not know how it is to be done, but let Mr. Stetson continue to agitate the subject.

Another thing. I have for twenty years voted for the largest sum of money needed for the making and repairing of highways. I have always voted to carry that money into the rural districts, saying that a village without a country to sustain it, was no more than a head without a body to support it. I have always taken that ground. I have not always succeeded in getting the largest sum, but I have always voted for it. I have always thought the system of allowing persons to work out their road tax was a disadvantageous and unprofitable one. A number of men get together, with half a dozen oxen and a scraggy horse, and pretend

to work on a road in some back district; their taxes are assumed to be all worked out, but they do not perform effectual labor, and there are no roads. There are many towns in the county of Piscataquis and in the State of Maine which are suffering from that cause to a greater or less extent.

Then, again, about road making. In addition to casting my vote for the largest sum of money, I have always felt a very great interest in the improvement of the roads in the village. I have within a few years laid out six or eight hundred dollars in the improvement of the road and an adjacent bog in view by the little stream that runs near my house. There was a little narrow bridge there, the sides filled with rubbish, and a dangerous place to pass. I have contributed every year something besides my taxes to have these permanent improvements made.

I want to say a single word on the subject of permanent improvements. The best way to secure good roads is to pick out the very worst places and make them the best. Take a bridge, for instance, put a good granite wall on the side, fill it up, and make a permanent improvement that will stand for all time,—so much is made; so much is done, and even men who do not take much pride in such matters will be really pleased and say that a good thing, a lasting work has been done; and when that has been done you will take hold of other places, which require less labor, with new vigor, and when you get through with them, make another permanent improvement, that your children and children's children will see, and that nothing but the general destruction of all things will remove.

I wish to encourage the very able gentleman who addressed us to pursue the subject, and "keep it," as the politicians say, "before the people."

Mr. LELAND of Sangerville. I have taken some interest in the lecture, although the suggestions of the speaker range somewhat higher than we are at present prepared to go. We are not ready yet to build macadamized roads, nor other costly roads. The trouble, as I understand it, lies here. We raise a sufficient sum of money, if it could be expended on our roads during summer, to put them in good condition; but the trouble is, that in the winter we have drifting snows, that fill the roads, especially cross roads, and these must be opened, and it requires so great an amount of work through the winter to keep the roads passable, that when June comes, which is the time when the work is usually done on the roads, there is very little money left. In some districts, the

men, when they have got through planting, having got a little tired, go on to the roads. They seem to think it is not cheating themselves, but only cheating the town, if they idle away the time, and so they will get together and "talk horse." That is the great theme. They all have fast horses, or colts that are "threatened with speed," as Mr. Chamberlain said this morning. It is not so in all districts. There are some where the people take an interest in the highways, and frequently give a great deal of labor in breaking the roads during the winter season. Such districts have good roads.

The trouble is not so much from ignorance, although there is undoubtedly much of that, or from want of proper supervision, but from the fact that there is no money to put on them. And then, road fences are nuisances which should be abolished; they are the chief cause of the heavy snow drifts in winter.

Great improvement can be effected by passing over the road every spring, and frequently in summer, and removing all the pebbles. Our surveyor went through the entire district this season, and picked out every stone that would obstruct transportation, no matter whether large or small, and our road is much better for it. In some districts, the roads are covered with these stones, which are very annoying and a great obstruction.

In regard to building roads, so far as I have had experience, it would not agree with the lecturer's method, which was, as I understood it, to leave the road nearly level and not much raised. Now, our practice in building roads, of late, has been to make them rather narrow and quite convex. We may be wrong. We do not pretend to be engineers, by any means, but we have succeeded in getting very good roads in that way.

I have travelled in New Hampshire, where I found roads go around the hills instead of over them. The general plan among the first settlers here was to make the roads as straight as possible, going over the hills. As Mr. Lebroke has said, it may be no further around a hill than over it, and I think that when new roads are to be built, or changes made in old ones, this should be regarded. The zigzag road of which he spoke is an entirely new idea to me.

Mr. LEBROKE. I would ask Mr. Leland, if a road is made quite narrow, and very convex, is there not danger that it will not fulfill the statute requirement, that highways shall be safe and con-

venient at all times, by night and by day, for people to pass and re-pass, with horses, teams, carriages, &c.

Mr. LELAND. Perhaps "convex" was not the right word to use. I mean that they should have a true descent from the centre to the ditch; of course, the inclination must not be sufficient to cause carriages to tip over.

Mr. ROBINSON. What is the width of your road, after it is made?

Mr. LELAND. I have hardly ever taken the pains to measure, but we intend that they shall be sufficiently wide for carriages to pass each other readily.

Mr. TURNER. From my observation and experience, I am much opposed to raising roads high in the middle. Where this is done the frost goes deeper in winter, and it is much longer in coming out in spring; leaving the road wet and in bad condition. I want a road well made, but as nearly flat as water will readily drain off from.

Mr. LUCAS of Somerset. The great difficulties in regard to roads, as far as my experience goes, are, first, to get them located where they ought to be, and, secondly, to put them between points of sufficient importance to get a good road. In the county where I live, the idea with the first settlers was to settle upon the highest hills, and roads were made from one hill to another, and continued to be so made for a good many years, and, to a great extent, to this time. It is very difficult to get any alteration made in those roads. Almost every selectman has some friend whose personal rights must be taken care of; and the same applies when roads are located; they are located more in the interest of individuals than of the public. It is a great difficulty. Here are the farms on the old roads, and the buildings, and the orchards, and here is an old gray-headed man, who has worked hard all his life, and his labors have gone for the benefit of the public, and, now he is to be deprived of his rights and privileges by taking away his road. All these things conspire, in this portion of the county, against our having good roads.

The utility and necessity of good roads were fully set forth by the lecturer. There are very few miles of road, in this section of the country that he or any engineer would not see could be improved by changing the location. But, there is this difficulty in the way; here are all these personal friends of the authorities who locate our roads, and their interests are to be regarded.

The first thing, as I said, is to get the road properly located, and

where it will meet the wants of the public. In relation to building the road, I should agree fully, so far as new roads are concerned, with my friend from Houlton, that the road should be grubbed to a sufficient depth, then ploughed, cleared entirely of roots, and then shaped and made smooth. That is the whole thing; all which is necessary in making a road.

In relation to repairing roads, there is a diversity of opinion. I will tell you what our practice has been. In the first place, we plough the road thirty feet, from ditch to ditch, plough from the ditch towards the road on each side. We then remove the turf. Then we plough twice more, and scrape it, throw the turf back, put some gravel on top, and then we are done. The drainage is the same as others have described here. We put in ditches where they are necessary.

Mr. PUTNAM. One gentleman speaking of road fences, called them a nuisance. When I have been driving horses and cattle, I have found it exceedingly convenient to have good road fences. But the Legislature has passed a law that highway surveyors may throw them down in the fall, and our surveyors do so, and put them up in the spring. It costs but little to put them up compared with what it would to break out the drifts. The town does it, at the public expense.

Mr. GILBERT of Androscoggin. I desire to speak upon only two points. First, in reference to legislation. We all know that great changes cannot be brought about at once. Any change in reference to our present methods of locating or constructing roads, or of keeping them in repair, must be brought about gradually. We must first bring the minds of the people up to it, by informing them on the subject, and then legislating, if legislation is necessary, to correspond with the progress of correct views. As the matter now stands, I would not legislate except upon one point. I believe that we should empower our county commissioners in certain cases *to grade* as well as to locate. And to illustrate why I would do this, I will make some allusions to actual occurrences. Reference has been made to the fact that many of our roads pass over high hills, from the fact that the first settlers located themselves upon the highest land, and the roads were built to accommodate those settlers. New roads are continually being made upon low ground, at great expense, and the old roads discontinued, at much inconvenience to those living upon the hills. In many such cases, where it is imperatively necessary that some change

be made, it can be done at much less expense *by bringing the road up to grade*, than by a new location, and without discommoding any one. One reason for this is, that I am opposed to increasing the number of roads in a town, because of the great expense of keeping them in repair. The new location must be kept in repair for the distant travel; the old location must be kept in repair for the neighborhood travel; consequently, the town is subjected to the expense of keeping two roads in repair instead of one, and that for all time, when perhaps a much less expense would have graded the old road, and made it equally good, if not better than the new one. But the county commissioners have no such power. The road must pass over those hills as formerly, or they are compelled to make a new location.

Another point. The old road through Turner to Auburn passes over a series of clay hills, and in the spring of the year they are very bad; indeed, at all seasons of the year those hills are more or less troublesome to transportation. A new road has now been located, following the low land bordering on the stream, in order to get a level route. That old road is thickly populated; many of the farmers along the route are wealthy. The new location passes entirely behind them, upon the further end of their farms, altogether out of their way, damaging them to a great extent, and with no convenience to the people living on the line of the old road. Now, instead of the new location, I consider that the public would have been equally benefitted by grading the old road (and it could have been done in this instance at much less expense than building the new one); the people living on the old road would have the convenience of the road after it was graded, they would be subjected to no inconvenience, and the town would not be put to the expense of keeping two roads in repair instead of one. Consequently I believe to that extent we need legislation upon this point.

One other point. It is one to which I have given considerable thought, and in the present aspect of affairs I do not consider that we need any legislation upon it. I believe that, in reference to keeping roads in repair, the towns have all the power that is necessary. They can raise money and appropriate it, almost, I was going to say, as they please. That is, the selectmen are road commissioners by law. The towns can raise money to be worked out in the method that has been so frequently alluded to here, in the discretion of highway surveyors appointed by the selectmen,

or they can raise money and put it into the hands of such men as they see fit, to be worked out in any manner they prescribe; and that is quite sufficient for our present purposes. Let us first make use of these privileges, and when the people are educated up to that point, if we need legislation to go on in further improvements, let us obtain it.

My method would be to have the selectmen place the money in the hands of some two or three competent individuals, and let those men employ their own help and repair the roads, using the money to the best advantage; not in proportion to the taxes in the several sections, but in proportion to the needs of the various sections of the town. The town itself should own all the machinery to do it with. They should own the team; they should own the necessary tools of all descriptions. Those two or three men should take the money in their hands and go into the various sections of the town, and work the whole season, and keep the roads in repair. I believe that this plan would work wonders in the improvement of our roads.

Mr. WAUMELL. I know nothing about building roads, but I do know something in reference to raising money and expending it on the roads, and taking it out in labor in the different districts. In the town where I reside, after a contest between the farmers and the villagers, whether we should raise money and expend it, or whether the taxes should be paid in work, we finally, after the farmers had got two or three thousand dollars of over-work charged, agreed to raise money enough to pay them for their overwork, and take the amount of money the selectmen said was necessary and repair the roads. They agreed to raise the money, and two years ago they did raise it. Another condition was, that every man in the district might go on the road and work, and should be paid in money, according to the work he did. They went to work with the money that was raised, and after a short time it was difficult to get farmers to take their teams and come out on the road and work for ready pay; they could earn more on their farms they said, and so laborers had to be obtained from the village. Last year money was raised, also, and every man who rides through the town knows that the roads have never been so good before as they are to-day. The roads are such that you can trot a horse almost the whole way. It was done with money.

We have had on our board of selectmen a man who knows how to build roads; and he has had the entire charge of it. He has got

a road that will last for years without having another dollar put on it.

The farmers in my town have come to the conclusion that they can earn more on their farms than they can on the roads, and we have to take what Canadian lumbermen we can find in the village, put them on the roads and make them work, and pay them what they earn. I believe if every town in the State should adopt this system, both farmers and all other citizens would find it money in their pockets.

MR. PUTNAM. I have tried for several years in our town to raise money and put it in the hands of commissioners, instead of having highway surveyors appointed, but I could not get a vote. The traders are as much opposed to it as the poor man who works out his tax. The poor man wants to retain the statute labor, because he goes to the merchant and offers to work out his tax. The answer is, "Well, you may, if you will do it for sixty or seventy cents on the dollar, and take it in goods out of the store." These poor men cannot do in a whole day what a man ought to do in three hours, yet they want a dollar and a half apiece credited to them for what they call a day's work. So we had to take statute labor in making the road of which I have spoken. I could put on their horses, and I did, and they were satisfied that their horses earned all they got for them. I never made a road so cheap nor so good, and most of it was done by horse labor. They don't want me for surveyor, they say, and I don't believe they do.

MR. LUCAS. We have suffered in the same way in our town. We were never able to raise money to build a road or repair one; it always had to be done by statute labor, except perhaps a couple hundred dollars was put in the hands of the selectmen for that purpose. Formerly, our rule was, to allow $12\frac{1}{2}$ cents an hour, the men boarding themselves and oxen. They would try hard to get in twelve hours a day. About fifteen years ago, being surveyor, I adopted a rule, that I would give them a dollar and a half a day, for men and oxen, and they could come at seven o'clock or half-past seven, or if they did not come till eight, I would allow them for a day's work, if they would do it. They would then work about nine hours, and I found that, under that system, they did as much work in nine hours as they formerly did in twelve. They took hold and worked smart, just as if they were working by the job; and they were well satisfied to do it.

Adjourned.

EVENING SESSION.

The meeting assembled at 7½ o'clock, when D. H. THING, Esq., of Mt. Vernon, delivered the following lecture on

WHAT CONSTITUTES SUCCESS? AND HOW TO ATTAIN IT.

Mr. President:—It is the great end and aim of all men to succeed, but the ideas of how that success is to be reached, or of what constitutes the goal aimed for, are well nigh as numerous as the individuals in whose minds they originate. A laudable ambition, yea, a heart-stirring, soul-moving ambition to succeed is always commendable, and the individual who does not possess it as one of the prominent and governing traits of his character will be very likely to fail, in whatever enterprise or direction his efforts are put forth. By a laudable ambition I wish to be understood an ambition and determination in the very heart and mind of the man to fill just that place in the world in which providence has placed him, and to fill it with the best possible acceptance to the divine law, the law of the land, and to his own conscience. To do this he is to be studious, industrious, temperate, frugal, saving, generous, (no contradiction of terms) must be honest with his own family, with himself, and the community in which he lives. He must be honest with his family by providing them a comfortable, and, so far as may be, a tasteful abode; must furnish his wife with the means by which to fill the place of the wife of such a man as I am describing, by keeping the larder well supplied, her house well furnished, herself well dressed and furnished with all those means of social and intellectual culture which are necessary to enable her to fulfill the duties of companion, wife, mother and friend; his children must have an education, must have social privileges, the privileges of the Sabbath and sanctuary; must have access to the best religious, literary, agricultural and political papers; must be clothed so as not to be ashamed to go into company with other youths of their age; must be educated to believe that, while they conduct themselves as properly and make as good use of all the opportunities and privileges for improvement within their reach, they are just as good as anybody else, and must at the same time be trained to habits of industry and economy. He must be honest with himself, and by this I mean that after he has by dint of industry, energy and perseverance, compelled nature to remunerate his honest toil, he is to turn round and pay his mind for thus

directing his hands. In other words he is to expend a portion of his gains in improving his intellectual powers, thereby rendering himself a better man inherently, better qualified to enjoy his own existence, to fulfill the duties of social life, to contribute to the happiness of others, and to elevate the standard of intellectual and practical knowledge, morality and religion in his own family, neighborhood or town, or in the State, nation or world at large, in whatever sphere he is called upon to exercise his talents or exert his influence; he must be honest with the community in which he lives, by being ever ready to bear his part with heart, hand and purse in providing those means of social, intellectual, moral and religious culture which are essential to the advancement of any community, and so indispensably necessary to the development of such a community as our sons and daughters will be content to dwell in; must be ready to comfort the afflicted, aid the needy, and assist the unfortunate; must remember that while he, perhaps, was advancing in worldly prosperity, from 1862 to 1865, faster than ever before, other men, whose lives were equally dear to them, and perhaps worth more to their country, were falling in defence of our free institutions, and that some of their widows and orphans are within his reach and entitled to his sympathy, protection and material aid; must remember that the debt of gratitude which he owes to his forefathers for the inestimable blessings and privileges of civil and religious liberty which he enjoys, is to be paid by fostering and perpetuating those blessings for the good of those who are to come after him; must be ready to deny himself, and if need be, sacrifice his own will or convenience for the good of others; must be ready when any enterprise is started in his vicinity, having for its object the good of humanity, whether that enterprise be an agricultural society, farmers' club or lyceum, to do just what will be for the best interests of the community, remembering that their interests are to be consulted, that he is but one individual of the same, and that if whatever is agitated is calculated to advance the intellectual, industrial or moral interests of the community, present or future, he is in duty bound to give it his candid support. None of us admire the man who, when asked to do something for posterity, excused himself on the ground that posterity had done nothing for him. Poor selfish fool! posterity will do something for him, whereof he will be amazing glad if he knows anything about it, and that is to forget him as soon as he is buried, for he has done nothing to cause himself to be remembered.

While we condemn the remark and pity the contracted and benighted soul that made it, let us be careful that we are not influenced by the same considerations. Again, if a man is a farmer he must be honest with his farm in order to be honest with posterity, for if while he is growing richer his farm is growing poorer, he is running up a debt for somebody else to pay, while he is taking away their very means by which to do so, and his farm, instead of remaining a monument of his industry and far-seeing justice, will only be a reminder that here lived one who cared only for himself, who through life played the tune played by the French on their retreat from burning Moscow, (and which they have not quite forgotten to play yet,) "the devil take the hindermost."

But, ladies and gentlemen, I was to say something of success. First, as to what it is. Second, how a laboring man may succeed even in the State of Maine, and, Third, a few words on the influence of a successful life.

You have already conceived what my ideas are of what constitutes a successful life. The poet has beautifully and truly said, "That life is long which answers life's great end." Our lives are not measured by the years we live, but by the deeds we do. That life which fails to answer life's great end is a failure though upon that head may be the snows of eighty winters. That life is long which is filled with earnest effort for the comfort, happiness, prosperity and salvation of our fellow men, whether like Joseph Warren we die with our first mighty effort, or like good old Simeon only depart when we behold the consummation of all our fondest hopes.

Let me be understood. A man may toil for threescore years and ten upon his little farm of fifty or an hundred acres, may never own bank stock, bond or mortgage, may never be called to fill a position of what the world calls honor or trust, may die worth no more dollars than when thirty years of age, save what he may have improved his farm, and yet the universal verdict of that man's neighbors will be, that his life has been a decided success. And why? Because he has filled his place in the world to the best of his ability. He has been growing better himself and the world is better for his having lived in it. His farm has been growing more beautiful and productive. The poor in him have found a friend. The afflicted a sympathizer. The sick a helper. The young an adviser. The aged a supporter. The whole world a well wisher, and the idle, wicked, selfish, covetous man a constant, living reproof. He has

been in very deed a light in the world and in himself, for as Milton says,

“Virtue could see to do what virtue would
By her own light, though sun and moon
Were sunk in the flat sea.”

Again, a man may live in a civilized and christian community, enjoy good health, work hard, save every cent, accumulate ten, twenty or fifty thousand dollars, die and be buried under a splendid block of marble, and yet his neighbors will tell you honestly and candidly that his life was a total failure, that the world would actually have been better if he had never been born.

And why? Because he lived for himself alone. The poor never rose up and called him blessed, he never made the widow's heart leap for joy. It mattered not to him that the rent was damp with the sweat and tears of midnight toil, that to obtain it orphans went supperless to bed, and the fire went out upon the hearth, he only took his own, and after putting it in his capacious pocket buttoned his coat complacently about him and may be thanked God he was not like other men, “extortioners,” &c. His money has not helped to build churches, (though if he was to offer his place for sale the first thing he would tell of would be how near it was situated to one,) nor to endow benevolent institutions. He never sent the gospel to the heathen or caused Christ to be preached to his poor neighbors; his rule of practice was to get the largest interest possible at all times and upon all occasions, and his rule of faith, to hope for a chance to get more next time. But need I pursue this further? Are you not all prepared to say with one anciently, “Let me die the death of the righteous and let my last end be like his.” Am I not fully understood? “Vice is a monster of so frightful mein, as to be hated needs but to be seen,” but when he is richly gilded too many of us are prone to look upon the gilding and forget the deformity hidden beneath.

But the world moves. We live in an age of progress. Public opinion is getting nearer right. An individual in the 19th century has a destiny to work out for himself, he is not satisfied, like one of Shakspeare's characters, who

“Doating on his own bondage
Wears out his time
Much like his master's ass,
For nought but provender.”

I am happy to know that in this age a man stands in market at nearer his true value than formerly. Events which have been cast-

ing their shadows before have already come. In our own country events which, in the wildest moments of our imaginations, we never dreamed of living to behold, have transpired, and others, the outgrowth of these, are pressing upon us. Caste is being destroyed, and all is calling to a higher life and a purer civilization. And what is now demanded is the more general diffusion of intellectual, scientific and practical knowledge, and thereby the more just and equal distribution of the blessings and privileges resulting therefrom. The world demands this and is earnestly pressing after it, and the contracted souls who have served themselves, and that continually, and will continue to do so, must stand aside or be run over, for revolutions never go backward.

If, then, filling our place in the world to the best of our ability constitutes success, it becomes our duty to inquire how that success may best be reached. But first let me ask, if this be a fact, ought it not to go a great way in reconciling our young men and women to the State of Maine, that State which we are so justly proud to call our mother? Hard and rocky though many of her fields may be and only yield their returns to the iron nerve and indomitable will of the skillful farmer, and though long may be her winters and short her summers, though we lack the rich bottom lands of the Mississippi, and the broad prairies of Minnesota and Nebraska, and cannot even comfort ourselves with the rattlesnakes of Kansas or the fever and ague of Ohio, yet here our fathers and mothers braved successfully the mighty forests, the rushing streams, the wild beasts and savage men. In place of the forest they gave us the fruitful field, and where once arose the smoke of the red man's wigwam, now is seen the cottage of the farmer and mechanic, the abode of domestic enjoyment and civilization. Here cluster our first recollections and associations; around us are our friends, our society is as good and our privileges perhaps as great as any to be found in the world. In every village a church spire points heavenward, and in almost every valley is to be found that temple of liberty and nursery of free institutions, the common school house, and beneath the green sods of her quiet valleys our fathers sleep. When I look abroad over this beautiful landscape, with its clear streams, its silver lakes and glassy ponds, in their settings of emerald, shaded by the mellow tints and gorgeous hues of autumn, its valleys teeming with grains and fruits, its green hill-sides dotted with the flocks and herds of the thriving and industrious farmer, the rushing cataracts destined to turn spindles in untold thou-

sands, its mighty forests, capable of supplying half the ship-yards of the world, with more than half of our State yet unoccupied, with all our facilities for progress and improvement in useful knowledge, with the road to real and permanent success so plainly marked out before us, I can but ask if it is wisdom to throw away all this for the, at best, uncertain hope of accumulating more dollars somewhere else?

We cannot all be merchants or professional men. The great majority of us must continue to till the soil as our fathers have done before us. We cannot all be rich, even as the world counts riches, but we can all do our duty, and we can do it as faithfully in Maine as in any other State, find here as many opportunities for doing or getting good, make ourselves as useful to our fellow men, live as much respected and die as much regretted here as anywhere else. If we do this we shall not only make our lives a success, but shall make such a mark upon the community around us as shall tell for good long after we have passed away.

If this is real success, and if it may be as surely reached in Maine as elsewhere, let us inquire how. You will please remember that I am talking in a farmers' meeting, and mainly to persons in the *higher* walks of life—I mean to farmers and mechanics, and to those who earn their living by the labor of their hands. It is well known that our circumstances, as a general thing, will not allow us to employ private teachers for ourselves or our children, or send them to boarding schools or classical institutions of learning. Our sources of improvement must be found mainly in our midst. We see the best talent of our land and world devoted to instruction in schools of theology, law, medicine, commerce, or the arts, and years of toil, the most patient and incessant, devoted to training and educating a man for successfully prosecuting his chosen vocation. We see associations formed for mutual improvement and protection, and all those guards thrown around the members of those several associations necessary to the successful prosecution of the same; provided they bring to it those resources of earnestness and integrity which are an essential element of success in every vocation.

Farmers and mechanics also have to some extent moved in the same direction. We have agricultural societies, shows and fairs, mechanics' fairs, boards of agriculture, the Agricultural College, and of late the farmers' and mechanics' club. So much has been said of each of these that you will hardly expect me to say

anything new, otherwise than to exhort you to avail yourselves of the opportunities for improvement thus held out to you. Perhaps you will allow me to say a few words of the latter as a source of practical improvement looking from the stand-point which we have erected. Suppose that in any of your towns you get half or even one-fourth of the farmers and mechanics to unite in one of these associations for mutual improvement and information. During two-thirds of the year you meet weekly for the discussion and consideration of practical subjects. You all meet on a level, are governed by parliamentary rules, have a subject which you can all understand and in which you are perfectly at home, are among your friends and neighbors, and have your rights, as much respected as though you were in the halls of legislation. You are enabled at the same time to communicate what you know of the matter before you, get what others know, become accustomed to convey your ideas so as to be clearly understood, make yourselves acquainted with parliamentary rules and usages, and thus acquire a self reliance which nothing but practice and experience will give. Thus you may qualify yourselves for the places in social and public life which too often heretofore none but the professional man has been supposed to be qualified to fill. The good to be gained in this direction will of course be much greater to the young than to those of us who are in middle life or already passing down the hill. Here we have a school for the young men and women of our State, and when I say men and *women*, I mean it; for it is folly, in this enlightened day, to say that men should have more or greater privileges or opportunities for improvement in social and practical knowledge than women. Here we have an institution right at our very doors, with next to no expense, and available to the humblest boy or girl, which, while it gives us all the advantages of a debating society or lyceum, at the same time stores the mind with just that knowledge which will be needed in after life to enable them to discharge, with credit and acceptance, its various duties, and we thus lay the foundation for what we have just spoken of, viz: a higher grade of social, intellectual and industrial life. Again, the reports and other agricultural works, which will naturally find their way into the hands of the club, will form the nucleus of a library, which every club should have, and thus give the younger members an opportunity to gain some lasting good during the leisure hours of winter, by devoting to useful reading and study the time which is so often

wasted, and worse than wasted, upon the sensation novels and self-styled *literary* papers of the day, and which are oftentimes no more fit for a place upon the sitting-room table than the yellow-covered trash of Eugene Sue is for a Sabbath school library.

But why dwell longer upon this point? The great truth that all men were created equal and endowed with certain inalienable rights, &c., was deemed so plain by our forefathers as to be declared self-evident, and it seems to me that no less apparent are the good results to be expected from a well conducted farmers' and mechanics' club, provided the people can be influenced to avail themselves of the opportunities thus held out. And here we come to the real difficulty. Two or three, or a dozen men can be found in almost any community to organize and start a club, but how hard we find it to get the rank and file to fall in and take hold in earnest, as they do of the practical operations of their farms and shops. What is wanted is, for a few of the leading men in the community to take hold of the matter in earnest, giving to it their attention, support and influence, and being present at its meetings, always of course taking their wives with them, for it is to be supposed that the better half is to be found under the roof-tree of any man with public spirit and enterprise enough to run a farmer's club, and it is idle to expect the gentlemen to show themselves for any length of time where the ladies are not found. Let these leading individuals attend, not to show their superior attainments or abilities, or to patronize their more unpretending neighbors, for of all things earthly men and women object to nothing so much as being patronized. But let them do so to show that they appreciate the importance of the matter, and are as willing to labor for the good of the community as for themselves, and to help all who are trying to help themselves, to take a step in the right direction whenever the way is opened for them to do so.

Too many in every community are disposed to look on and see if an enterprise is likely to succeed or to become popular before they identify themselves with it. They act on the principle of Josh Billings, who advised his friends never to bet on a horse race, but if they ever did so to be sure and bet on the winning horse.

The pioneers in every progressive movement are often looked upon as enthusiasts or fanatics, but if a movement of this kind succeeds, somebody has got to step boldly out in advance of the age, being only careful to get an affirmative answer to the question Is this right? is this for the best interest of all concerned, present

and future? and then go steadily onward felling the trees and grubbing the road for their more timid followers. If a few leading individuals in each town will do this and persevere, people will soon see that they are in earnest, and earnestness of purpose always begets confidence.

I have spoken of the farmers' and mechanics' club as one of the means by which success is to be reached, because it is comparatively a new thing, and because it is perhaps better calculated to produce the general results aimed for than any other enterprise now available, and not because it is the only source of improvement, or able of itself to supply all the needs of our various circumstances, for a real and satisfactory success is only to be reached by honestly and earnestly availing ourselves of all the sources and opportunities of improvement within our reach, treasuring up knowledge to-day that we may impart it to-morrow, doing present duties to-day, and doing with all our might whatever our hands or our hearts find to do. But I must hasten on, or the thirty minutes which I have allotted myself will be up before I am down. I wish to say a few words on the influence of such a life as I have described. It was said by one of the Greek sages, that no man was so low as to have no influence, or so mean as to have no friends. All men have influence in proportion to their standing in the community, and it is of the first importance that that influence be cast upon the side of right. No act of our lives however trivial, but is to some extent an index of our character. Perhaps the most of you have read "Black House," and if so you have been interested and amused at the way in which Mr. Detective Bucket "reckoned up" the individuals with whom he came in contact; and we should be surprised if we knew how often our associates are "reckoning" us up, and from how seemingly small and unimportant acts they get impressions and form opinions that will stick to them through life. We all know that there are in every community some men who never put one foot before the other, who never turn their hand over, but for the furthering of their own ends or plans, or in some way benefiting themselves; men who have so long looked upon the world as one vast "grab bag" hung up for their especial benefit, and out of which they are to extract something that will return them a semi-annual dividend in current funds, wholly irrespective of the wants and rights of others; men who make the fact that a certain venture or investment has left one dollar, more or less, in their pocket, a full and complete justification of the means

used to gain the same; men who have let the love of gain possess their minds and their hearts to the exclusion of everything else, till every good feeling is dwarfed or suffocated completely, who will not be changed or even restrained by any good influence, and upon whom it is idle and useless to expend either our time or our talents. The better way is to leave them to die quietly in their crust of selfish worldliness, and let the very small hole they will leave in the world be filled up and smoothed over by the onward and upward march of the generation which shall succeed them.

But such men are rare. Those who succeed according to the standard we have set up, are looked upon by the better portion of the people as examples worthy to be followed; and their example is followed, and it acts in a two-fold capacity, for when we see a person in any calling or profession achieving such success as would satisfy our ambition, we very naturally follow the course marked out, and do our best to come to their standard; and when a really good man or woman sees their example followed by friends and associates, they are very sure to watch, with increasing care, that their influence may be such as will tell for good upon those over whom it is exerted. Our opportunities for getting and doing good, for improving ourselves or our fellow men, will soon be past. If perchance we start on the right road and begin to make some commendable improvement and progress, it only seems to open the way for still greater progress, and by the time we bring our thoughts into some tangible shape, and hope to make them a reality, our term of active service has expired, we receive our discharge, and leave to other hands the task of prosecuting the work which we have only commenced. Then of what vital importance it becomes to those who are to succeed us that what progress we make be in the right direction, that those who are to take up the cares and burdens which we lay down may be able to make far greater improvement than we have done, that whatever mistakes we have made may serve as warnings to keep them from failure, and that whatever of success has crowned our efforts may serve as beacon lights to guide them onward.

Ladies and gentlemen, if we have done, or may do, anything to make our good old State of Maine greener or fairer, her society better and more refined, her morality purer; her opportunities for improvement in social and industrial life more numerous and more equally distributed, her fields and vineyards more productive, her dwellings more beautiful and tasteful, her labor more pleasant and

profitable, her sons and daughters more happy and contented with their lot, we shall have done something towards making our lives a success ; we shall not have lived in vain, and whether our years be few or many, if we can so fill them with good deeds that when we are called to lie down to rest beneath the green sods of her quiet valleys, it may be said of us, here lies one who made the world happier and better for having lived in it. We need ask no higher eulogy.

Mr. NORTON then read the following paper on

IMPROVEMENT OF SOILS BY MEANS OF THOROUGH CULTIVATION.

Agriculture is the occupation of by far the larger part of the people of this country ; it is the great interest which overshadows all others. If that is prosperous, all others are prosperous ; if that languishes, all others must languish. Men must eat and be clothed, and the first step from the savage state involves the cultivation of the soil. Agriculture has made great strides within a few centuries ; it could hardly stand still while all other branches of industry were undergoing so rapid change. Production has increased ; the standard of comfort has been raised ; old habits and prejudices are steadily giving away before advancing knowledge ; the farmer is beginning to see the benefits to be derived from judicious application of capital in improving the capacities of his soil ; he is no longer content to follow a mode of culture simply because his father did so before him ; he studies his soil, he seeks for information as to the best mode of cultivating it to advantage, and when once obtained is not slow in profiting by it. The question now is, how to raise upon each acre of land the largest quantity of the most valuable product at the smallest cost, and with the least permanent injury to the soil. It is not enough to be able to plant corn or sow grain. The farmer should know the adaptation of soils to the different grains and grasses, and the best rotation of crops ; the nature and food of different plants, and the proper application of manures.

To insure agricultural prosperity it is not alone the farm that needs cultivation, but the farmer. The end of tillage is not merely to improve cattle or grain but men and women. Not alone to raise large crops and smooth Shorthorns, but to produce large hearts and noble minds. The truly educated farmer may understand but little of the natural sciences, but he may be rich in observation ;

he may have clear conceptions of order and fitness, he may not carry learning into the field, but he carries brains. It is mind mixed with soil that makes the prize farm. Intelligence is the best fertilizer. Agriculture and all useful arts progress so fast, and so far, as man advances. Successful tillage is an index of civilization, it is the record of human progress.

But to come more directly to my subject. **IMPROVEMENT OF SOILS TO BE ACCOMPLISHED BY REPEATED PLOUGHING.** There is a wide difference between the use of the plough in American and European farming. This difference is due to the fact that the large amount of humus in our virgin soil made the fallow unnecessary and established a practice of single ploughing, which continued long after the destruction of this humus. The object of repeated ploughing is to prepare the soil for future crops. Its purpose is to enrich the soil by enabling it to absorb the fertilizing gases from the air, by destroying weeds, and by thorough pulverizing to allow the roots to grow so as to insure a good crop. The Romans adopted the naked fallow to the extent of six or seven ploughings, and so do some European farmers at the present day; their object is to deepen the soil, as well as to prepare it for a crop. The effects of such ploughing on the soil is thus stated by Thaer: "A simple ploughing in spring or autumn certainly will turn up and break the surface of the land, but it will not divide it sufficiently to break the clods and reduce them to loose earth. The soil when clodded together soon becomes hardened into compact masses, when it is covered without being broken, and when exposed to the heat of the sun becomes as hard as tile. Lands when suffered to acquire this state are not productive because the greater part of plants having fibrous roots are unable to penetrate those clods, and consequently are forced to turn around them, and the power of vegetation contained in that portion of the ground which they occupy is therefore wholly lost. There is scarcely any means by which these clods can be broken except by continued fallowing during the whole of the season, the effect of which is to bring them all successively to the surface, where they may be exposed to the action of the atmosphere, and having imbibed moisture and become softened, they may be broken by the harrow and other implements. If this process can be continued for one season, and care be taken that each operation shall be performed when the soil possesses the proper degree of humidity, the field will be transformed into a homogeneous, light, loose powder, and the nutritive and fertilizing parti-

cles which it may contain will be brought into action. Thus we frequently see fields which were to all appearance exhausted become exceedingly fertile after being carefully fallowed, even though they had not received any additional supply of manure." I think the importance of fine pulverization of the soil is not sufficiently understood. When the delicate fibrous roots of any crop have to make their way through a hard and dry mass of baked earth, or at best among coarsely broken clods, they must grow and receive nourishment with great difficulty, when compared with the extension of the same roots through a finely pulverized bed of earth favoring their full growth.

In a discussion at the New York State fair, held at Utica, on the management of pasture lands, Mr. A. L. Fish, said "To merely invert the sod and take off a crop, then turn it back and strip it again, and so on through the popular rotation, then seed sparsely with one or two kinds of grasses, without regard to depth and thorough pulverization, I do not accept as judicious cultivation. The lay and texture of land is so unlike in different localities that it would be difficult to adopt a rule for general practice without broad exceptions; some soils requiring to be pulverized and packed to make them less porous, others to be pulverized and not packed to leave them more permeable. All soils must be fine to receive full benefit from the circulating elements passing through them. No seeds will germinate or grass roots grow without their presence, which is good proof that they contain the life-giving principle. The fact that air and water will grow plants without earth, but earth will not without them, is also good proof that the soil is only a repository for the food of plants, where it is held in a physical medium by a mechanical faculty of the soil. If we accept the theory as sound that a small amount of the inorganic portion of the soil enters into the bulk of growing plants we must look for a mechanical faculty in the soil, as a base of its productiveness; whatever we recognize as a vital, sustaining principle in the soil, it behooves us as farmers to see to it that it is developed in the soil we occupy. To make the point I wish to impress, I will assume that all physical growth is from minute particles of organic matter contained in the circulating elements which attach by contact with surfaces adapted to retain and absorb them into a physical medium. The soil I will say is a physical medium, in which organic matter in all its minutiae is held by a mechanical faculty, for decomposition and chemical combination. When we consider

that plants obtain food in the soil by fibrous roots with mouths too small to be seen without microscopic vision, we reason that it is by some subtle faculty which we recognize as a vital principle. I will suggest that it consists in a capillary texture of the soil by which small particles of manurial matter are brought in contact with the surface to which they adhere. Leachy soils have a texture admitting of the circulating elements passing through them so rapidly as to wash away manurial matter from attaching surfaces. It is a natural tendency of soil to become too porous, small veins will form by water leaching through them and grow larger by use till they require breaking up to pulverize and refine their texture so that water will filter slowly through them, and each particle of soil ever so small has a surface to which still smaller particles of matter will cohere if brought in contact, hence the importance of occasionally ploughing the soil to refine the texture of that too porous, or to make a tenacious soil permeable."

Our clay soils are richer than most others in the materials of which plants are made, but in a good degree locked up from use by their tenacity, and need only thorough pulverizing and mellowing to become very productive. Sufficient importance is not generally attached to thorough pulverizing and mixing of the various ingredients of the soil. However rich these may be in plant food, vegetation will starve if this food is not found in suitable form to come in contact with the delicate root fibres which act as mouths of the plants, and its availability will depend greatly upon the atmosphere and the chemical changes which are facilitated by loosening and mixing the soil. If there is any one element of plant growth of more importance than another, it is water. Crops usually fail or succeed in proportion as they are supplied with water. And this is somewhat within the control of the cultivator, by draining and pulverizing of the soil. Drains remove useless water, and the loosening of the subsoil allows the egress of the water through all its pores, which are then filled by air. If by means of the plow, cultivator or hoe, we keep the surface fine, we have it continually watered by the atmosphere, which contains more or less moisture all the time; and as the air circulates through the fine surface it is continually robbed of its moisture, which is taken up by the little rootlets; therefore by simply keeping the surface loose by cultivation, we may, to a considerable degree, protect our crops in case of drouth. Indeed, if the soil

could be kept thoroughly pulverized to a sufficient depth, and often stirred, a crop of corn could be produced without rain.

It is of the highest importance to the farmer that an element of such value as moisture in the soil should be in some measure under his control. Modern agriculture, by a system of draining and plowing, so that air can penetrate, and water ascend by capillary attraction, has brought the control of moisture in the soil very much within the power of the farmer. Anything which will prevent the surface soil from becoming hard, and at the same time assist in maintaining a uniformity of texture, is favorable to the retention of moisture. Now air is the best non-conductor of heat, and bodies are good or bad conductors, about in proportion as they are solid or porous. Iron is better than wood, granite is better than brick, and hard pressed soil is a better conductor of heat than soil which is loose and porous. A hard trodden path is warmer in summer and colder in winter than the cultivated grounds by its side. When soil is pressed hard it dries rapidly, summer winds passing over the surface carry off its moisture, the surface is speedily parched and vegetation languishes. Rain will not penetrate a soil that is pressed hard. We are told that in some parts of Asia the roofs of houses are covered with soil, which is kept rolled down so that it sheds the rain and answers in place of tile. Having occasion to dig a ditch along a path in the time of a drouth I found the soil dry to the depth of three feet, when on each side of the path the soil was moist, showing that hard pressed ground sheds the rain and dries much sooner than loose soils. Thus a few inches of fine soil on the surface forms a good non-conducting stratum, and likewise has the advantage of being easily secured. In our Maine Agricultural Report for 1861 may be found a very valuable paper entitled "CULTIVATION A FERTILIZING AGENCY AS REALLY AS MANURE," (which we recommend every farmer in the State to read,) and from which I quote as follows: "It is of no practical value to us having in our soils the means of accumulating fertilizing matter, if at the same time we place it in a position in which this power is rendered inoperative; consequently we have two means by which to promote the accumulation of ammonia in the soil, and these are, 1st, increasing the capabilities of the soil to absorb ammonia; and, 2d, giving the atmosphere a free access to the soil, so that these powers may come into full operation. The addition of lime to the land has in this respect a double action, viz: it sets part of the ammonia in the soil free and available for pro-

moting vegetable growth, and it also renders the soil more competent for accumulating a store which will maintain the fertility of the land; and thus we have in the use of lime as a manure a valuable means of realizing the first requirement, an increased absorbing power. The attention may now, however, be advantageously directed to the facilities for the increase of these powers, and these are manifestly two-fold, namely, the exposure of the soil fully to the air, and the passage of rain through the land. The tillage of the land is, therefore, just the agency required to accomplish the desirable result, for as I have said before, the inversion, stirring and crushing of the soil by the various operations of ploughing, cultivating, harrowing and rolling, each and all promote the exposure of fresh portions of the soil for atmospheric action; and whatever capability is possessed for the secretion of ammonia, the soil is thus furnished with the opportunity for its exercise.

“ If you view our field labor as so many means for exposing every portion of the surface soil to the air, you will at once realize the value of many operations which we have hitherto only considered as of mechanical value in preparing the land for seed, by rendering it light, and giving the roots freedom for growth and extension. But the advantages are double; for not only is it necessary for the luxuriant growth of a crop that it should be so placed that its roots have a freedom of action for searching after the food which the crop requires, but as I have already explained, the means we adopt for attaining this result equally facilitates the success of the crop by the accumulation of fertilizing matter which is being simultaneously made. This free and loose condition of the soil is equally favorable for the passage of rain *into* the soil; and when this is properly assisted by an efficient under-drainage, then alone is the full advantage derived from the rain and its fertilizing contents.

“ With a knowledge of these principles, if you review that old established practice of fallowing, you will not fail to detect the reason for past success in this practice, and you will see another instance of that true union which exists between practice and science, which every lover of agricultural progress hails with feelings of pleasure. The true principle of fallowing has been to expose the land to the wind, rain, frost and heat, and to keep the land moving as much as possible. Manifest have been the advantages derived from extra ploughing, which to the eye appeared at the time productive of little change or benefit, but the succeeding crop has in

many such cases given evidence of increased capabilities of production, which, until lately has been set down as simply resulting from the mechanical condition of the soil being more favorable for growth, instead of its being also referred in part to the increase of food for the crop which was then obtained." * * *

"The stores of ammonia which the atmosphere contains are gathered by the soil, and subsequently liberated when required by a growing crop, whilst the organic matter of the soil is also by the same agency prepared to minister to vegetable productiveness. Thus we have nearly all the requirements of our crops supplied from natural sources, and these are rendered available by our various tillage operations. The conclusion to which we are brought by these facts is, that tillage operations rendered free and available for vegetation certain fertilizing matters which are essential for our crops, and that the degree to which the resources of any soil are developed is proportioned to the extent of these operations. Practically it matters but little whether so much alkaline matter, ammonia, and organic matter is added to the soil by manure, or converted from a dormant to an active condition. It is manifest that in both cases the soil is equally enriched by equal quantities of the same materials; but there is this advantage in favor of the tillage operations, that while the two methods may be equal in a chemical point of view, yet the mechanical conditions are very materially in favor of the tillage operations as a substitute for manure. The food being the same, equal results would be obtained, provided other conditions were equal, but if the mechanical condition of the soil is very much improved, it will enable the crops to grow more freely, and this is so much the more advantageous for the increase of the crop resulting from our tillage operations."

Farmers generally do not realize as they ought, the fact that good tillage may be made equivalent to an application of manure. We ought to understand that tillage, in once sense, *is manure*, and to remember that the very meaning of the verb *to manure*, from its derivation, and as formerly used, was, to cultivate by *manual* labor. So that when we plow or harrow our soils to improve them, we *manure* as really as when we apply dressing from our stalls.

Adjourned to meet at 10 o'clock on Wednesday.

SECOND DAY.

WEDNESDAY, August 31.

The Board meet at 10 o'clock. The first speaker of the morning was Mr. Z. A. GILBERT of Greene, who read the following paper on

PLOWS AND PLOWING.

The importance of an implement so common as the plow is apt to be overlooked. We admit its importance without much thought, and without realizing the magnitude of the truth to which we are giving assent. The fact is so apparant that it may be put down as a self-evident truth that the plow lies at the foundation of all wealth and of all civilization. So close is its connection with civilization that its mechanical construction has kept even pace with the progress of society; and to-day may truly be said to be typical of civilization itself in all countries. In barbarous countries, where no vestige of civilization or of progress can be traced, no furrows of even the rudest implement which could be considered as bearing a resemblance to a plow, have ever been turned; and the experience of the past has proved that none ever will be till the light of civilization shall break upon the darkness of their clouded minds. Among the half civilized nations of the earth, the plow, in all the known past as well as at the present time, is of the rudest construction, and like their civilization, has shown no signs of improvement through all the long years during which their history has been known.

How unlike this is the plow as we find it among the enlightened nations of the world. The experience of years of practice in its use, the skill of the intelligent plowman, and the genius of the skillful mechanic combine to make it what the intelligent farmer of to-day demands. And how wide the contrast between its scientific proportions and the rude implement bearing the same name, where science and intelligence are never brought to bear upon its use. The contrast is as striking, the extremes as widely separated, as between the intelligence, the civilization, and refinement on the one hand, and the ignorance, the superstition and degradation on the other.

No less does the plow lie at the foundation of wealth. All of power—all of prosperity—all of wealth we as a nation are at this time blessed with, is dependent first upon the plow, and second to the intelligent hand that guides it. All of our great manufactories

giving employment to hundred of thousands of ready hands would cease their hum and remain silent monuments of past greatness, should the plow for a season only refuse to turn its furrows. Our commerce, now floating ships upon every sea, would find its business stagnate, and the vessels would remain idle at the wharves. It would be difficult picturing the utter stagnation of business, the desolation, the want and hunger which would be induced should the plow cease its labors only for one year. A contemplation of the picture will give us an idea of the value of the implement which contributes so much to our prosperity and happiness, and to which we are indebted for our daily bread.

An implement of so great importance may justly claim our attention for a few minutes in collating its history, though the time given to this must necessarily be brief, and the account fragmentary on account of the more urgent claims of other branches of the subject under consideration. Only some of the prominent points in its history will be alluded to, and this in a somewhat rambling and disconnected manner, on account of necessary brevity. I shall leap from point to point without attempting to insert the filling necessary to round it into perfect fullness. The facts here collected have been culled from various sources. For many of them I am indebted to the Report of the Utica Plow Trial, published by the New York State Agricultural Society. This, so far as I know, is the only attempt to furnish a connected history of the plow ever published in this country.

The earliest record we have of an implement resembling a plow in any degree, is that of a forked stick, with the long arm prepared for the team to draw by, and the short arm sharpened for entering the ground. Modifications of this rude implement, with some slight improvements perhaps, were the best in use in the days of Cato and Cincinnatus, and agrees with the description given by Virgil in the *Georgics*. A decided improvement, however, was soon after introduced, consisting of an iron shield, or cover, to the point; and with this attachment it is found in use in some parts of the world at the present time.

It was not till somewhere about the eleventh century that the idea of a wedge form for a plow for the purpose of removing the furrow from the path of the plow, in order that a space might be left clear for the next furrow, began to dawn upon the mind of man. The coulter for dividing the furrow slice from the land was also introduced about this time. It was not till still later, though the

time cannot be definitely fixed, that the idea of the double wedge for the purpose of first raising the furrow and then twisting it to the right was introduced. It appears from all that is known that this invention, in a crude form, came from France. These were all the improvements that we find any record of for a long series of years.

A revival of interest in agriculture in England occurred in the beginning of the seventeenth century, and connected with this revival of course was an increased attention to the improvement of the rude implement which had previously served them in a crude manner the purposes of a plow. About this time a plow was introduced from Holland, known as the Rotherham plow, which, on account of its great superiority over anything which had preceded it, is deserving of special notice and a full description.

It was manufactured by Joseph Foljambe of Yorkshire, but notwithstanding its work was much better and its draft much lighter than any which had preceded it, came slowly into use except among the more enterprising farmers. In this respect it met the same fate of many improved implements, not excepting plows themselves, of the present time; proving to a dot that the conservative element among farmers can be traced through a long line of ancestry. This plow was made of wood, covered on the mould-board and land side with straps of sheet iron. The mould-board approximated in shape to the theory now admitted to be the true one, of a union of the lateral and vertical wedges connected by a curved line so that the furrow slice is first raised and then gradually turned over to one side. It was also supplied with a cutter and an attachment or clevis on the end of the beam by which the draft could be changed, so that the plow would draw off or on the land as desired. In form, style, and general appearance, it bore a close resemblance, and would compare favorably with those old wooden plows which were in use among us some half century ago, and which all the old men now here probably guided in their boyhood, and which we young men have frequently seen stowed away in some out of the way corner and kept as a relic of the past. Indeed, one man at least among you, whose hairs are not yet silvered by the touch of Time, does not have to look through the lapse of many years to the time when he saw plows of similar material, and but little if any superior in pattern, exhibited for premium at a county fair in this State; and to-day, should the effort be made, could find a neighborhood in a flourishing county, which boasts—

and may justly do so—of its advantages and its progress, where these plows are annually driven afield and made to do the work belonging to a worthier representation of its kind. Verily the past is so securely bound to the present that it is hard to cast off forever all the connecting links!

Soon after the appearance of the Rotherham plow, in the year 1730, the celebrated Jethro Tull published a work, in which he advocated the use of four-coultered plows, and gives his reasons therefor. The four coulthers divide the land into narrow strips, affording free admission to air and water. The furrow, in consequence of being divided into small strips, is more thoroughly pulverized or loosened in the operation of turning, than it would be remaining in one slice. Here we find an idea which has been wrought upon by science and genius from that day to this, and at last has been accomplished in an easier and more thorough manner than that advocated by Tull. Although Tull was a thorough radical in all progress, the plow he recommended was a cumbersome affair when compared with the Rotherham plow in use at the same time. The beam was ten feet four inches long, made of ash or oak, five inches deep and four inches wide. The forward end was made to rest on a clumsy frame work attached to a pair of wheels, one of which running on the unplowed land was twenty inches in diameter, and the one running in the furrow twenty-seven inches. The attachment of the beam to the wheels was made by two tow-chains, one attached to the axle of the wheels and the other to the top of the frame-work on which the beam was made to rest. Such was the implement with which the celebrated Jethro Tull illustrated by practice, the radical theories which he labored so hard to impress upon the agriculturists of his times.

No other noticeable changes were made in the plow for nearly a century. As yet they had been constructed without any fixed rules in regard to the shape of the mould-board. Each manufacturer had a form of his own, shaped up according to his eye, consequently his art could not be transmitted to others, and when he died his patterns could not be copied. Hence the art was lost as soon as it was found. Indeed, unless a maker had a very exact eye he could not at all times reproduce his own ideal. "Thus," Arthur Young tells us in his agricultural report of Suffolk, that "a very ingenious blacksmith of the name of Brand, made a plow of iron, of which there is no other in the kingdom equal to it; and yet when he died no one else could make them."

It was not till the latter part of the seventeenth century that the idea presented itself that the surface of the mould-board could and should be constructed upon purely mathematical principles, and from these principles practical rules could be laid down by which mould-boards could be constructed exactly alike and multiplied indefinitely. Among the first to grasp the idea of constructing the mould-board upon strictly mathematical principles was Thomas Jefferson. It seems that the idea had been working itself out in his mind for many years, and at last was put to a practical test in the year 1793. Mr. Jefferson had several plows constructed after his patterns and put to use on his estates in Virginia. Their work attracted much attention, and the fame of his plows spread across the water to the mother country and won him merited renown among the agriculturists of England.

Some thirty years before the appearance of Mr. J.'s plow in this country, the celebrated James Small of Scotland, invented the cast iron plow. He took the Rotherham plow, previously described, and improved upon it in almost every particular. He died after manufacturing it for thirty years, and at his death left the plow so well perfected that it is used at the present time in many of the best cultivated districts in the country where it was manufactured. It was known as the "EAST LOTHIAN PLOW."

In England as well as in Scotland the Rotherham plow was the basis of improvements; although in the former country the improvements were exceedingly slow in being developed. In 1785, or more than twenty years after the cast iron plow was invented in Scotland by Mr. Small, Robert Ransom of Ipswich, obtained a patent for making plowshares of cast iron, the other parts being made of wrought iron. This was the prelude to other important improvements which were soon after carried into effect. But the cast iron plow was a long time in coming into general use among the common farmers of England. The prejudices of those who are not highly educated and who do not read, think and act for themselves, are hard to overcome. Superstition, too, clings to them with a power that is unaccountable. In view of these facts it does not appear so strange that opposition to inroads upon their old customs should have been strong and hard to overcome. They had their discussions upon the merits of the improved plows, and doubtless opinions were expressed for as well as against them. At a primitive farmers' club, after opinions were expressed and arguments brought forward, both pro and con, it was finally

resolved that "cast iron plows do make the weeds grow." It was as late as 1810 before plows, made entirely of iron, were in common use.

In the year 1803, this same Mr. Ransom obtained a patent for case-hardening or chill-hardening shares. This was an important improvement, as is fully shown by the fact that it proved of such practical utility that it was extended to other parts, and has been handed down to the present time, both in England and in this country. The process and the effect are so well understood that it needs no description from me. Mr. Ransom's plow may be taken as a representative of the utmost perfection to which the art of plow-making has reached in England at the present time.

In this country improvements in plows were met with even greater opposition, and were slower in making their way into public favor than they were in England. Thus there is no trace of their ever having been a plow made on the principles laid down by Mr. Jefferson, save those made by himself. The first American, after Mr. Jefferson, who set himself about improving the plows in use in this country, was a man by the name of Charles Newbold of New Jersey. He made the first cast iron plow ever made in America, and obtained letters patent for it dated June 26, 1797. This was thirty years after Mr. Small's cast iron plow had gone into general use in Scotland. The inventor used it successfully himself, and spent \$30,000 in perfecting and trying to introduce it, but all to no purpose. The farmers' prejudices were so strong against any improvements, their opposition to new fangled notions so great, that they could not be induced to use them. In some way they got the unaccountable notion that the cast iron plow "poisoned the land, injured its fertility," and like the same kind in England "made the weeds grow." Consequently they adhered to their old notions and used their miserable old plows for many years before they were enlightened enough to see any advantage that these improved plows possessed.

Numerous patents were granted for plows near the beginning of the present century, the most important of which was one granted to David Peacock of New Jersey, dated April 1, 1807. This resembled Mr. Newbold's plow in form, but was cast in three parts instead of being all in one piece like Mr. Newbold's. There were improvements added to this plow from time to time, one of which was the famous lock coulter. These plows were extensively used throughout the country, and many of them were to be found in

use among the farmers of New York, New Jersey and Pennsylvania as late as 1850. Still later than this, Jethro Wood of Scipio, N. Y., obtained several patents, the last of which, dated September, 1819, contained his most mature views upon the subject, and describes a pattern which he never improved upon. Very large numbers of plows were made from his patterns. The sales in the city of New York, in the year 1820, amounted to some 4,000, and largely exceeded the sale of any other plow then made. David Hitchcock of New York, constructed a plow which he patented in 1823, which had a large sale for eight or ten years. He made seven sizes, none of which would work at a greater depth than five inches, and the best work was done at a depth of four inches. These would hardly meet the wants at the present day of the deep tillage disciples of the Tribune Philosopher, and for this reason, or some other, have been superseded.

Among the most successful improvers of the plow of this generation stands the name of Joel Nourse of Boston, he having made and sold more plows than any other man, probably, in the world. Mr. Nourse learned the blacksmith's trade of his father. At the age of nineteen his father gave him his freedom, and entered into partnership with him. They began the manufacture of the old-fashioned wooden plows by employing an expert workman to make the wood work, while they made the iron work. Mr. Nourse liked to converse with the farmers who visited the shop, and as he had a keen eye, a quick ear, and a dexterous hand, he caught up all the hints dropped in conversation and wrought them into his plows. These improvements caused a rapidly increasing demand for his work. From these humble beginnings grew the immense business of the celebrated firm of Ruggles, Nourse & Mason; and to the genius of Mr. Nourse we are indebted for the celebrated Eagle plows, so long manufactured by that firm and their successors. From the year 1841 to 1861 these plows reached the sale of 25,000 annually.

The names of Prouty and Mears are associated with the invention and manufacture of a series of plows which were extensively used all over the country. Many of the cast iron plows first introduced into this State were manufactured by that firm. They first manufactured and sold the Hitchcock plow. Mr. Mears soon saw their imperfections, and as he was an ingenious mechanic, set himself to correct them. The result was the centre draught principle on which their series of plows was ever after, and are still manu-

factured, and which is almost universally adopted by all plow makers. These plows made good work, and are still popular.

An important improvement in the mathematical construction of mould-boards was perfected by Samuel A. Knox of Worcester, for many years the designer for Ruggles, Nourse & Mason. His mould-boards were constructed on strictly geometrical principles, and consist of a series of straight lines, running from the point to the rear of the mould-boards, gradually expanding at the rear as they approach the top, thereby forming the desired twist. The furrow slice is but slightly lifted, and moves in all its parts on the straight lines of the mould-board, thus causing the very least resistance possible and rendering the plow of very light draught. While the furrow is being turned it is twisted in a manner that completely pulverizes the whole mass. The action is simple, and the furrow retains its shape and is placed with great precision into the desired position. The land on working is found to be light and mellow, requiring but little labor to prepare it in the best manner for the application of the seed. J. Stanton Gould in his history of the plow, says of Knox's mould-board that "it turns the furrow very handsomely as well as evenly, but its pulverizing power is somewhat deficient." This opinion must have been expressed at random, without a practical knowledge of the work of these plows when compared with others claiming the same merits. Wherever used they are justly celebrated for the very thing which he says they are deficient in, and as the firm who own Knox's patent manufacture more plows than any other firm in the world, the evidence is conclusive that their plows possess the merits which intelligent farmers at this time demand in a plow.

A patent was granted to Aaron Smith of Bloomfield, Michigan, dated May 10, 1844, for a plow which was introduced under the name of the "Michigan Plow." This plow is made up of two distinct plows attached to the same beam. The plow was manufactured for many years by the well known firm of Prouty & Mears. A plow called the "Sod and Subsoil Plow," constructed on the same principle but from a different pattern of mould-boards, for both plows were at the same time manufactured by Nourse, Mason & Co., and are still manufactured by their successors, the Ames Plow Company. These double plows are the best ever invented for sod lands that are comparatively free from obstructions, and will be further noticed under another head of my subject.

Other patents have recently been granted, and parties are now

introducing the plows. Without doubt they have points of excellence and will in time establish themselves in the favor of many farmers.

We have thus glanced at some of the most important steps in the improvement of the plow. The history is fragmentary and disconnected, but it will serve to point out the milestones of progress in its development, and give an idea of the various steps through which it has passed, and of the leading minds who have made it a study, and by whom it has been brought to its present state of perfection, and to whom we are indebted for its present degree of usefulness. When we consider how simple a machine it is, and that it has always been regarded as the basis of all civilization and all wealth, it is astonishing that it should have taken so long to bring it to its present state of perfection. The locomotive engine, infinitely more complicated in its construction than the plow, dependent entirely upon its operations for its existence, has leaped into its present condition—a condition almost equal in its arrangements to the human system, and but little inferior to it in its action—in the lapse of a few years; while the plow of to-day has waded through the slow progress of two hundred years since the hand of genius first attempted to shape its proportions.

In the further consideration of my subject it becomes necessary to reverse the order of the title so that it will read PLOWING AND PLOWS, and after we have ascertained how we wish to do the work, look about us and see if we can find the implement to do it with. Under this arrangement the first thing to be considered is the object of plowing. There are several results to be attained in the operation of plowing, all centering in the desire to increase the productiveness of the soil, while at the same time we are preparing it for any desired crop. The *first* object is to invert the soil; and the object of inverting the soil is first to cover all sward grass, weeds and living plants, which would obstruct the subsequent working of the soil for the production of the desired crop, and to utilize them by converting them into plant food; and *secondly*, to mix the soils. All understand very well that plants absorb a certain amount of mineral matter from the soil, and in order for the mineral constituents to be available to the plant they must be within reach of the rootlets of the plant. There is no soil to be found whose mineral constituents are evenly distributed through the whole mass, and hence that soil will be rendered more fertile by repeated inversions with the plow. Again, the same

crop may have been grown on the same soil for a series of years until the land utterly refuse to produce remunerating results. The available mineral constituents within reach of the plant have become exhausted. Plow it; turn up the soil from below and mix with the exhausted surface soil, and the land is rendered again fertile. A plant, too, may actually starve, for a substance which an exact chemical analysis will show exists in abundance. The trouble is it is not available. Plow the land, expose it to the action of the elements, and the plant will again thrive.

The second object to be attained by plowing is to pulverize the soil. That plow which inverts the soil only, does not accomplish all that a plow should be required to do. The rendering a soil fine, porous and light, is of far more consequence than its inversion. The objects of this pulverization may be briefly summed up as follows:

To promote those chemical changes which will render the mineral combinations available plant food.

To prepare the soil so that the roots may permeate it freely in all directions.

To prevent the cooling of the soil by the evaporation of stagnant water from its surface, thus counteracting in a measure the damaging effects of an excess of water.

To secure the absorption of the moisture in the atmosphere by the particles of soil, thereby increasing the humidity of the soil in times of excessive drought.

Should I attempt to expand upon these reasons for pulverizing the soil, and explain their full bearing, it would take up more time than could be given in one whole paper, if devoted to that alone; hence I give a summary of the reasons and leave the hearer to work out mainly the bearing of those reasons himself. Some of the more important facts alone can be alluded to at this time.

The porosity of a soil is greatly increased by pulverizing it; therefore "a finely pulverized soil will condense the greatest amount of manurial substances; will retain them the longest against the action of water, and will give them up the most readily to the rootlets of the growing plant." We all know that a solid lump of earth presents an impassable barrier to the rootlets of a plant, and will turn it aside as surely as a stone; and we know too that it will absorb but a small amount of manure; but pulverize it, make it porous and light, and its power of absorption is greatly increased. One of the most active agents employed in rendering inorganic matters in the soil soluble, so that they may become

available plant food is carbonic acid. In order that this acid may be formed it is necessary that the carbon in the soil be brought in contact with the atmosphere, that it may obtain the necessary oxygen to convert it into carbonic acid. Pulverize the soil and the air is freely admitted to all the pores and comes in direct contact with the carbonaceous matter in the soil.

Soil in a finely pulverized condition radiates heat much more rapidly than when it is solid and compact; therefore it will cool more rapidly. Dew is deposited during the night most copiously on those bodies which are colder than the surrounding air. Therefore the pulverized soil receives more moisture from the atmosphere by the deposits of dew upon its surface than a hard, compact soil. Furthermore, the porosity of a soil being increased by pulverization, its capillary power is increased, and, in addition to accession of moisture from the air, it is continually pumping up moisture by capillary attraction from the reservoirs below.

The roots of plants in a soil properly prepared for their ramifications, will extend long distances in every direction. The roots of plants push themselves in the direction of the least resistance. Therefore, if we would have the roots of plants extend their researches freely in all directions through the soil, that they may search out and appropriate the life-giving forces stored in the soil and awaiting only the touch of intelligent action to cause them to contribute their stores for the benefit of man, we must pulverize the soil. Thus in whichever direction we look, whatever branch of philosophy we apply, whatever course of reasoning we pursue, we obtain proof that the soil is rendered more fertile by pulverization. A recent writer says, "The way to increase the manure on our farms is by a more thorough breaking and mingling of the soil." It is the basis on which all agricultural operations depend. Jethro Tull advocated the theory that the fertility of a soil depended solely on the degree of fineness of its particles—that the effect of manures was entirely due to their pulverizing effects on the particles of the soil. The light of science does not entirely corroborate this theory, although it gives full weight to the effect of thorough pulverization.

If the primary object of plowing is to pulverize the soil, then the highest qualification of a plow is not to turn a smooth, handsome furrow, however desirable that may be, but to pulverize the furrow thus turned in the most thorough and perfect manner. Farmers in years past have been perfectly satisfied if a plow would

perform the work of inverting the soil in a satisfactory manner, and have depended entirely on some other implement for the more important work of making it fine. A properly constructed plow is the best implement for performing this part of the work, that was ever invented; and the plow that performs the pulverization of the surface soil in the best manner may possess the other qualification of inverting the furrow slice in the most perfect manner, thus combining both of the invaluable requisites in the same implement. And further than this, while constructing a plow with a view to the very best work in these two directions, experience proves that it is not seriously to the disadvantage of the draft of the plow. Thus while we are obtaining the most desirable points of excellence in a plow, we are not obliged to surrender minor points of excellence, but find they can all be combined in one implement.

The advantage derived from using a plow which will pulverize the soil at the same time that it inverts the furrow, is found in practice to be greater than is at first apparent. The harrow is an imperfect implement at best for the purpose of mellowing the soil. It is true that a portion of the inverted soil, when it is in just the right condition, can be made fine with a harrow, but it is very superficial work at best. It levels the uneven furrows, but if the work were long continued the soil would become completely packed instead of its accomplishing the object in view—that of thoroughly disintegrating it. The cultivator does the work better than the harrow, but is open to the same objections, only in a less degree. With either of these implements the labor spent in the secondary operation of mellowing inverted furrows is nearly equal to the cost of the plowing itself; and yet the disintegration is only “skin deep,” while the principal part of the furrow lies as compact as it did before the share entered the soil. Experience, then, proves the plow to be the most effectual as well as the most economical mellowing of the soil we have. Cultivators of the soil will do well to give this point of the subject careful consideration. As pulpit teachers often say, “take the subject right home with you” and study it while about your labor. Study it philosophically, chemically, mechanically, and financially, and see if science and art do not combine to teach the facts which I have sought to bring to your notice—see if this is not the philosopher’s stone which will turn all the base elements of the soil into a golden harvest. Consider whether you are not suffering an annual loss from the use of

cheap, old style, inferior plows, which require an undue amount of team to draw them, and which perform that part of the work which they do in a very imperfect and unsatisfactory manner. Consider if this loss is not enough to make the difference between a non-paying operation and a profitable crop.

Inseparably connected with the subject of thorough disintegration of the soil, is the question of deep and shallow tillage; and when we consider the conflicting testimony we have upon this point, the confirmed opinions of practical cultivators freely given and forcibly expressed, both pro and con, we feel that an additional opinion here expressed, however strongly that opinion may be sustained, either by theory or practice, will add no weight to the superabundance of testimony already accumulated. Still this paper would be incomplete—a connecting link in the subject would be left out—did we not devote a little space to its consideration.

To illustrate the conflicting opinions existing upon this question I will make two quotations. All who have read the report of the American Institute Farmers' Club of New York have been curiously interested in the discussion on this subject that has from time to time taken up the time of these savans. A committee of seven gentlemen interested in agriculture were chosen to visit Salem county, New Jersey. Dr. Trimble, a member of the committee, says: "We were shown some eighty corn fields in a day's ride. These fields were all very much alike, and the committee were unanimous in estimating the crop at an average of from seventy to eighty bushels to the acre. The proper depth to plow had been the subject of a long series of experiments with most of these men, and they had almost unanimously decided that it was best to plow less than five inches in depth; and as near as we could judge from the testimony, four inches was about the average. We saw one large field of excellent corn, that was plowed only three inches." Therefore Dr. Trimble thinks deep plowing not advisable. In alluding to the subject again, he further says: "I have much testimony to prove that five inches plowing or less has proved much better than ten inches or more." There is no mistaking the fact that the doctor is an advocate of shallow plowing. In opposition to this I will make another quotation. Dr. Hexamer says that he "plowed a field in the spring twice the depth that it was ever plowed before. The result was that a portion of heavy clay was turned on top, which could not give food to the young plant, and the consequence was that field was unproductive that year. After

being thoroughly mellowed and manured it became the most productive of any on the farm. It has since been plowed some inches deeper, and still continues to be the best field on the farm. Everybody knows that plants grow better in deep, loose soil than in a shallow and compact one. The very laws of nature tell us to till the ground well and deep. Go over the parched fields of the South made sterile by years of wanton, reckless robbing of the soil and shallow plowing; ask the mullains, the live-forevers and the scrub pines which find but a scanty supply where corn and cotton luxuriated; ask the crumbling ruins which your eye meets on every side, once the comfortable homes of wealthy planters, but long before the war abandoned for richer fields; the very dreariness and desolation which surround you exclaim, 'Obey the laws of Nature.' By the hard work of man and beast the ground must be broken up and deepened before hard frosts set in, when the alternate freezing and thawing will finish the work of pulverizing and mellowing." So much of Dr. Hexamer. These opposing views no doubt were honestly expressed and certainly can be plainly understood. Now, "when doctors disagree who shall decide." We must study the matter ourselves. We must view it over by the light of science—let philosophy teach us the advantages of the one and the injurious effects of the other; then put in practice what we have learned from our study of the subject and watch the results.

The advantages of deep tillage are so closely allied to the benefits derived from thorough pulverization that the arguments we have presented in favor of the latter are equally applicable to the former. Indeed, thorough pulverization cannot be secured with shallow plowing. If we believe that the roots of plants need a mellow bed in which to extend and search out the food which is absolutely indispensable to their growth; if we believe the soil should be loosened in order that the air may penetrate it and come directly in contact with the carbonaceous matter in the soil; if we believe that the soil must be stirred, broken, loosened, that its capillary power may thereby be increased, and the needed moisture always existing below be drawn up in times of drought to water the famishing plants; if we believe that it should be made porous and light that it may drink up the falling dew deposited upon its surface, we must plow deep. Furthermore, an excess of moisture at or near the surface causes land to be cold, from the fact that the heat is taken up in

evaporating the water; hence we should stir the soil deep that the water may pass freely down into the soil. An excess of moisture is counteracted by deep plowing, an excess of dryness is prevented by the same deep tillage. Therefore, by whatever light we view it,—whatever arguments we bring to bear upon it, we arrive at the same conclusion—*deep and thorough tillage*. The questions here arise, “Do practical results agree with scientific conclusions? Is not science at fault, and is not this the cause of the radically different opinions entertained by practical farmers?” True practice corresponds to the highest science—it is true science put into practice. They walk hand in hand and never disagree.

All soils are not equally benefitted by deep plowing. Moist, fine, compact soils, lying on a hard, impervious subsoil, must be worked deeply and thoroughly, if we would reap remunerative harvests. Soils naturally loose and porous, having a porous subsoil which allows any excess of water to pass readily through it, and also alluvial soils which are of the same nature to any depth which the roots of plants naturally penetrate, are not equally benefitted with the soils first named, by the same deep tillage. But even such soils are rendered more sure to yield bountifully, through a series of years by the labor bestowed upon them, when worked deep, than they are when the surface only is skimmed. They are vastly better prepared to resist the severe droughts which every year visit some portion of our country, and they are also better prepared to contribute their mineral elements to the growing plant. A young man from the East emigrated to one of the new States of the West, carrying with him some ideas about farming learned here in New England. He thought, instead of merely skimming the surface with his plow he would give his wheat a good mellow bed to grow in, and therefore let his plow down into the soil. The consequence was he lost a large portion of his crop from overgrowth. He rendered the fertilizing elements of the soil too easily available by deep tillage.

Nearly all agricultural writers when discussing this subject, conclude by saying that the soil must be “gradually deepened”—that “it will not answer to turn up a large amount of soil that was never before stirred, all at one time.” This may be so if you are *making a soil*, and if the extra depth turned up be a lifeless, infertile subsoil. Where the soil is already deep and you are only delving deeper into a lower stratum of hitherto unworked, fertile soil, there

need be no fears about putting the plow down to the desired depth at once in our New England practice.

I have practiced deep ploughing on all kinds of soil, from the light, sandy, naturally drained river land, to the wet and heavy high land soil, and always with beneficial effects over the former shallow tillage. I have succeeded in raising heavy crops of corn, grain and grass on sandy land, by plowing ten inches deep where the shallow soil never before had been stirred deeper than five or six inches. Some years since I came into possession of a field completely run down by shallow tillage and scanty manuring. The crops of grass produced barely paid for cutting and curing. The double plow was put into it in the fall of the year, turning up at least four inches of soil which never before had felt the plowshare, and leaving it upon the surface, open to the influence of frost, air and sunshine. In the spring the field was manured with twenty ox-cart loads of thoroughly fine manure to the acre—a portion spread broadcast and the remainder put in the hills—and planted to corn. The result was not like Dr. Hexamer's, but was one of the best crops ever harvested on the farm. The next year the same operation was repeated on an adjoining portion of the same field with still more satisfactory results. The following crop of grain and the succeeding crops of grass on both pieces have confirmed the wisdom of the operation. I never have hesitated to plow deep at once on any soil, and I never have been disappointed in the results.

In addition to the qualifications of a plow already enumerated, it is necessary that it be light of draught, and that also it should be of good material, well put together, that it may be durable. It should also be capable of being easily guided by the plowman, and not over-cumbersome to handle. The best plow then will come the nearest to possessing the following qualifications :

- 1st, Power to perfectly invert the furrow.
- 2d, Power to thoroughly pulverize it.
- 3d, Ability to turn a deep furrow.
- 4th, Ease of draught.
- 5th, Ease of guiding and handling.
- 6th, Durability.

Selection of Plows.—Where shall we find them?

Having a fixed idea in the mind of what we wish to accomplish with a plow, the query would arise, "Is there an implement manu-

factured which in practice will do the work which a plow theoretically should do, and if so where shall we find it?" The demand of the times, among the best farmers of the Northern States, is for a plow that will turn a deep, narrow furrow, and thoroughly pulverize it in the operation of turning—deep, because they wish to till deep, narrow, because no plow can pulverize a wide one. The committee on agricultural implements at the State Fair in 1868, state that the patterns of Maine plows are decidedly superior to those manufactured out of the State, while the workmanship is greatly inferior. If my theory of a good plow be correct, if we wish for a plow to perform its work in the manner which has been described, then the statement of the committee in reference to the patterns of the Maine plows is incorrect. So far as I have learned, there is not a sward plow manufactured in this State which will perform, on lands comparatively free from obstructions, the full office of a plow. We have those which will turn a shallow furrow to perfection—the work of which would delight the eye of an Englishman—but they are entirely wanting in pulverizing power, and will not delve deep enough to satisfy the wants of the progressive farmer. The best farmers, therefore, must go out of the State for their plows, as long as the inferior implements made here meet with a ready sale. The opinion seems to prevail among manufacturers that farmers will not purchase any other than a cheap plow. Not long since a farmer not unknown to the members of this Board, went to a manufacturer of agricultural implements for the purpose of inducing him to commence the manufacture of a better pattern of plow than was then within the convenient reach of the farmers of his county. The reply was that farmers would not buy a high priced plow. On what facts are such opinions based? Let such men go to the homes of the farmers; see their substantial, convenient, tasty buildings, erected at much cost, with a view to the ease of the family and the comfort of the domestic animals; see the improved stock occupying those comfortable quarters; note the improved implements for use upon the farm—the harrows, the cultivators, the forks, rakes, mowers, all of the improved kinds, and selected on account of their merit, and not because of their cheapness. Visit the dwelling—the cook-room, furnished with all the latest improvements to facilitate cooking—the sitting-room, furnished with piano or organ, the table covered with the best books and periodicals of the times. Converse with the family and note their intelligence. Think you the head of such

a family will look for a *cheap* plow instead of a *good* one? Have not our scythe manufacturers learned that they cannot sell a cheap scythe at any price, when a "Clipper" or a "Harvest King" is exposed for sale? No! cheap tools are not what farmers are looking for. The demand is occasioned by merit alone. Who buys a mower because it is cheap? and are not the highest priced rakes almost the only ones sold at the present time? The plow is no exception to this rule. Farmers want a good plow at whatever cost. So long as the best are not manufactured in the State many farmers will go out of the State to obtain them.

As has before been stated, the best plow for lands well prepared for tillage is the double plow. When tested by the requirements which have been laid down it is not found essentially wanting in any particular. The work performed by it, when in skillful hands, comes the nearest to perfection of any plow now made. The forward or skim plow cuts off the sward about two inches in depth, and turns it very nicely into the bottom of the furrow. The other plow follows and lifts the remaining portion of the furrow slice and inverts it on top of the sward already deposited. As this second furrow is free from sward, the operation of lifting and turning completely disintegrates it through its whole depth, leaving the whole mass completely mellow. The sward being separated from the main furrow, allows the admission of air and rots very readily. Although the plow cuts a deep furrow, and pulverizes it so effectually, still it is light of draught. The furrows being divided and turned into two parts, offers less resistance in consequence of being more easily bent and turned than it would if turned in one undivided slice.

There are other plows possessing a high degree of merit, whose work would be found, upon trial, very satisfactory. Among these may be mentioned the "Deep Tiller" series, manufactured from Mr. Knox's designs by the Ames' Plow Company; Mead's conical plows, the Collins' plows and the Holbrook plows, all possessing merit, and all claiming to effect pulverization while turning. Messrs. Holbrook & Small manufacture a swivel plow for level land, designed to turn the furrows all one way, thereby doing away with the inconvenient and unsightly "dead furrow." The working capacity of this plow has been tested by good judges, and is well recommended. Farmers will do well to give it a trial. The Collins' plows are manufactured at Collinsville, Conn., and are a new invention, both in form and material, being cast from

cast steel, and possessing the hardness of cast iron and the durability of steel. The steel plows heretofore sold were made from steel plates bent and twisted into the desired form. This new invention gives promise of furnishing a very desirable plow.

Having selected a good plow, skill and judgment are required of the plowman in order to bring out its best working capacity. So little interest is manifested in the subject, so little pride is manifested in its use, that we have but few skillful plowmen among us. The first thing necessary is to properly adjust the team to the plow. In order that the plow may hold easy, and at the same time pass with the least possible resistance through the soil, it would be necessary that the line of the draught be regulated so that it will pass from the point of attachment at the shoulders of horses, or the ring of the ox yoke, on a straight line through the attachment upon the end of the plow beam to the point of resistance on the mould-board of the plow. This of course is practically impossible, since it would necessarily pass through the furrow-slice itself; but the attachment should be such that if a mathematical line were projected through the clevis it would strike the point of resistance. If this attachment be too far to the right hand the plow runs off; if too far to the left it "lands too hard;" if too low the plow does not run at the desired depth; if too high it runs too hard on the wheel. This causes it to be hard to guide, and increases the draught very materially. Therefore plowmen are greatly in error where they "fid down," as it is termed, the chain with which their oxen are attached to the plow. This arrangement brings the draught out of a straight line, and entirely disarranges the proper working of the plow. There is no plow manufactured, either in or out of the State, whose designer arranged the parts with a view to having the draught so low. Yet plowmen still adhere to this old notion, and curse the plow for its imperfect work.

Rev. Mr. GURNEY. The paper which has been read, so far as I am a judge, is a very practical and a very exhaustive one, and still there was one point not touched upon, and I do not know that it comes under this general head of plows and plowing. What I would like to hear discussed is, how much land shall we plow? Is there not danger of plowing too much? I think we ought not to plow any further than we can manure thoroughly and well. It seems to me that by plowing we exhaust the soil. You

may talk as much as you please about fertilizing by plowing, but if you only plow you certainly exhaust the land. You may plow ever so deep, there is a time coming when the soil will become exhausted unless you put something to it. It seems to me there is danger of pressing this point too far. You may plow a farm until you run it completely out. If you go to buy a farm, the first question you ask is, "How much has this been plowed? Has it been run over, and cropped, and cropped, and cropped? If so, I don't want it." Then there is another thing. I have been taught by experience and observation that, as a general thing, it is poor policy to plow pastures; but I have seen them plowed in these regions. The first condition of a pasture, just as it comes from the burning of the trees upon it, is the best condition; and every time you plow it afterwards you injure the pasture. It is a mistake, emphatically so, unless you manure it, and, as a general thing, people do not manure their pastures when they plow them. They have run out; they have got into moss; they have run up to bushes, and they plow for the purpose of seeding them, getting them into clover, as they say. I believe it is not a good plan to plow a pasture, but lay out the same money you expend in plowing and seeding the pasture in applying bone dust, superphosphate, ashes, plaster, salt, or almost any fertilizer, and you will have a superior pasture—a pasture which will last longer, will give better feed, and give better results than by plowing.

I think we plow all our fields too much—our common mowings and common tillage. It seems to me that it is the most exhaustive kind of farming to plow. In the region where I have lived for some years past, the farmers have adopted almost as a maxim, "the less you can plow the better," and as long as it is possible for them to keep their land in good grass without plowing, they do so, by top-dressing, by re-seeding, by harrowing, by applying plaster, ashes, salt, or any fertilizer that will keep the land in grass. They will do almost anything rather than plow. You cannot determine of course by that what should be done here—the soil is different; but it seems to me by top-dressing—beginning *early enough* after it is seeded down, and continuing to top-dress, you can greatly delay the necessity for breaking up the soil; and the longer you can do that, the more profit you will get, because it costs so much to seed land and to work land. I believe if this point were duly considered we should gain by it;

and if it is proper to bring it in here, I should be glad to hear something said of the methods of working farms in this region.

Mr. P. M. JEFFERDS of Foxcroft. It seems to me that Mr. Gurney confounds *cropping* with *plowing*. I believe there is such a thing as fertilizing the soil by plowing, and observation last winter in California convinced me of that more fully than anything I had ever seen before. By plowing the ordinary drift soil, that has always been considered barren, and allowing it to lie until the next year, it will produce an abundant crop; but if they plow it and sow it the same season they cannot get a crop. This convinces me that there is some virtue in plowing.

Mr. Gurney spoke against plowing pasture lands. I have a field of some fifty acres. It was cleared of the forest about twelve years ago, and produced good crops of hay for three or four years. It was producing a good crop when I turned it to pasture. I have not pastured it heavily, but it has turned to moss—what we call “bear’s grass.” I would like to ask Mr. Gurney how he would kill that bear’s grass, and get a good sward for pasturage on that land?

Mr. GURNEY. I do not know. I am no farmer, only the son of a farmer; but it seems to me that there are fertilizers that will bring in clover and other grasses, which will swamp that kind of grass.

Mr. JEFFERDS. My experience is, that this bear’s grass will grow deeper and deeper until you get a sod a foot deep, one solid mass. Besides, I will ask Mr. Gurney how much it would cost to go over that field with superphosphate or any concentrated manure? It would be pretty expensive.

Mr. GURNEY. Yes, but you have got to manure it, any how.

Mr. JEFFERDS. No, sir. I will plow and sow it one year. I began six weeks ago to plow the field, or about fifteen acres of it. Next spring I will give it a thorough harrowing and seed it. It will make grass so that I can get a ton to the acre for three or four years, if I choose to mow it.

The CHAIRMAN. What proportion of the surface is covered with this bear’s grass?

Mr. JEFFERDS. Perhaps three-quarters. In wet seasons white clover will come up in spots in this pasture, but it will not amount to much, and nothing good can grow much as long as that worthless moss is there; everybody knows that. But by plowing early in the season, and especially in such a season as this, we derive great advantage by exposing the soil to the air. Undoubtedly one

cause of the fertility of the soil in California is their long droughts. The earth becomes so dry that the air passes through it, and when it is moistened it acts like bread rising; it expands and leaves the soil fine and perfectly decomposed. I came into possession of a farm here that had been in the hands of heirs, and was considerably run down. I cut about thirty tons of hay on sixty acres the first year; the next twenty; and the next not more than fifteen. The second and third years were dry seasons. A large part of that I turned over, sowed grass seed, and got fair crops of hay. I mow about thirty-five acres, and cut from fifty to seventy tons of hay. We do not plough enough; we crop too much, as brother Gurney says; but we do not plow enough, neither do we summer fallow as we ought.

Prof. FERNALD. I was glad to hear the lecturer advocate deep tillage; I believe fully in that. I have sometimes thought that if there were a law passed by the Legislature declaring that every farmer owns to the depth of one foot, it might result in great good, for then he would be more likely to try to make use of all he possesses. He seems too often to forget that he owns the soil to an indefinite depth, and sometimes only skims over the surface. Now if it be true that plowing to the depth of six inches will furnish material for plant food for a given number of years, and going twelve inches will furnish double the amount of plant food, it is also true that it will not answer to depend for an indefinite length of time upon what the soil will afford, but returns must be made commensurate with what is taken away. Then, if the farmer would keep his soil in good condition, *he must return in proportion to what he takes away*, and yet not hesitate to put the plough down deep, and let the soil furnish all it is capable of affording.

It is undoubtedly true, that there is great advantage in deep and thorough pulverization of the soil, for by pulverizing and opening up the particles of the soil to air and moisture, there are brought in contact with the little pebbles and particles of the soil the very elements that are necessary to break them down, decompose them, and eliminate from those pebbles the phosphate of lime and potash they contain—the very fertilizing ingredients which are locked up in those pebbles, and can only be set free through the agency of air and moisture. So by thorough pulverization of the soil, chemical changes are brought about which are indispensably necessary in order to set free what otherwise would remain locked up, and be of no service whatever as plant food. There is no question in

regard to the very great value of thorough pulverization in furnishing material for plant growth.

A point referred to by Mr. Gurney, with reference to keeping grounds long in pasture, is, one that came up during a course of lectures delivered by Mr. Willard of Little Falls, N. Y., before the students of the college. Mr. Willard stated that there are pastures in New York which have been maintained in good heart for sixty years, and that those old pastures are considered by dairymen greatly more valuable than re-seeded ground. They are more valuable in that the grasses spring up on those old pastures earlier in the season, they continue longer, and they are richer in those materials that go to make up milk, butter and cheese; that ten quarts of milk from one of these old pastures will make one pound of butter, whereas it requires thirteen quarts of the milk produced from re-seeded land to make the same amount of butter. This is an advantage on the side of the old pastures, and those pastures are kept up for an almost indefinite period of time by top-dressing, in the manner which was indicated by Mr. Gurney—by applying fertilizers—not by plowing. That is the policy adopted by the dairymen of New York, and I think it is also adopted by the dairymen in Massachusetts and some other States, but especially it is true in the State of New York. Wherever there are bare places they re-seed them. They resort to any and every expedient by which they can keep the land in grass, without plowing. They make an effort to sow grass seed that shall come into blossom at different periods of the year, so that they shall have one grass coming into blossom early, another kind a little later, and another later still, and thus supply fresh, nutritious grass for their cattle through the entire season.

Mr. C. CHAMBERLAIN. I like the remarks of brother Jeffers, and I hope the citizens of this vicinity will not be backward in participating in this debate; but when we have a man who has come from a long distance for the purpose of aiding in this convention, I believe in working him while he is here. We have with us Mr. Gold, Secretary of the Connecticut Board of Agriculture, who knows all about the subject now under consideration, and I would like to hear from him.

Mr. T. S. GOLD of West Cornwall, Conn. I have been very much interested in the remarks, and as the subject of pastures was up last, living in a dairy region, I will state my experience.

We have there pastures and meadows that never have been

plowed since the settlement of the country, and we would not, under any consideration, touch them with the plow. The meadows are maintained in their fertility by top-dressing. The fertility of the pastures is maintained by being used rather as night pastures, and getting a little more than their share of the droppings of the cattle, otherwise, I think we could not boast so much of their fertility. But "circumstances alter cases." There are in other sections of Connecticut lands that I should not attempt to keep in permanent pasture or meadow at all, and there are portions of my own farm that I should not hope to keep in that condition without the use of the plow, and fertilizers in connection with it. But those old pastures and old meadows are our most valuable grass lands—lands that we could not get along without—lands that will yield us, when mowed, from two to three tons per acre every year, with proper top-dressing—mixed grasses, fine, thick clover, timothy, redtop, and June grass, all mixed together, the very best quality of hay for cows. Those lands we would not touch with the plow on any consideration.

Mr. NORTON. You mean by "meadow lands," swamp lands?

•Mr. GOLD. No, sir; by "meadow lands" we mean anything that we mow.

Mr. NORTON. We call swamp lands "meadow," here.

Mr. GOLD. I understand the distinction. In some parts of Connecticut they mean by meadows, low intervale and swamp lands, and by arable land they mean uplands; but we call anything we mow "meadow," for the time being; and most of our meadows are hill lands; most of them are permanently in grass upon our best farms, and have been so ever since the settlement of the country.

QUESTION. What do you use for top-dressing?

Mr. GOLD. Principally barnyard manure, composted sometimes with muck, but more often with very little addition except straw and the refuse from the stable.

QUESTION. What is the value of muck in that connection?

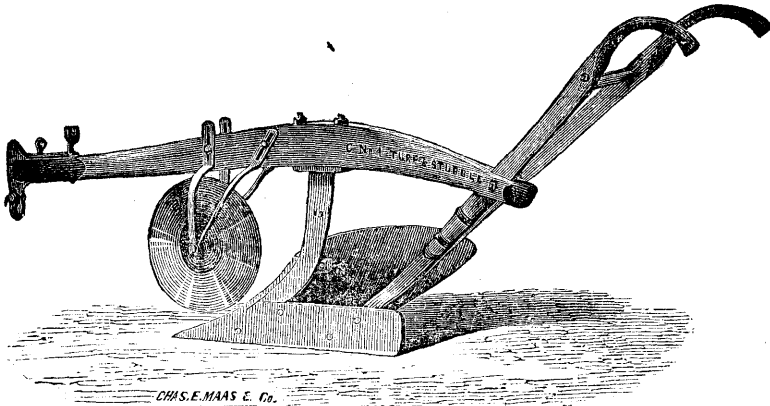
Mr. GOLD. It depends somewhat upon the character of the soil on which you wish to put it. If it is black, mucky soil, we don't consider it of any value—on some of those hill lands there is black soil for one or two feet before you get down to the hard pan—naturally black soil. We do not consider that muck is a very great addition to the manure heap, but anything put upon the surface

that will open the turf a little is a benefit, and muck certainly is beneficial in that respect.

QUESTION. How does gypsum work?

MR. GOLD. Gypsum is advantageously and universally employed upon our best farms. A slight dressing is used every year. It costs us about \$8.00 a ton ground, delivered at the mills, and they put on from one to three bushels per acre. It brings in clover, especially.

With regard to plows, I have used the plows that have been referred to, almost all of them. Mead's Conical Plow, which is made at New Haven, seems to possess all the advantages of light draft, perfect pulverization, and easy management, and my men and my neighbors have given it their unqualified approval in these respects.



COLLINS' PLOW, (With Revolving Coultter.)

I have also used the Collins' plow. The advantages claimed for the cast-steel plow are, that it will keep itself perfectly clean and bright in any soil. No matter how mucky or tenacious the soil may be, it scours itself bright, and keeps itself so. That is fully admitted to be true. I used to be afraid that it would break; that a cast-steel plow used among our rocks, with a strong ox team, would be readily broken, for the point is quite sharp and slender; but two years' experience with one enables me to say that I fear very little danger from that cause. It has done many weeks' service where there were sunken rocks and careless plowmen and heavy teams, and the point has not been damaged nor the plow broken in any way. If it is broken any blacksmith who understands the management of cast-steel can draw it out and sharpen it, or put on a new point of cast-steel.

Mr. LUCAS. I will break up an acre of ground this month that bore a ton of hay this year; next spring I will apply twenty-six loads of green manure to that ground, and put fourteen loads in the hill, plant it with corn, and raise fifty bushels; next spring plow it and sow it with wheat, seed it, and raise twenty bushels. I have then expended forty loads of manure upon that ground. It bore a ton to the acre before I plowed it, and two tons afterwards. I want to know how much of the value of the manure have I lost in the crops raised? In other words, how much grass or hay would that have produced if I applied it to the surface instead of plowing the ground?

Mr. GOLD. That will depend entirely upon the character of your soil. If your soil is a gravelly, sandy, quick soil, your manure will be almost exhausted in two years' cropping. If your soil is of a mucky, loamy, somewhat clayey nature, as much of ours is, the effects of that manure will show for ten years. I have seen the effects of the application of manure for that length of time, and more, where there was only a small portion of a field highly manured.

QUESTION. How would it be if it was not plowed at all? How long could you see the effects of the application of say five cords to the acre on the surface?

Mr. GOLD. Well, sir, on a soil that contains carbonaceous matter in considerable quantity, and clay, there will not be much manure wasted; it will remain there until taken up by the crops, and will continue to benefit the land for several years. But upon a hungry, gravelly, sandy soil you must look for the returns from your manure very soon. I cannot answer such a question any more definitely than that. It will depend entirely upon the character of the land how long you may expect the manure to show its influence upon it.

QUESTION. Here is the grass crop, the staple crop of the country. One great object is to ascertain what application to make of our manure to make the most of it; whether we shall put it upon the surface, or whether we shall plow and take crops as we do, and then take the grass that follows?

Mr. GOLD. In my immediate vicinity, and on my soil, top-dressing has been the favorite method of applying manure; but there are other sections, with somewhat different soil, where they consider top-dressing of very little value, and plow in

their manure, so that it must depend, as far as my experience goes, entirely upon the character of the soil.

To conclude my remarks with regard to the Collins' plow. I have had but one—the letter C. It was designed both for turf and stubble plowing. It did not turn my turf—a heavy, strong turf—very well, and was not entirely satisfactory. We tried it this year, upon our lighter turf, with more satisfaction. We tried it, however, in heavy soil, that had been under the plow several years—quite heavy, quite rich and deep—and it pulverized it perfectly, and left itself absolutely clean; just as bright as when it was put into the soil; as clean as the blade of a knife; never allowing any of the clay or muck-soil to adhere to it; and every plowman knows that it is a very great pleasure to have his plow always clean and bright. It is said that it will keep bright in any soil, no matter how tenacious it may be. These are the special advantages claimed for it, and as it is a strong plow, a light plow, and has that other advantage that no cast-iron plow possesses, I believe it may be safely recommended for use upon such soils.

MR. THING. In your fields that have been used for pastures for so long without plowing, are you troubled with moss or knolls?

MR. GOLD. Our pastures and outlying lands, upon which the cattle range, but never lie down, always come off from them at night, do become moss-covered, and bushes spring up.

MR. THING. Have you any remedy for the moss?

MR. GOLD. I think ashes are as good as anything that can be applied.

QUESTION. Have you ever harrowed a mossy knoll with a heavy harrow?

MR. GOLD. I have never done it. Some have tried sowing clover, with very good results.

QUESTION. What would be the effect of salt on those mossy knolls?

MR. GOLD. We cannot get salt enough in the interior of the State to use very extensively. I occasionally get a bushel of refuse salt from a merchant, and I usually put it in my manure heap.

QUESTION. Would not a strong application kill off all the moss, and everything else that is connected with these moss knolls?

MR. GOLD. Salt has been used with very great advantage upon some farms where it could be obtained very cheaply, say for ten cents a bushel. This was refuse salt, that came with cargoes of

hides from South America. It could not be used for anything but manure, and gentlemen have applied it with great and permanent advantage to the land, at the rate of say ten bushels or more to the acre.

QUESTION. What I mean is, if you covered the knolls all over with salt, would it not kill the moss and grass, and everything else?

Mr. GOLD. Yes sir; but after a time I think better grasses would come in.

QUESTION. Do you irrigate the land that you keep for permanent pastures?

Mr. GOLD. Not much of it. I should irrigate if I had opportunities to do so, but I have not. With irrigation, there is no need of much top-dressing.

Mr. GURNEY. I would like to say a word in confirmation of what Mr. Gold has said in reference to pastures. You cannot apply one rule to all places. I have seen pastures that have never been plowed, and yet have improved every year; I have seen pastures and have had pastures that would keep a cow through the season, and mow from ten to twelve hundred pounds of hay on spots where the cow had not fed; and I have seen mowings that would give two or three tons to the acre, and all done by top-dressing. Plaster and salt were applied to the pastures with excellent results. I have seen salt applied that cost seventy cents a bushel at the depot. Perhaps ashes are better than anything else to the extent that they can be had.

Secretary GOODALE. It occasionally happens that we do not understand one another, because we use terms to which our hearers attach a different meaning from what we intend to convey. When Professor Fernald told us what Mr. Willard said about pastures in New York, we might likely have in our mind's eye pastures such as we often see. Whereas, there is in truth almost as much difference between the pastures of Herkimer county and the average pastures of Maine as there is between swamp meadow and upland meadow. In that county, and in fact throughout that whole dairy district you will find the richest and best lands devoted to pasture; and as a general rule you will find a smaller surface of pasture support a cow well through the season of grazing than is required of mowing land to supply hay for the winter feed. With us the rule is the other way, and although our mowing lands yield less than theirs, and our winters are longer, the cattle roam over more

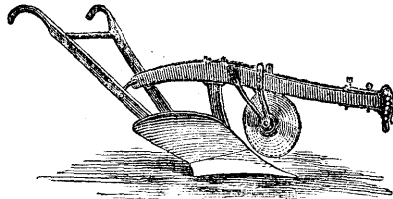
area in summer than suffices to yield their winter's keep. In Herkimer county, where Mr. Willard lives, a pasture would hardly pass for a good one unless, if left to grow grass, it would yield two to three tons of hay to the acre.

One especial advantage attributed to old pastures I understand to be this, that when they are rich the sward gradually becomes occupied with numerous varieties of grasses, and as one sort chooses one kind of food and another another, and so on, you get much more growth than if only a few sorts grew on it; and they also furnish a more uniform supply of nutritious food, since they come along one after the other.

It has been stated as the result of exact counting and assorting that as many as one thousand distinctly rooted plants, embracing as many as twenty distinct species, have been found growing in one square foot of rich, old pasture sward. Such a pasture as that is not obtained in a hurry, nor should I, for one, be in a hurry to plow it up. We have lands capable of being put into as good condition as those of Herkimer county, and I have no doubt it will be accomplished in time, for I believe there is progress in store for us; but we must work for it, and work judiciously and to the best advantage.

I hope we may hear farther from Mr. Gold, because Litchfield county, where he resides, more closely resembles some of the land about you and the hilly portions of Cumberland, Oxford and Franklin counties, than almost any sections out of the State which I have ever seen; and for this reason, in addition to others, I deem his experience and observation particularly valuable to us.

I will add a word in regard to the Collins' plow which has been spoken of. Mr. Gold says he found some difficulty in turning a heavy sward. I have used that plow for a year or two past, and can truly say, and after making due allow-



“COLLINS' PLOW.”

ance for the favor with which a “new broom” is generally received, that it has given me better satisfaction than any other I have used. Perhaps I ought to add, however, that I have not tested all the plows of recent introduction which have received commendations of good judges. I have not had occasion to try the Collins' plow on very heavy sward, but on old land, a heavy clay

loam, it pulverizes the soil admirably; and a somewhat light land sward was turned by it as well as could be desired. On the whole I have been exceedingly pleased with its work wherever I have had occasion to use it.

QUESTION. Is the superphosphate, manufactured by the Cumberland Bone Company, a good top-dressing for grass land?

Secretary GOODALE. I would rather not be questioned with regard to that particular brand, because, being employed as their chemist to direct its manufacture, my answer might be open to criticism as unduly influenced by parental partiality, if not also by self interest. There are plenty of those who use it, and they can give you their opinion of its merits. But with regard to *any* good superphosphate, I will say, that the testimony regarding its efficacy *upon grass lands* is as conflicting as it is with regard to gypsum, ashes, or any other fertilizer. In some cases it has proved highly efficacious and profitable, in others the benefit has not equaled the cost. I would be cautious in applying it in any given case before I had tested its efficacy by application to a small spot here and there. If the land is such as is improved by leached ashes, you may probably use it successfully, for the chief value of leached ashes is due to the phosphates they contain.

Another hint may assist in forming a judgment. If your cattle are found occasionally gnawing at a bone as if it were a choice morsel, the indication is very plain that your pastures are lacking in bone-forming material. This is a common and growing evil, and will grow more and more so until the cattle become seriously afflicted with "bone disease," unless you apply phosphates to the land in some form. It is very common in such cases to give the cows bone meal with their food, and it is good as any temporary palliative is good, but it is a miserably shiftless method compared with the better way of giving it to them *in the herbage* grown upon land which has been supplied with phosphate, for by this method *the crops are increased in amount, and in richness also*, and thus they are supplied with what they need to form bone in the best possible form, and with what will make milk and meat in addition.

I have been surprised to learn the extent to which bone meal is bought and used, especially for milch cows. It indicates the exhaustion of pastures to an alarming extent; and it indicates also the constituent which is lacking. If the exhaustion were shown merely by scanty growth, we might as readily infer that potash or

some other element was wanting, but here the evidence is clear of the want of bone-forming material—that is to say, of phosphate of lime. If the herbage contained a sufficiency of this indispensable constituent you would never see any signs of bone disease such as is now so common and becoming more plentiful every year.

Adjourned to afternoon.

AFTERNOON SESSION.

Hon. A. G. LEBROKE delivered the following extempore lecture, upon

LAW FOR THE FARMER.

Phonographically reported by J. M. W. Yerrington.

Mr. President, Ladies and Gentlemen:—The subjects which I shall discuss, in my way, are fences, lot lines, pounds and trespasses, wilful trespass, ways or highways, law of the road, including the regulations for traveling upon the road, fires as necessarily set, miscellaneous matters, among which will be a review of the new statute for the prevention of cruelty to animals.

Fences.

In speaking of fences perhaps I might say that we have a subdivision of law in this country, and in all other countries wherein the English common law prevails. We have what is called the *common law*, which consists of those ancient usages and customs adopted and sanctioned by the courts in Great Britain before the American Revolution, together with such statutes as had been enacted in England, and were in force there and in force here up to the days of the Revolution; which were applicable to our new State and situation in this Western World, and the customs in our courts sanctioned. And to make it very clear to you, I will say that common law means all laws which are recognized by the courts, which the *Legislature* have *not* enacted. If your Legislature enact a law, it is *statute law*, and is inflexible and binding to all intents and purposes, without question, being left only for the construction of the courts—and to them on the further question of its constitutionality. Common law is just what would exist in this State if our statutes were all repealed; we should still have the common law, which would be the entire jurisprudence of the State. It would be those ancient English usages and ancient English statutes which were adopted in this country up to about

the time of the Revolution, together with such new usages and customs as our courts have adopted without legislation. At common law every man must take care of his own cattle; and, if those cattle encroached upon the enclosure of an adjacent proprietor, or anybody else, they were liable to distraint; that is, liable to be taken and held as a pledge for the payment of the damages and whatever costs might arise. No man was obliged to build a fence anywhere except by binding agreement, or by prescription; the common law was his fence. In some respects the common law has been re-enacted by statute; and in other cases, in relation to fences, it has been modified, and in others, abrogated in part.

As the law now stands, substantially, a proprietor may be held to build a part of the partition fence when he himself cultivates, or improves, or pastures along the side of the line; and the adjacent proprietor is obliged to build the other half of the fence, if he occupies, or cultivates, or pastures opposite that line. This is a matter of statute—an abrogation of the common law in that respect. If two men own each 100 acres of land adjoining each other, and between them there is a lot line 160 rods long, and each of them cultivates, pastures, or occupies along on one side and the other of the line, each man is obliged to build one-half of that fence; and if the parties do not agree between themselves, then either party may apply to the fence viewers of the town, who must be chosen every year, to make an adjudication; and to make it certain that every town has fence viewers, the statute provides that in case no fence viewers are elected, the selectmen of the town shall be the fence viewers. If, after due notice, on application to the fence viewers by the opposite party, and an adjudication by them of the portion which shall be assigned to each party to build, the proprietor neglects for the space of thirty days, to build his half, which the fence viewers have assigned to him, the other party may go on and build that other half which the adjacent proprietor ought to have built, and may recover double what it cost to build that fence, after the other party has had thirty days' notice, and double the fees paid to the fence viewers. This relates to cases where the lands are cultivated. But suppose one man cultivates all the way along on the line, and the other man does not cultivate nor pasture at all—it is a mere waste, a common, or wood-land; then the proprietor who cultivates cannot compel the adjacent proprietor to build any fence at all, but he may go on and build the whole of the fence, and then, if at any time the adja-

cent proprietor shall see fit to cultivate or pasture, or occupy any portion of the land adjacent to this fence, he may be compelled on proper notice, and an adjustment by the fence viewers of the proportion he shall pay, to pay for one-half of this fence already built, whatever it may then be worth.

Sometimes very difficult questions arise, as where a man occupies land, and cattle occasionally run in. I cannot go into all these nice questions this afternoon; I can not make you all lawyers if I would, and I would not if I could, because I should thereby deprive myself of the necessary means of subsistence. It is only the first principles that I shall teach you, if I teach at all. It is sufficient to say that a man may be compelled to build one-half of the fence along one side of his farm, while he may not be compelled to build any part of the fence on the other side of his farm if he has abandoned it to waste, common or wood-land; and if his neighbor should encroach upon him, along the part where there is no fence, he will have his remedy against his neighbor.

When the fence viewers have given notice to parties, and have had a hearing and made an adjudication, and a proper minute thereof in writing, and a copy of that adjudication has been recorded by the town clerk of the town, that becomes a binding obligation, so far as it goes, that each shall always keep that fence in repair, and keep it up according to that adjudication, which is not only binding as between the parties, but upon their heirs and assigns; in other words, binding upon subsequent owners. Parties may very properly, and very easily and peaceably, agree, under their own hands, what portion each party shall build and keep in repair; and that being recorded with the town clerk, is binding as between the parties, their heirs and assigns. This is really the cheapest and most Christian-like way in the world in which to take care of these fence matters. Agreements in writing if not recorded, may be made, which may hold as between the immediate parties, but may be found invalid against subsequent owners. It may happen that if a fence has been kept up in separate portions for a period of twenty years by the proprietors, or those under whom they claim, that such prescription will be held to be binding upon the parties, their heirs and assigns.

It is quite frequently the case that neighbors keep up a sort of *joint fence* together, no actual division having been made, but each one contributes a little labor, and they go on in an amicable manner from year to year and patch up this fence. Suppose A's

cattle pass upon the enclosure of B, or B's cattle upon the enclosure of A through such fence, what are the rights of the parties? They are precisely as at common law. Where two parties agree together jointly to build a fence and keep it in repair, and both act diligently or otherwise in doing it, if A's cattle come upon the enclosure of B, by reason of a defect therein, A must pay B for the damages they actually commit. There is only one exception to this matter of trespass, or right to impound, where cattle break in upon your enclosure. If A and B agree to build a line fence in separate parcels, A this half and B that half, or the fence viewers establish the portion that each party shall build, or if a division is established by prescription and A does not keep up his part of the fence as good as it ought to be, if B's cattle break in upon A, because A's *half* is defective, A cannot recover. Suppose B's half is defective, and A's cattle break in through B's half, which B ought to have kept in repair, B can not recover. In other words, where a man has a particular part of a fence allotted to him to keep in repair, if he fails to keep that special part in repair, and somebody's cattle, being lawfully on the adjoining close, break through that particular part, which he *alone* was to keep in repair, then he cannot recover if the fence is defective, because the injury was the result of his *own* neglect; but the joint fault of himself and his neighbor will not excuse his neighbor, or anybody else. All fences four feet high and in good repair, consisting of rails, timbers, boards, or stone walls, and brooks, rivers, ponds, creeks, ditches and hedges, or other things, which, in the judgment of the fence viewers having jurisdiction thereof, are equivalent thereto, shall be accounted legal and sufficient fences.

No man is obliged to build any fence upon the highway. That matter remains precisely as at common law. To step aside a moment from this legal discussion, I will say that in my opinion we ought not to have any road fences. We do not require any new legislation, however, in relation to this matter. If every man would throw down his road fence, and would either impound or take in trespass those cattle which encroach upon him, the whole matter would be settled. But that feeling which farmers like to have, of security, by night as well as by day, has induced them to build these fences, at a very large expense, vastly beyond, as I heard a member of this Board say, what any man would at first estimate. You are not obliged to build these fences, and if anybody's cattle get into your fields along the highway, whether you have a fence

or not; or, if you have a fence, whether it be sufficient or not, that person is liable in an action of trespass, and there is a lien upon the beasts for all the damage they do, whether you proceed by impounding or go to some good, honest lawyer and get out a writ of trespass.

I might remark, that by the statute, these rules of division of fences do not apply to village lots, and other lots which do not exceed a half acre. But in cases where the owner improves his lot, the adjacent proprietor is obliged to build one-half the fence whether he improves or not. I have thought it might be well, although it is perhaps a digression from my principal subject, to advert to the matter of boundaries between adjacent proprietors, in relation to the building of fences. Most of you understand that where a man goes on a piece of land, without the consent of the owner, and holds it openly, notoriously, peaceably, exclusively, but adversely, for twenty years, under our laws, he becomes the owner of that land ordinarily. This is not strictly prescription, because prescription is of an incorporeal hereditament; in other words, prescription is of a right of way, or the right to draw water, or the like; but it is gaining a title by long continued trespass. If I go on A's land, by his consent, and stay there forty years, I do not thereby get a title; but if I am a little more wicked, and go on without his consent, and stay there peaceably, openly and quietly, and hold notoriously adverse and exclusive possession, and continue that possession twenty years, I own the land, and he, through his laches, has lost it.

I do not know how many times the question has been asked me, but probably about twenty-five times a year, whether a man has lost his land in this way, where a division fence has been built a little off from the line—an accidental deviation from the true line. I always answer no, because such possession lacks the elements I have named—open, peaceable, notoriously adverse, and exclusive possession. Suppose one or both parties are mistaken, and there is no adverse possession; it is a mere mistake, and no title is gained or lost.

Another rule is, that parties should be very careful when they are building a division fence to build it upon the true line. The avaricious man frequently gets caught in the meshes of his own selfishness, in building a line fence. If I am building a division fence between myself and my neighbor, and there is a little uncertainty about the line, I will build it a foot inside of my own line

rather than a foot beyond the line, because when the fence stands wholly upon one side of the line, it immediately attaches to the soil and becomes a part of the realty to which it is so attached, unless built there by the consent of the owner of the soil. If I build my division fence wholly on my neighbor's land, by trespass, he owns the fence, and may enforce that right. So, unless the land was very valuable, much more so than the fence, I would be very sure that the fence I built was not upon my neighbor's land.

I have built about a mile of fence on a little piece of land, about thirty acres, that I own. I have a very good neighbor who has built his part of the fence and done very well. He has been very kind to me, and has put nearly all the fence on my land. Still, if he will only let it stay there till we agree to move it, we shall use it for the purpose of a line fence, and I shall not complain.

When one party ceases to improve his land or lays open his enclosure, he shall not take away any part of his partition fence adjoining the next enclosure improved, if the owner or occupant thereof will pay therefor what two or more fence viewers, on due notice to both parties, determine to be its value.

When there has been a legal record division of a fence dividing improved lands, and a proprietor proposes to lay waste his land, in order to exonerate himself from liability to maintain his part, he must give six months' notice of his intention to all occupants of adjoining lands.

Pounds and Trespass.

I notice here and there among the audience one of that unfortunate class called lawyers, and I suppose that every one of them knows precisely what I shall say about pounds and impounding beasts. If you were all lawyers, I would not utter a word on this subject. But there is a statute provision that each town shall furnish one or more sufficient pounds, which shall be kept in repair, and that they shall elect annually one pound-keeper at least to each pound, in which cattle which have been committing trespass, or which are found in the highway contrary to law, may be placed. That pound-keeper is not only to be elected, but he is to be sworn; he is not only to be sworn, but he is to give bonds to the acceptance of the municipal officers of the town; and if he fails in any one of these requisites, and there is any lack or laches, he is no pound-keeper, and is a trespasser if he undertakes to act as pound-keeper. Suppose there were a pound-keeper but no pound in a

town, the town is liable to indictment; but there can be no legal impounding of beasts where there is no pound in the town.

If you wish to impound a beast which you have found on your premises, you should first ascertain that there is a pound in the town; secondly that a pound-keeper was chosen; thirdly, that he was sworn; fourthly, that he gave bonds; fifthly, that those bonds were approved by the municipal officers of the town; sixthly, that the municipal officers have fixed and caused to be recorded the pound-keeper's compensation for keeping and feeding beasts committed to his custody. Then you must proceed strictly according to law. You must take up that beast, and within ten days you must drive that beast to the town pound, and make a certificate, stating your name, your residence, a description of the animal, the close in which the damage was done, the name of the town in which the close or farm is, and make a claim for your damages and unpaid charges; then the pound-keeper, if properly chosen and qualified, may receive that beast, may keep him enclosed in the pound the first day, and after that in some secure place where it may be more convenient if necessary. If a claimant appears and objects to the damages, or if no claimant appears, the pound-keeper shall appoint two disinterested appraisers to appraise the damages, if damages are claimed, and shall issue his warrant to them. They shall thereupon be sworn by a justice of the peace or by the pound-keeper, give reasonable notice, and go on and make an estimate, and make a sworn return to the pound-keeper of their doings. If the animal was taken up in the highway, and a penalty is claimed, that penalty should be claimed in the certificate filed with the pound-keeper, and then no estimate of damages is necessary.

The pound-keeper, in the first instance, when he receives an animal, shall immediately post at his own dwelling, and in two other public places in the town, *and keep posted for three days*, notice of the fact that he has received the animal, stating the name of the impounder or finder, the time and cause of impounding, a description of the animal, and calling upon the owner thereof to pay lawful damages and charges, and to take the beast away. Notice by the town crier, if any in town, must be given. If the value of the beast exceeds \$10 notice must be inserted in a newspaper, if any in the county is published. This is an extraordinary provision. When a constable posts the warrant for a town meeting, if it remains posted never so short a time, it is enough; but a

pound-keeper must *keep* this notice posted for *three days*. At the end of ten days, if no party pays the bills, and no replevin suit is brought, the pound-keeper shall sell the animal at public auction, after having posted up in two public places in town, at least forty-eight hours before the sale, notices of the time and place of sale, with a description of the property.

Now, after all this has been done, suppose that pound-keeper was not legally qualified in any respect; suppose your certificate is wrong in stating your residence, or the town in which the close is situated, or in not properly describing the animal, or claiming too much fees, or any other requisite has not been complied with, then you are "gone up." Suppose the pound-keeper makes any mistake in issuing his notices and putting them up, does not give a proper description of the animal, or the amount claimed, or suppose one of the preliminary notices is torn down before the expiration of the three days, and that can be proved, then you are "gone up," and you are a trespasser; and not only a trespasser, but a trespasser *ab initio*; everything you have done becomes unlawful, by a turn of the legal kaleidoscope, and you are a trespasser from the very beginning.

So, when a man comes with a case of that kind to my friend yonder, and asks him about impounding cattle, he either looks sour, or laughs, and says "you can't do it; you haven't a man in your town who can do it. I should not want to undertake to do it myself, and I don't believe any lawyer would do it." You say that is wrong. Perhaps it is; but it is just like any other proceeding *ex parte*, where there is a proceeding looking to the forfeiture of property, in which the legal notice is not directed to the true owners. It is a proceeding, as lawyers say, *in rem*, rather than *in personam*. It is a proceeding against a thing rather than a person. The owner may never have heard of the matter.

There are other provisions. If the pound-keeper is told that the beast is from a drove, or owned by a person out of town, he must adjourn the sale for thirty days. It is an *ex parte* proceeding; it is a statute proceeding; it is against common right; and therefore a statute proceeding of that kind is most strict law; as lawyers say, *strictissimi juris*. You must proceed exactly according to the provisions of the law, or you fail. To be sure, the statute points out this course, and if you go right, and there is a proper pound-keeper, you can hold the animal and get your damages in that way, or may recover the penalty—75 cents—for a horse,

mule, or any neat beast that may be found in the streets; and I suppose most people have the impression that this would be the proper mode to pursue.

As to cattle running in the highway, there was, until 1868, when a change was made, a statute providing that by a vote of the town neat cattle, and animals of a certain description, might run in the highway. There is no such law now, and the effect of that law was never understood by people generally. I have told you that no man was bound to build a fence upon the road—he never was in this State; and that law which permitted a man to turn his cattle into the highway did not, in my opinion, permit them to run on his neighbor's land, whether he had a fence on the road or not. I say this fully aware of the *dicta* in *Lord vs. Wormwood*, 26 M. R. It was simply a remission of the penalty for running in the highway. But that is all swept away; there is no such law now; and people are not only liable to the penalty, if they allow their cattle to run in the highway, but for all damages which they do.

There was a case recently tried in the Supreme Court, in which Judge Cutting delivered a very terse and able opinion. It was a case where a horse had been frightened by a hog, and an accident resulted. The Judge, in his sharp way, says,—“This animal, the swine, was unclean by the Levitical law, and prohibited by the statute law from running in the street, and the *owner or keeper* was liable for all damages that might ensue from his appearance upon any portion of the public highway without a keeper.” So it is an unsafe thing to turn cattle into the highway now unless they are attended by a driver or keeper.

A man has a right to take his horse into the highway, and drive him or lead him; he has a right to take his mare and drive her, with her colt by her side without being fastened, if that is the custom of the country, and that colt is protected, because it has a driver or keeper, in a certain sense; constructively, it is under the care of its owner. It is lawful to drive cows in the highway to and from pasture, and when the truant boy deserts his trust, and leaves them to wander unattended, the owner becomes liable for all damages they may do in the highway and for the penalty.

There is a practice of taking up stray animals and advertising in the newspapers, or in some other manner. This is dangerous. There is no law to protect this proceeding. If an animal, found doing damage or in the highway, is kept by the finder for more than ten days, and that for the purpose of impounding, he

must lose the keeping of the animal, and forfeit one per cent. of its value for each week till he does impound or the forfeiture amounts to the value of the beast. In other words, you may hold animals for the purpose of impounding and not otherwise.

Now, how are you going to take care of your neighbor's cattle if this impounding is as difficult as I have described it? and it certainly is, as any lawyer will say. There may have been many cases where cattle have been impounded and sold, and where the parties have submitted to the sale; but there has been scarcely an instance, within ten years, where the case would have been found sound throughout. I know of none. You may say that the advice I am going to give is selfish. Not entirely so. There is a remedy "short, sharp and decisive," and that is the remedy by writ called trespass *quare clausum fregit*. Bring your action of trespass against the owner or keeper of the cattle, and attach the cattle as for a lien upon them, and you may hold them even though it is the man's last cow. Some would say, "*quere*" or "*dubitator*," but I do not; I will give others the benefit of the doubt. I say you may hold any animal by this lien, if you proceed as you ought, although it is more difficult than the ordinary practice. There are a few instances in which general rules do not apply. For instance, take the law with relation to taxes. A last cow may be taken for taxes, but the implements of husbandry can not be. But ordinarily, men who own cattle are able to pay the damages resulting from their trespass. You may attach their other property or resort to the lien, and your case is sure. You may bring your action directly in the Supreme Judicial Court, and recover full costs. In ordinary personal actions, where the damages to be recovered are less than \$20, the plaintiff cannot recover as costs a sum larger than one-quarter of his damages, though the costs should be a hundred dollars or more; but in *trespass quare clausum fregit*, he may recover full costs, though he recover only one cent damages.

You may say that I am selfish, in that a lawyer must be applied to in this case. Suppose he is; he may make five dollars out of the operation, and ordinarily does out of a writ of trespass of this kind; but impound an animal, with all the difficulties that lie in the way, and you will probably involve yourself in your attempt to confiscate another's cattle, in a law suit, which will cost you a great deal more than an action of trespass, and the lawyer will derive a much larger fee than he would in the trial of a simple action

of trespass *quare clausum fregit*. So my advice, honestly, fairly and squarely given, is "don't resort to impounding for redress in any case against a known owner, but resort to your action of trespass which is decisive and certain." I see one or two ministers of the Gospel before me, and perhaps I would modify that so far as to say, that I would tender the olive branch first.

I have a suggestion to make outside of the legal view of this matter, and those of you who have seen my little lot of 30 acres know that I mean what I say. Your statutes require that a fence shall be four feet high, and of such a character that the fence viewers shall regard it as a fence. Let us see. If you want to build a stake and rail fence, you must have, for every length of fence, two stakes, a cap, a bunk, and four rails of ordinary size, to satisfy the fence viewers. You build in that way, in many instances, a rather questionable fence. How much will it cost to make it five rails high instead of four? You will need no more stakes, no more caps, no more bunks, and only one more rail, the cost of which is a mere trifle, and then, if your fence is otherwise properly built, you will have a fence about which no question can arise. One rail more on your division fences, and your highway fence dropped out of the way, would eventually save an immense amount, protect your highways from snow drifts, make better neighbors, and a richer State.

Highways—The Law of the Road.

It scarcely becomes me to say anything upon the necessity of highways, the manner of building them, or the advantages to be derived from thoroughly constructed roads throughout the country, after the elaborate and exhaustive argument of the gentleman who spoke upon this subject yesterday. I will only speak of some special legal matters which were not appropriate to, or which he did not see fit to weave into, his very able discourse on this matter. In the first place I will say that in locating a road, whether it be a common town road, or a county road or public highway, as it is sometimes termed, the public do not acquire the absolute fee in the soil, any more than do the public become the owner of the absolute fee in the bed of this river. All non-navigable streams are thus situated, that each riparian proprietor owns the soil to the middle line of the water—*ad flum medium aquæ*. The public have the easement, the right to attach a servitude to the water which runs over the bed of the stream. Precisely analogous to

this is the location of a highway. The public have an easement over this land; they place a servitude of public travel upon this land over which the roads are located; but whenever these roads shall be abandoned, the fee of the soil, and the soil itself, reverts to the adjacent proprietor over whose land the road runs.

Here, then, is an important principle. If the public have only the right to travel over this road, you own that land out of which that road has been carved, except for purposes of public travel, so that if any grass grows thereon, you may enter and harvest the same, without any obstructions to the public travel. If there is any gravel or stone there which the highway surveyor does not need for the repair of the highway, you may go upon it and take therefrom these materials, without being a trespasser, from the familiar principle that you cannot be a trespasser upon yourself. Then you have the right (unless the town supersede you, which they may do, to a certain extent, under the statute,) to plant trees upon the land; you have the right to smooth down the side opposite your farm to make it more beautiful, and even to cultivate crops, if you do not injure anybody. If anybody should enter upon the side of the road adjacent to your fence, and take therefrom grass, or trees, or stone, or gravel, he would be just as liable to an action of trespass *quare clausum fregit*—in other words, for trespass, for breaking into your close—as if he entered your enclosure.

I make this statement because the matter was suggested to me by Mr. Goodale, and for this other reason also: that if the people of the country are only made aware that they own the fee in the soil where the roads exist, they might feel more interest in planting trees, and the highways be made more attractive to the eye, and really the whole country more beautiful.

Do not understand me to say that you have the right which certain people claim and exercise upon the public highway, whether it is adjacent to their own homes or not, to raise obstructions, like piles of wood, brick or lumber, which may hinder public travel. If you do that you are personally liable for every injury that arises therefrom upon the public highway. The town may be liable too, and if the injured parties do not think you responsible, they would be likely to resort to the town, and the town would look to you for indemnity. The highway surveyor has a right to remove all obstructions from the road, and haul them away to a safe place, and if the owner does not remove them, he has the right to put up

a notice and sell them. It is a very simple process, not like selling property for taxes, or impounding beasts.

Towns are not necessarily obliged to grade their roads the whole width of their location, nor to make them *absolutely* safe. Where the country is sparsely populated, such a labor might cost the entire valuation of the town. Towns are only compelled to *make* and keep in repair a way of reasonable width, considering the kind and amount of travel, where people can pass and repass with reasonable safety, with their horses, teams, carts, carriages, &c., at all seasons of the year. If any obstructions exist outside of such travelled path, and within the limits of the road, which neither the town in making the road, nor nature, placed there, and a person *necessarily* travelling out of such beaten track, is thereby injured, he being in the exercise of ordinary care, and no other cause contributing to produce the injury, may recover of the town having notice; or he may recover of the individual by whose fault the defect existed, as of a *tort-feasor*. If the traveller, being out of the usual path, comes in collision with natural obstacles, or those necessarily caused by the town in making or repairing the way, he is out of the travelled part at his own risk. Of course obstructions placed *in the travelled path*, except as a warning against defects, or to prevent the spread of contagious sickness and the like, would create liability.

“*Law of the Road.*”

This relates to the rights and duties of travellers upon the road, and is a subject in which no class are more interested than farmers. There are statutes which substantially cover this matter. “Where persons travelling with a team are approaching to meet on a way, they are seasonably to turn to the right of the middle of the travelled part of it, so far that they can pass each other without interference. When it is not safe or is difficult on account of weight of load to do so, a person about to be met or overtaken, if requested, is to stop a reasonable time at a convenient place to enable the other to pass.” The rule in New Brunswick, and perhaps in other British Provinces, is the opposite of this, (i. e. to turn to the *left*.) If you digress from one statute rule and injury results from that digression, you cannot recover damages, nor can you excuse yourself for injuries inflicted upon others, caused by a departure from this injunction.

“When a person with a team is stationary or travelling slowly

on a way at a place unsafe or inconvenient for passing him with a team, he is, if requested, to drive to the right or left, or to stop a reasonable time at a convenient place to allow the other to pass."

The old statute of 1840 did not have the words "if requested," nor enjoin any request except where a party overtook another; but still the decision in the case of *Kennard vs. Burton*, 25 Me., settled the principle, that a party, seeing that another has a load of such magnitude that he cannot conveniently turn from the road, is bound, being in a light carriage, to stop a reasonable time, at a convenient place, to let that team pass. On the other hand, I apprehend that it is the duty of the driver of a heavy team, if he sees that he is approaching a lighter team, to stop his team, whether requested or not, in a convenient place for the other to pass, and if any accident happens in consequence of his neglect to do this, he is liable for damages, the other party being in the exercise of ordinary care.

Suppose you see a team stationary in the road, or you are approaching a loaded team, and undertake to drive by. Here the injunction is peremptory. You cannot blame a teamster for moving slowly. You at your own risk put the whip to your horse and attempt to drive by. You should request him to wait. It is always safe to make this request of the other party. To be sure, if you did not do it, he would not be justified in assaulting you or unnecessarily crowding you out of the road, but it is your bounden duty, when you want to go by a team which is moving too slowly for you, to call upon the party and request him to stop there, or at some other place near by, or to turn out where you can safely pass.

Every person who claims damages of another who travels upon the road, must be in the exercise of ordinary care himself. If any damages occur, partly by his own fault and partly by the fault of the other party, he cannot recover. If, however, he is guilty of some little neglect, but his neglect does not contribute to produce the injury, he may recover. But if his own carelessness helps to produce the injury, he cannot recover any damages, though the other party was in fault. You may be seriously injured by a collision with a team or otherwise, but if you have done some wrong yourself, however small, which contributes to produce the injury, then you cannot recover. You must not allow your team to remain stationary so as to obstruct travel, nor to be on the road without a driver.

Three or more bells are to be fastened to your horse or the foremost horse hauling any carriage on snow without wheels. For a violation of any of these statute provisions, a party is not only bound to pay all civil damages which may result therefrom, but is liable to be punished by a fine not exceeding \$20.

Highways and Roads.

Highways are to be made safe and convenient for travel with horses, carts, wagons, carriages, &c., at all seasons of the year, by day and by night. Towns are *obliged* to keep these roads in repair, and if they have not done so, the town having notice of the defect, and you are injured in consequence, is liable to damages, if you were in the exercise of ordinary care;—not always watchful, not always cautious, not always vigilant, but using such care as men who travel ordinarily use. No matter how slight the defect, if it is a defect, although it be a stone not larger than a robin's egg, if it be really a defect, and the jury so find, the town is liable.

But when you are travelling upon the highway with your teams, always be careful to exercise due caution. If you see danger ahead, haul up your team; do not knowingly drive into difficulties; because if you go where ordinary prudence would dictate that it is not safe to go, and meet with an injury, you suffer by your own carelessness, and cannot claim damages of the town.

It is not necessary that notice of a defect be given to the town officers; notice to one or two of the inhabitants may be sufficient. In fact, where a defect has existed for such a length of time, and is so obvious, that from the nature of the case the inhabitants, or some of them, must be presumed to have knowledge of it, notice may be inferred without any absolute proof of notice to the town.

The law does not compel towns to put section men upon the highway nor to light the highway. You have a right to travel at night; but when you do, you must exercise a vastly higher degree of watchfulness, vigilance and caution than would be required in the day time. Suppose you are travelling upon a highway over which you have never passed before, with a horse that is a stranger to the way, you would not be justified in putting on the whip and driving *rapidly* over hills and through valleys in the night without seeing where you were going. Constant watchfulness and vigilance are then required; and that is only "ordinary

care" in the night. Less watchfulness and vigilance would make "ordinary care" in the day time.

Fires.

As to fires which farmers must necessarily set. If a man wilfully sets a fire upon his own land, or upon the land of another, with the intent to commit an injury, he is liable for all damages anyhow, and probably, in some form, criminally. But in all forest regions like these, it becomes necessary at times to set fires for the proper clearing of the land. The old statute of 1840 says that a man may set fires, in a proper, prudent manner, and must watch and guard them afterwards, for necessary purposes, and be protected, but be holden for any deviation from that rule. The statute of 1857 is substantially the same, and I suppose the new statute of 1870 will not be essentially different. You may set fires for necessary purposes—to burn over a felled piece, to burn up the stumps, rubbish, and other material upon your land; but it should be a reasonable necessity. Fires should never be set for amusement, any more than the public highways should be used for wrestling. You may travel upon the highway, but if you go there to indulge in sports, and get your necks broken by reason of defects in the way, there is no remedy against the town. So you must not set fires except for necessary purposes. In a proper way and prudent manner, you may set fires. Not at a time when it shall be *absolutely* safe; not at a time when you would put your life or soul's salvation at stake that no injury would ensue, because no man would ever dare to set a fire in that case; but when men of ordinary prudence and care would deem it reasonably safe to set fires, and then you should exercise such watchfulness and vigilance in watching and guarding such fire as a man of ordinary care and prudence would do, considering the great injury which might result from any neglect in that particular.

It is hardly possible for a lawyer to decide upon a particular statement what would be regarded as a suitable time to set a fire. He knows the law precisely as he knows the multiplication table, but there is such a vast range of discretion with a jury as to whether a fire has been set at a proper time or an improper time, that it is impossible for him to foretell the event of a suit. The rule makes a jury of twelve men entire autocrats of the whole question, and I have been inclined to the opinion that some of the hardest verdicts have been rendered against men in this matter of

setting fires that have ever been given in any class of cases, because if they think the setter of the fire was any way in fault, they may saddle him with all the necessary or probable consequences of that fire, which may escape from his land to the land of A, thence to that of B, C and D, clear down to the end of the alphabet. This apparent bias may arise in part from the fact that the sympathy of the jury is awakened in estimating the loss of the sufferer, and perhaps comparing the poverty of one man with the wealth of the other. But that is one of the incidents attending our system of jury trials, which the law cannot fully remedy.

If any man should set a fire to-day, dry as the earth is, to burn stumps, or burn over a felled piece any where within reach of civilization, and damage should ensue, I would say if I were a juror, that he ought to be held responsible for it, because it is not a proper time. This is a question of *fact*, not of *law*. Frequently, I admonish my neighbors not to set fires, so as to keep them cautious and vigilant, but there are times in the course of the year when my neighbors may set fires without my leave. It is sometimes necessary that these fires should be set. It was by this means that the dense forests which sheltered savage men and wild beasts were cleared, thus introducing the glorious civilization which blesses New England. The right to set fires has not yet disappeared, and it is for every man to judge for himself, at his own peril, that he gets a fire at the proper time, and manages it in a prudent manner.

I think, as my friend Mr. Chamberlain says, in his works already published, that a great many trees have been destroyed that should not have been, and if every farmer would read the admirable paper he has written on that subject, I think there would not be the wonderful hankering to burn up the forests which has already devastated a portion of the country. I would commend that paper to the careful perusal of farmers, because our forests are now one of our most important elements of wealth,—one of the elements which ranks Piscataquis county among our richest counties in natural resources. The wants of the world have become such that every tree that can be sawed anywhere is valuable, and the time is coming when the countries on the shores of the Mediterranean, and even as far east as Jerusalem and Smyrna, for ought I know, will call upon the west for its forests. So be careful how you destroy these trees by fire; but when it becomes

necessary, you have the legal right, in a proper and prudent manner, to do it; but if you do not act properly and prudently, you are answerable for all the consequences, even the destruction of villages and cities.

I will say but a single word in relation to another kind of trespass. If any man enters upon another man's garden or field, after having been once forbidden, he is liable to a fine of five dollars. Should he take fruit from any tree, he is not strictly, at common law, holden for larceny, but he is held, under a special statute, for an offence about equal to larceny. By a statute passed in 1869, our Legislature enacted, that any person entering upon any orchard, fruit garden, vineyard, or any field or enclosure wherein is cultivated any domestic fruit whatever, and plucking any of the fruit, shall be fined \$20 and costs, and imprisoned not less than thirty days; and each owner or person employed in such orchard or garden is created a constable to arrest the offender, and carry him before a magistrate or other tribunal, that he may be properly punished.

Cruelty to Animals.

There is another matter which our Legislature in 1869 took up which has struck me with a great deal of force. It had called out legislation in other States, and is a great step in moral, humane, and religious progress. The Sacred Word informs us that "the righteous man regardeth the life of his beast." That most tender hearted poet that ever lived, that man whose effusion was almost angelic—Cowper, says

"I would not enter on my list of friends
(Though graced with polished manners and fine sense,
Yet wanting sensibility) the man
Who needlessly sets foot upon a worm.
An inadvertent step may crush the snail
That at eve crawls along the path;
But he that has humanity, forewarned,
Will tread aside, and let the reptile live."

Human slavery in this country was a blasting and impoverishing institution to the soil on which it was planted, bad for those who practiced it, and bad for those who, with less interest in it felt bound to uphold it; but for that reason alone, slavery would not have been abolished in this country for a hundred years. It was that feeling in the heart of every man, that "light which lighteth every man that cometh into the world," that feeling that it was wrong and cruel to hold human beings in bondage, the tears that

the tender-hearted shed, the great sympathy that was aroused by ministers of the Gospel, sometimes called "political preachers,"—it was these which finally blotted out slavery in this country. But here is another question, that of cruelty to animals. Other States, even New York, the great emporium of western commerce, the great commercial light of the occidental world, yet being the wickedest place on God's earth, has been subjected to a law somewhat similar in its character to the law which has been enacted in this State to prevent cruelty to animals. I wish I had the power to make you feel just as I feel in relation to all species of cruelty. There is difficulty in enforcing these laws, because when you see an act of cruelty committed, others may think it is not cruelty, and they like the excitement. I wish the people of the State of Maine were all educated up to this act. It is so like the New Testament I must read it to you. In Bangor they have a Society for the Prevention of Cruelty to Animals, and there this law is enforced; and so in other large places in this State, men and women are giving their attention to this subject. I cannot make you feel as I feel, but I am happy to read to you the embodiment of the wisdom of our Legislature. If that Legislature never did another act that was worth copying, if it did a great many foolish things, (as I know it did some) that act alone, I think, is worth more than the loftiest monument of marble that could be erected to their memory. Here it is:

"SECT. 1. Whoever shall overdrive, overload, overwork, torture, torment, deprive of necessary sustenance, cruelly beat, mutilate or kill, or cause or procure to be so overdriven, overloaded, overworked, tortured, tormented, deprived of sustenance, cruelly beaten, mutilated or killed, any horse, ox, or other animal, and whoever having the charge or custody of any such animal, either as owner or otherwise, shall unnecessarily fail to provide such animal with proper food, drink, and shelter or protection from the weather, shall for every such offence be punished by imprisonment in the jail not exceeding one year, or by fine not exceeding two hundred dollars, or by both such fine and imprisonment.

"SECT. 2. Every owner of or person having the charge or custody of any horse, ox, or other animal, who shall knowingly and wilfully authorize, or permit the same to be subjected to or suffer unnecessary torture or cruelty, shall be punished for every such offence in the manner provided in section one.

“SECT. 3. Every owner, driver, possessor, or person having the charge or custody of an old, maimed, or disabled or diseased horse, mule or other animal, who shall cruelly work the same when unfit for work, or cruelly abandon the same, shall be punished for every such offence in the same manner provided in section one.

“SECT. 4. Any person who shall carry or cause to be carried in or upon any vehicle or otherwise, any animal in an unnecessarily cruel or inhuman manner, shall be punished in the same manner provided in section one.

“SECT. 5. No railroad company in this state, in the carrying or transportation of cattle, sheep, swine, or other animals, shall confine the same in cars for a longer period than twenty-eight consecutive hours, unless delayed by storm or other accidental cause, without unloading for rest, water, and feeding for a period of at least five consecutive hours. In estimating such confinement, the time the animals have been confined without such rest on connecting roads from which they are received, shall be computed, it being the intention of this act to prevent their continuous confinement beyond twenty-eight hours, except upon contingencies hereinafter stated; and animals unloaded for rest, water and feeding under the provisions of this act, shall be properly fed, watered, and sheltered during such rest by the owners or persons in custody thereof, or in case of their default in so doing, then by the railroad company transporting them, at the expense of said owners or persons in custody thereof.

“SECT. 6. If any owner or person in charge of said animals refuses or neglects to pay for the care and feed of animals so rested, the railroad company may charge such expense to the owner or consignee, and retain a lien upon the animals until the same is paid; and no claim for damages for detention shall be recovered by the owner or shipper of any animals for the time they are detained under the provisions of this act.

“SECT. 7. Any railroad company, owner, consignee, or person in charge of such cattle, sheep or other animals, who shall violate any provision of the fifth or sixth sections of this act, shall for each and every such violation, forfeit and pay a penalty of one hundred dollars.

“SECT. 8. Any person may take charge of any animal whose owner has abandoned it, or is failing to properly take care and provide for it, and may furnish the same with proper shelter,

nourishment and care at the owner's expense, and shall have a lien on such animal for the same.

“SECT. 9. In all cases where a lien is given under this act, the person or corporation having such lien may sell such animal or animals at public auction, in the town or city where such animal was found or is detained, after giving the party claiming or owning such animal three days' notice in writing; or in case such party cannot be found, then by publishing notice of the time and place of sale three times in any newspaper printed in the county where such animal was found or detained; and from the proceeds of such sale may deduct all costs, charges and expenses, and a reasonable compensation for trouble in the matter, and hold the balance, if any, for and pay over the same on demand, to the party or parties owning the said animal or animals, or his or their legal representatives.

“SECT. 10. It shall be the duty of all sheriffs, deputy sheriffs, police officers and constables, to prosecute all violations of the provisions of this act which shall come to their notice or knowledge; and all fines collected under this act shall be paid over to the treasurer of the city or town where the offence for which the fine is imposed, was committed; and in case a society should be formed in such city or town for the prevention of cruelty to animals then such fines shall inure and be paid over to such society, in aid of the benevolent objects for which it shall have been formed.

“SECT. 11. The several municipal and police courts and trial justices in this State shall have concurrent jurisdiction with the Supreme Judicial Court of all offences under this act.”

This law is an effluence from that genuine spirit of humanity for which many of our people are noted in this country, and for which I would I could say that all the citizens of the State of Maine were celebrated.

Let me say, that I wish our Legislature would enact a law, no matter how unpopular it might be, that it should be unlawful for any man to use upon any horse, reasonably well broken and reasonably under the control of his driver, any check rein whatsoever, and any person using such a rein should be liable to a fine of \$20. In breaking a young horse you may be obliged to use rather severe methods, and so some things which may seem a little cruel, unless you have more wisdom than most men, because they are intractable and very unsubmitive; but when a horse is well broken, and rea-

sonably safe, the use of a check rein is cruel. Hardly a day passes that I do not see, here in Foxcroft, tied up at some grocery store, a horse with his ribs as prominent as if he had swallowed a lime cask head foremost, with his poor head drawn up and his mouth perhaps cut half way up into his jaw. That is wrong; that is cruel; that is wicked. The agony the horse thus suffers is incalculable.

Then, again, this hurts a horse in his travel. As a mere question of economy it is wrong. My experience is, that my horse gains in time two miles out of eight by the absence of the check. It is much more convenient. I do not object when you have a high-strung horse, that has stood in the stable for a week or two, or for a few days, (he ought never to stand more than a day or two) and is full of life, to your putting a check upon him for half an hour. It may be necessary to hold that horse in subjection under certain circumstances. The old-fashioned martingale has passed away, almost entirely. That was somewhat cruel. Our livery stable keepers are getting more wisdom. When I find a pretty old horse checked up taut for me to drive, I think that man is going to fail in his business, unless he cheats somebody. Much as I might claim superiority over a horse, I believe that when he puts his head down going up hill he knows better than I do the easiest way for him to travel. Then how convenient it is to be without a check rein when you come up to the watering trough! Your horse can drink at his leisure, and swing round his neck to drive off the flies, and he will feel as nice and comfortable as need be. I have hardly ever driven a horse, however spirited he might be, that I did not, after I started out from the village, unhook his check rein. I know that this is not popular, because I know a good many think their horses look better and handsomer when they are checked. Look here. You are made of flesh and bone, and the structure of your bodies is not so very materially different from the structure of the horse. You are subject to pain as the horse is. Suppose somebody should suggest that you would look a little better if you had a straight pole tied to your back and your head lashed back to it! It might be very nice for you to walk with your head braced back for a time, but I don't think you would like to continue it a great while. I apprehend that more agony is caused to our beasts of burden by the use of the check rein than by all the blows of whips or clubs that are inflicted upon them. This is not a popular doctrine, I know; horse jockeys don't like it; but, as I told you yes-

terday, I have given up trying to be popular. The first few years of my life, I undertook to be a popular man, and I found it the hardest road I ever undertook to travel in all my life.

I feel very much obliged to you for the kind manner in which you have listened to me. I have attempted to state the propositions clearly, but the law is not an exact science, like mathematics. I have said enough, outside of the law, to identify myself; to show you, if not that I am like the Pharisee, "thanking God that I am not like other men," at least that I have opinions of my own, and I intend to entertain them until I am properly convinced of their fallacy by sound argument. As to this matter of humanity, it is one on which I feel deeply. I have lost a good many warm friends by checking them in their cruelty to their animals. I have been thought by my neighbors to be almost fanatical in my attempts to prevent what I thought was cruelty to animals. But I was so made up; I do not claim any merit for it; but I say that with all the true religion and all the true piety in the land, we need a humanity that shall take in not only the unfortunate of the human race, but even the brute creation, committed by the Divine Author to our care, and which should be protected by a kinder and more gentle hand.

Ladies and gentlemen, again I will say I am very much obliged to you for the kind attention you have given me in this discourse which I have delivered without previous preparation.

Hon. A. M. ROBINSON of Dover. It strikes me, Mr. President and gentlemen, that the whole subject matter embraced in the lecture has been pretty thoroughly exhausted by the eloquent gentleman who has addressed us. I can add nothing to the leading principles laid down, or the leading instructions given. All I can do is merely to epitomize, or to make a little summary of some of the generalities, and that I will endeavor to do very briefly.

Let me state a little fact which occurred to me while the gentleman was speaking of the cost of road-fences. I suppose a fair average for the expense of building and maintaining a highway fence would be a dollar a rod, and that, I think is a low figure. Upon that basis it has cost this town of Dover \$48,000 for their road fences; and so other towns in proportion to the length of their roads. I know the length of the highways in the town of Dover, and I base the estimate upon a dollar a rod.

With regard to trespasses of cattle—the most practical thing

touched upon here, the one of most general interest, and the one which gets, oftener than any other, into the law—the general rule is, that every man is bound to keep his cattle upon his own premises. That was the absolute English common law rule, and by the statute it is only qualified, as the gentleman has told you, in one single instance. There is only one solitary exception, as I understand the law, and as I understand him to have laid it down, and that is, in adjacent closes, in premises occupied by yourself and by your neighbor; and there the provision is, that you may compel him to build his half of the fence; or, if he refuses to build it, then the law allows you to build his half, and you have a claim upon him for that portion which he should have built. Then, all that being accomplished, if through his fault cattle break through into your premises, you may recover damages from him. If they break through from your fault, then you cannot recover.

Mr. LEBROKE. And to make it entirely clear, the neighbor's fault can only be from not keeping up his particular part of the fence.

Mr. ROBINSON. Yes, that is the proposition. You see how very narrow the exception is. The general rule is absolute, with that sole exception, that you should keep your cattle upon your premises.

Now with regard to enforcing your rights at law. The difficulties in the way of impounding have been fully stated. It is a resort to which I never advise any client. The reason is, that all he is to gain out of it, if anything, is the sale of the animals; he gets nothing until he gets through the long and tedious process, and comes finally to the sale. He gets that by virtue of a title either in himself or somebody else. Well, it is not an ordinary contract of bargain and sale, where latitudes are given, and where courts and juries may come in to aid and assist, and give a fair construction to a binding obligation. It is a statute sale, and the title is acquired, purely and simply, by virtue of the statute alone, and the owner of the beast is not a party to it, in any single step it takes. What does the law say, and wisely say? It says, where you attempt to enforce a statute title you must follow every iota in the statute, or else your title fails, and you are a trespasser from the beginning—*ab initio*. Therefore lawyers never advise impounding. There are other and serious difficulties. For instance, in most of the towns there is no pound, and no pound-keeper. It is a complicated, troublesome and expensive process.

Towns are bound by the statute to make a pound. I think the exact language of the statute is "to maintain a town pound." That provision is sometimes evaded by a vote of the town, that the barn or barn-yard of a certain man shall be a pound. I am inclined to think that that would be reckoned maintaining a town pound.

Then with regard to suits in trespass. If you seek a remedy in law, it is by a suit for trespass, and that is plain and clear, and the claim for damages attaches to the animal. I understand the law to be as it has been stated to you. Whether it is exempt under the general provisions of exemption or not, you seize the animal and hold it, if you proceed right, for the damage which the animal has done, against all parties. You strike at the thing, instead of the man, the owner, and hold it. It is a special provision of the statute, having no force in any other instance that occurs to me, except in the one instance of taxation, as has been stated.

Now let me relate to you a little of my experience in this matter of suing for trespass. Cases occur very often, and they are the worst cases for a lawyer, because they are almost always the result of an ebullition of temper. A man sues his neighbor because he got mad with him about his cattle. You see how vexatious such suits are. They are almost entirely costs, with no damages. The law regulating costs is, that wherever trespass is committed on your premises, wherever a man touches your soil, no matter how lightly, you may sue in the Supreme Court, and have your full costs. Ordinarily, if you recover less than twenty dollars damages, you cannot recover as costs more than one quarter the amount of the damages; but this is an exception. What is the result? Why, cattle break in over your lines and eat a little of your grass. You drive them out once and notify the owner. He refuses to take care of them. Perhaps, when you go and ask him about it, he will tell you that your cattle trespass upon him. You deny it, get into a controversy, and bad blood arises, and by-and-bye comes the sheriff, and suits back and forth. Now, all in the world there is in them is vexation and trouble and costs, and all growing out of bad blood; and hence the aphorism, that the law makes the worst line fence in the world. I know of repeated instances where parties have spent time enough and money enough to settle a little controversy, which did not involve damage to the amount of four and sixpence, to build a hundred rods of good yoke fence.

Mr. LEBROKE. That is so, over and over again.

Mr. ROBINSON. It is not an uncommon thing. They are the most vexatious, the most hurtful, the most foolish law suits in the world.

Now, gentlemen, what is the remedy? I can give you a rule. It is not a legal rule, but I can lay down a rule which will relieve you from all this trouble, and which will save your time, temper and money. It is not a very profitable rule for the lawyer, but it is an excellent one for the citizen; and that is, just so often as your neighbor's cattle come upon your premises, just so often drive them home to him.

Mr. LEBROKE. There was one thing which I was determined more fully to explain in my speech if I neglected everything else. How often it is, when a creature gets into a man's enclosure, that he goes and puts an advertisement in the papers that that animal will be sold, if the owner does not take him away and pay the expenses. Let me say, there is no such law. Your advertising in the newspaper does not amount to anything, except to give the publisher so much money. If you take up such an animal and do not take it to the pound within ten days, you are liable for trespass, and liable to pay one per cent. of the value of that animal, however valuable he may be, and lose his keeping besides. There is no law for advertising in the papers except by the pound-keeper. Whenever the animal is worth more than ten dollars, he must, in addition to the three notices he is required to post up, put an advertisement in the paper.

Mr. ROBINSON. That question was in my mind while the gentleman was speaking: What are you to do with an estray? It is a most embarrassing question. For instance, a year ago I found a stray horse in my pasture. I inquired of all my neighbors and no one could tell me to whom the horse belonged. My first impulse was to turn the horse into the road; but in making my inquiries I came to the conclusion that the horse was what is technically called in the statutes "an estray," and it occurred to me, Suppose the owner pursues the horse, and finds that he has been in my field, and says, "What has become of my horse?" "I have turned him into the road." "Why did you do that? Here is the law, requiring you to put him in the pound, I shall hold you to answer for my property." Suppose I had taken the horse up and attempted to advertise it, with all the loopholes in the statute, in view of which even I would not undertake to receive a title myself. Or suppose I had advertised it as an estray, and some person had

come up and said, "It is not an estray; it is my horse, and there is the document to prove it."

Mr. LEBROKE. I will say, as my brother Robinson does, that I should not want to meddle with an estray at all; but if I could easily get an estray out of my sight, I should be glad to do so. I should feel as the Irishman did in regard to the skunk he caught. He said the second time he ever caught a skunk he should let him alone! I see the difficulties into which my brother Robinson has drifted.

Now, I say, there is the single instance in which I think a pound becomes absolutely necessary. That is the only way in which you can get rid of that estray properly. You see you cannot bring an action for trespass and hold the horse without the liability of getting yourself into trouble, because you do not know who the defendant is. I do not know any way for you to get rid of him, unless you turn him into the road, and if it is in the winter season, you have no right to turn him out to starve. So I think the only legal course is, to make your certificate to the pound-keeper, and take the hazards of impounding; and if the man who has lost the animal should refuse to pay the bills, he would do that which would be morally wrong. Practically, I think I should be careful to see that there were no witnesses, and turn the animal into the road.

The CHAIRMAN. I want to congratulate the people of Piscataquis county, for I must say that in all my experience I never before saw two lawyers in a village agree as these two gentlemen do.

Mr. LEBROKE. But sometimes we quarrel awfully.

The CHAIRMAN. Well, you have a remarkably good time making up.

Mr. ROBINSON. Oh, yes, that is the best of it.

QUESTION. Mr. Lebroke has said that if a proprietor adjacent to me refuses to build his part of the fence, I may build it and recover double the cost from him. Does this claim hold good as a lien upon the land, suppose the man is a poor scamp?

Mr. LEBROKE. No sir, it does not. The action is a personal action, and not a lien upon the land.

QUESTION. Have the highway surveyors a right to use a certain per cent. of the tax for setting out trees?

Mr. LEBROKE. I think they have, if the town so vote.

Prof. FERNALD. It seems to me that the investigations on this

subject should lead to something practical in regard to one point. It appears from the statements that have been made by Mr. Lebroke and Mr. Robinson, that when a stray horse goes into an enclosure, the individual, instead of finding that he has a horse upon his hands, is quite likely to find that he has an elephant. Is not some legislation needed to remedy this difficulty?

Mr. LEBROKE. The answer that the Legislature would make would be "we have already pointed out, very particularly, the duties that you shall perform." Then you reply, "the people of our town do not furnish a pound." Then the Legislature would reply, "you ought to get the town indicted, and, have a pound made, and see that a pound-keeper is duly chosen." That is the difficulty. I think there ought to be some different legislation. I think the whole impounding system ought to be swept away, and something or other (if anything of that kind is to be had) substituted in its place. It is a very difficult proceeding, but it is like all *ex parte* proceedings, *in rem*, which are always difficult.

Mr. LUCAS. Suppose a drove of cattle come along, and you have no fence, but still there are the usual number of men to drive those cattle, and some of them get into your corn?

Mr. LEBROKE. They are liable for the damages, every time. The drivers, at their peril, should keep them off your premises.

Mr. SWETT. Suppose A and B own adjacent farms, and there is a line fence to be built. A wishes the fence to be built, and goes on in a lawful way and gets a division of the fence, and builds his part, and B does not. As I understand it, A is authorized to go on and build B's part of the fence. He builds it, and when he attempts to get his pay he finds that B's farm is mortgaged for all it is worth, and there is no chance for him to get a cent for building B's part of the fence. The question which I wish to ask is, Can A get pay for building that fence from the man who holds the mortgage on this property?

Mr. LEBROKE. I do not know that that matter has ever been litigated to a decision; but in one case that comes to my mind, where I was called on for instructions, I counselled the party to make the request both of the mortgagor and mortgagee. But when I came to bring my action I should not want to say, at this moment, where I should land. I think the mortgagor in possession is the owner, as against all the world, except the mortgagee. But in a case of clear insolvency I am very sure that I should serve a notice upon both parties. I am not clear that the mort-

gagee, out of possession, would be so far the owner as to be held to this responsibility. If there is any difficulty there, I will say it is one of the difficulties incident to owning property and being contiguous to those who are insolvent. The law presumes everybody to be solvent and honest, but in some instances it has been found that that presumption in relation to honesty, was not conclusive, and sometimes men are not solvent. I do not know that the question has been adjudicated. I am very glad it has been asked, for now you will begin to know how to pity a lawyer. He will get the best education he can in his early days, burrow in a law office for years, and spend the best part of his life in trying to prepare himself to attend to cases as they come, and yet there are cases constantly arising about which there are doubts until the court adjudicates upon them, and it is doubtful how the court will adjudicate; and when they do, you will sometimes find the judges five one way and three the other. I would like to hear from Mr. Robinson.

Mr. ROBINSON. It strikes me that you cannot recover from the mortgagee.

Col. SWETT. I asked the question because I have a case of that kind. (Laughter.)

Mr. LEBROKE. I always throw a drag-net, and hold everybody I possibly can. I should give notice to the mortgagee, and if the mortgagor was absolutely insolvent I should hold the mortgagee if I could; not having much faith in the claim if mortgagor was in the possession and mortgagee out.

Mr. DOE. Would the man who built the fence have the right to enter and remove it at any time, without rendering himself liable for trespass?

Mr. LEBROKE. I do not think he would. Whenever a line fence is built it becomes part of the realty, on the one hand and the other, and neither party can remove it until he gives the other party proper notice, and the fence viewers appraise it. Then, if the other party does not pay him for it, he can remove it. But in order to do that he must go still further, and abandon his own land.

QUESTION. I would like to ask, if in building that fence the party should happen to build it one foot upon his own land, would it prevent him from recovering damages from the other party?

Mr. LEBROKE. If that fact should be properly pleaded, and properly shown, I should say it would be a defence, because it

would be shown that it was not a line fence, but was built for himself.

QUESTION. Suppose the land on the other side of the fence passes into another man's hands before any part is improved, from whom should you recover?

Mr. LEBROKE. If the land passes by a new deed, then you must be sure, in order to hold the grantee, to have a written agreement between you and the other party, and have it recorded by the town clerk, or the fence viewer's decision must be recorded, and then the other man would be held just the same as the original owner.

Adjourned to evening.

EVENING SESSION.

The attendance at the evening session was large, the hall being crowded, and many ladies present. The first speaker of the evening was Rev. JOHN H. GURNEY of Foxcroft, who delivered the following address on

ASSOCIATED DAIRYING.

Gentlemen of the Board of Agriculture, and Ladies and Gentlemen:

I propose to talk on just two things, *Cheese* and *Cheese Factories*. I know of only two reasons why I was invited by your Secretary to present this subject: first, that I am interested in the subject; and secondly, that I have some slight knowledge of the workings of the factory system. I have spent the past fourteen years of my life in a region somewhat noted for the manufacture of cheese of a superior quality. Worcester county cheese has sustained somewhat the relation to Boston market that Orange county butter has to the city of New York. The town where I resided, together with two or three towns around it, gave this reputation to Worcester county cheese. The farmers in that region have proved by repeated experiments that no use of their land is so profitable on the whole as for making cheese. They have tried butter; they have tried beef; they have tried stock raising; they have tried sheep to some extent; they have even had the temerity to try horse rearing; but they always come back to the one article of cheese as the most profitable. Occasionally, either of these other articles, for a short time, has brought in better returns in mere cash, but invariably in the long run, they fall back on cheese as the chief article of production. They are too far from the market to sell their milk for city use, with the present communication;

their land is not adapted to grain production; it is adapted to grazing. They cannot compete with the west in the production of beef, nor with the north in stock raising. Cheese is their specialty, and they succeed in it. I see not why you cannot succeed in cheese as well as they. I see not why all the reasons for, and conditions of, successful dairying do not exist in Maine that exist in the hill country of New York, of Massachusetts, and of the other New England States.

It seems to me that *cheese dairying should be your chief business* as farmers. Your land it is true may be adapted to other purposes. Much of your land is not ill-adapted to grain; but the great objection to grain production is that you cannot afford it; you cannot compete with the west in this production; you cannot afford the fertilizers necessary to produce grain, to supply those qualities which have been exhausted from your soil, but which still exist in the comparatively fresh lands in the west; you cannot afford to raise any more grain than is absolutely necessary to keep your land well in grass. If you can keep your land in grass without plowing, every acre you plow runs you in debt. It costs too much to work your land and cultivate your crops; and it costs you too much to seed your land to grass to make grain raising profitable only where it is a necessary condition to grass. I think I may assume this to be a fact without attempting to prove it. I think no one will deny that distant as we are from the markets, grass is more profitable than grain, and that grain is only profitable as an antecedent to grass. Every farmer will raise some grain, simply because every farmer with land enough to make it proper to call him a farmer, has some land that must be taken up occasionally to keep it in grass. You might raise in part the grain necessary for your own use; but seldom a farmer in New England can afford to raise grain to sell. Every bushel that you sell runs you in debt, because you exhaust the soil; and you will find many farms in all this region that have been exhausted almost to barrenness by this wasteful, ruinous process of cropping, and by selling your grain, and even selling your hay, when you ought to be buying grain to feed out on your place. You might almost as well sell your manure, I think, to have your farms thrive.

I think you cannot afford even to raise potatoes for the market. The margin for profit is so small that only occasionally, when the price becomes exorbitant, can potatoes be produced at a profit. and the tendency is, by selling any bulky products of the soil like

hay, grain, or potatoes, to impoverish the soil, and in the end the balance will be against you.

How is it with horses? Is it wise to make horses the chief business of your farms? Some of you have done it heretofore. If you have a specialty here, it is horses. But how does it prove? In a pecuniary point of view possibly a few of you make a good thing of it. But really the majority of farmers are taxed heavily to put money into the hands of a few. You raise colts hoping to make a lucky hit, to get a fast horse that will bring you any where from a thousand to five thousand dollars. One out of one or two hundred horses possibly are fit for the race course; they are fit for scarcely anything else; and the hundred or two are not as valuable as they would have been if they had been bred for legitimate service, for workers or roadsters instead of for racers. As a community you lose money in your horse business. I do not speak here of the demoralizing tendency of the business: of its decidedly bad influence on our boys and young men: of the horse racing and gambling nuisance; of the idleness, the dissipation, of the loss of time and of money, sure concomitants of the business, of the undue prominence given to this interest at our fairs, taking the greater part of the time, space and money. I was amused last fall at the display at our agricultural fair; and I think it only illustrates the tendency everywhere. Horse grounds, horse sheds, horse men, horse women, horse boys, horse jockeys and horse talk everywhere and continually. I looked around carefully, searching, everywhere, for your display of cattle. A few stunted specimens, tucked away in the most out-of-the-way corner, as if their owners were ashamed of them and brought them there to *hide* them, instead of to *show* them, were all that I could find. We have read and heard tell of *Cattle Shows*, but where now are they? Where are the fat bullocks, the magnificent oxen, the beautiful cows? They ought to be there; they ought to have the first place, the place of honor in your shows, and the highest premiums. It is these that show prosperity. It is these that give a reliable and constant income if rightly managed.

I have been clearing the way thus far in order that I may be prepared to show you, if I can, that *cheese* should become your *specialty*. I use this word as it is now commonly used, meaning a peculiar and principal business or occupation. You should make your own butter, your own beef; you should produce your own mutton; you should raise to some extent your own grain, and cer-

tainly your own fruit and vegetables, but your chief business should be *cheese*.

First, your land is better adapted to this than to any other use. You cannot make as good butter as Vermont or New Hampshire. Still, this is essentially a grazing region. I have always fancied that the region of sharp hills like Vermont and New Hampshire, where the pasture is exceeding sweet is the butter country, and a rolling country like your own, like Worcester County, Mass., like the best dairy regions of New York and Ohio, are the better for cheese. I think I am safe in saying, that the farther north the sweeter and richer both butter and cheese. You want a land of rich pastures, of springs and running water, for cheese. You want a land of very sweet pasture, not so rich, for butter. And that is why Vermont and Berkshire County, Mass., can beat us all in butter. But I believe you can make as fine an article of cheese here as in the world. The cheese dairies of New England ought to make cheese that will command the highest market price. I think every condition exists except the intelligence and will of the farmer. You have got the pure water, the pure air, the capability of rich pastures. Now set your wills to work and increase your intelligence, until your fields are the richest and your facilities the best, and your cheese may stand at the head.

Secondly. *Cheese will return greater profits than any other use of your land.* The only question I think is between cheese and butter. This need be no question, because you can so arrange as to make either or both, as the market demands. But I argue from my own experience and observation that ordinarily cheese is the more profitable. In making cheese you use almost the entire substance of the milk; in making butter much of the substance of the milk, that portion left after the cream is removed, goes into the swill-pail, and of course cannot be as remunerative as if made into cheese. Farmers in cheese making districts buy their butter instead of making it; this fact proves to my mind that the greater income is from cheese. Winter made cheese sells at better prices than winter made butter. Your cheese season is very much longer than your butter season. And the early made cheese usually commands the highest price, not from its superior excellence but on account of the smaller supply.

The dairying business especially enriches the land; while selling off the crops, instead of feeding them out on the place, im-

poverishes the soil, running the farmer in debt to his land. I see multitudes of fields in these towns that ought to yield two tons of hay to the acre, which do not now yield one quarter of that amount. The fault is not in the land at all, but in a vicious system of farming. The same is true of the pastures. Rich pastures as well as mowings endure a severe drought, while the impoverished land is almost useless. Now I submit, that other things being equal, that use of your land is the most profitable which robs the land least of its fertility, or which, in other words, returns the most of fertilizing elements to the soil. That the dairying business does this I am very certain. The manure of cattle, it is acknowledged, contains nearly all the elements of fertility which the soil needs. Special manures are not a substitute. If they were, no farmer can afford to use them, ordinarily, to make hay or grain. He will find almost invariably the balance against him. And if his balance sheet show anything in his favor, he will still find his soil suffering for want of bulky excrementitious manure. All the patents in the universe cannot secure any fertilizer so valuable as that made or composted in the barn-yard or barn-cellar; in which I include of course the hog-pen. And this is an item not to be overlooked in the dairying business, which I need not enlarge upon because it is so generally acknowledged and understood. I can show you farms of 100 acres, as remote from market as you are, which will keep twenty-five cows the year round, with sufficient working force of cattle and horses, and which have turned off in cheese, veal and pork \$2,500 worth in a year, and which will at present prices turn off \$2,000 worth a year. This result has been accomplished by feeding out upon the place all the hay and grain which it produced, and by making immense heaps of compost in barn-yard and cellar for top dressing and other uses. I am sure this can be done here. But I see farms of 100 acres on which two or three cows are kept, producing butter and cheese enough for the use of the family, turning off a colt or two, a bullock or two, a few sheep and lambs, a little wool, a little pork, a few tons of hay, and a few bushels of grain, amounting to \$400 or \$500 per year, and the farm growing leaner, and the farmer growing poorer, of course, every year. This is not an exaggeration, my friends, I fear.

Here and there you see a farm showing unmistakable signs of thrift in buildings and land. The fields yield a heavy burden, while those beside them, of similar soil, yield scarcely half a crop. The pastures are green and growing, while those beside them, the

same kind of soil, are burnt up. What makes the difference? Look out upon yonder hill-side! How green and fresh it is! What are those beautiful spotted creatures reposing here and there and ruminating at their ease under the shade of scattered trees, in the hot noontide? Don't you know them? Those are veritable cows. How thickly they dot the pasture. They are resting, having filled themselves with the sweet grass of the fat pasture. But they are not idle. They are making milk, and their glands are secreting the sweet fluid, and each distended udder shall fill and overflow the ample pail shining in the sun in yonder farm-yard. How willingly at the touch and pressure of the gentle, almost magnetic hand, the white and frothing liquid flows, and overflows, until it stands like a fretted crown upon the vessel, which cannot hold it all. Please, now, step in from under the hot sun, into this cool and sweet room. A pleasant aroma pervades it. Open the shutters which keep out the glare and the flies, and for a few moments let in the light. What are these circular, yellow-tinted things that fill all the shelves, and look good enough to eat? Why, my friend, don't you know? Those are cheeses. And so tender are they that they will almost crumble at the touch, so that they have to be held with bands; and so delicious are they that they will melt in your mouth. And those only leave the farm bringing back needed wealth and comforts. All else goes back to the soil, giving constantly increasing richness and productiveness.

I have presented a few considerations to show that the best use of your land is for the production of cheese, or for the dairy; first, because your land is best adapted to dairying, and especially to cheese; and secondly, because dairying is the most profitable use of your land.

Now I want to show you, if I can, that the best way of making your cheese is by associating for that purpose in the cheese factory. And *first because this is in keeping with nearly all other branches of business and industry.* The cotton or woolen factory with its many looms has superseded the hand loom in our kitchens, which our grandmothers used; and who now uses for common purposes of weaving the old hand loom? Not only the fabric but many articles of apparel are now manufactured in the same way. Every article of clothing is thus made, not wholly, but to a great extent. Boot and shoe factories are but of comparatively recent date, and whole towns are engaged in this industry; most of our articles of furniture are thus made; very much of our food is thus

prepared; our best clocks and watches are turned out by scores and hundreds every day from factories; most of our tools and implements of husbandry, as well as those used in the arts and in trades, are made in the same way. Associated capital drives us through the land, over the railway, by the swift steam car, instead of our going as of yore, by the slow and lumbering stage coach. This doing things by combined effort seems to be the spirit of the age. Why should farmers be behind all? Why should not the same system be applied to their business where it can be applied? Why should they drag behind when progress is the law in everything else? System is already marking many of their efforts; cheese factories are springing up all over the country which is adapted to cheese making; several hundred in all, mostly in New York, Ohio and Massachusetts, some in Vermont and New Hampshire. I have been told that not one has yet been built in Maine. If I am in error in this, I shall be glad to be corrected. Is not this a fact worth noting, these several hundred factories; and yet the demand for cheese is greater than ever before. I mean for first quality cheese. And again, I say you possess all the requisites for making it here except this one, the factory; and this I say is a requisite. Many farmers would convert their hay and grass into cheese who now use their farms less profitably, if only they could get their cheese made in factories. I know in towns where factories have recently been erected hundreds more of cows are kept than formerly. The dairy productions of the towns have greatly increased, and consequently the wealth of the towns.

It is an argument for associated dairying that thereby the wives and daughters, usually overtaxed with hard work, are relieved of a great burden. A large dairy tasks exceedingly the time and strength of the women at our homes; so much so, that in very many cases they prefer, and the men prefer, a less remunerative and less laborious employment of their land. Now in associated dairying the burden is removed from the kitchen and the cheese room to the factory; and the mothers and daughters have a little leisure for other lighter and pleasanter tasks. And will it harm them or you if they take, with the sacrifice of no real interest, a little time and pains to ornament and beautify their homes? Will it not be better for us all if the gentle ones, whose burden of duty and of life, be it lightened ever so much, will still be all too heavy, have a little respite from these coarse and hard tasks which they too willingly endure? Will it hurt them or us, or the children that cluster

around them, if they find a little time for intellectual and social recreation and improvement? or if they so spare their strength during the week that the Sabbath be not wholly used for physical rest, and they be able to use its sacred hours for spiritual improvement and for worship in God's house? Oh! my friends, pardon me, for I have got to preaching before I thought of it; and you will still pardon me for adding that I do believe, as I have seen proved, that the cheese factory, to many a toiling, striving and contriving mother or wife, has become a blessed means of grace. This is not unworthy your consideration; for surely it has been the complaint in large dairies that the lady of the house who must give the dairy her attention, becomes so wearied with her task and so pressed for time on Sunday morning, that the Sabbath ceases to be a rest and a joy. What matters it if you save a few dollars, the cost of making at the factory? Will it compensate for all the drudgery and weariness they must endure? *But you do not save. And this is another argument in favor of the factory system.* I think it is plain that you do not save even the cost of making.

Some private dairies make as good and as marketable cheese as the factory produces; but the majority of private dairies make an inferior article. So that, on an average, factory cheese sells a cent or two per pound higher than that of private dairies; and this more than covers the cost of making. It is reasonable that this should be so. The system, the regularity, the superior facilities for curing, the improved methods of making cheese, especially on a large scale, render it almost certain that with equal skill a superior quality of cheese will be made in the factory. Then add to this the advantage in the market which a factory, with a large amount of cheese, possesses, the uniformity as well as superiority in the quality of the cheese, the ease with which you can adapt the size or style of the cheese to a particular market or taste. And do you not see, I say, that you will save, and not lose, by making your cheese in a factory for that purpose?

And still another advantage of associated dairying is, the regularity and reliability of the returns. Every month, if you please, your bill is made out, your account settled, and ordinarily your money paid you. I have never known any losses. Your money does not come to you in dribblets, and consequently waste away, you scarcely know how or whither; you generally know when to expect it, and you can meet your obligations. And, another thing; it is cash and not

truck; and cash is always better than anything else to buy with, and will go further. I have asked farmers, apparently well to do, having farms capable of keeping ten or fifteen cows, *in fact* keeping one or two—I have asked them, Where does your money come from? “Sure enough!” they answer, “We don’t have any money.” In certain conditions of primitive society the truck system is convenient. But I repeat, after all nothing is worth so much, and will go so far in purchasing as cash. I suppose all the farmers have money; but they meant in the answer they gave to my question, that they did not have much, less by far than they ought to have, considering the extent and capabilities of their farms. Good dairy products, especially first rate dairy products, and still more especially cheese, will always bring ready cash.

One more argument for associated dairying. It *benefits almost equally the whole community*. Every remotest farm that avails itself of the factory is benefited. Your woolen and cotton mills are doubtless a great benefit to the town. They employ a few score of hands, but otherwise than that, they are chiefly a source of wealth to only a few, mainly the proprietors. Their tendency is to draw the wealth to the villages from the extremities of the towns. They build splendid mills, and beautiful palaces, and colossal fortunes for the few. The wealth that comes in is not disseminated, but centralized, and much of it is sent abroad for the raw material. And still we say good speed to the manufacturing interest, especially when good and noble and public spirited men control it, as among us. Its prosperity is our prosperity. Every available privilege on our streams ought to be improved and used for manufacturing purposes. You ought to have cotton factories and boot and shoe factories, and manufactories for all sorts of wooden and iron utensils and implements. These, all, no doubt, are a benefit to the towns; they increase wealth, but mainly to the proprietors and to the villages.

On the other hand, the cheese factory is a disseminating and not a centralizing point of wealth. It is merely the agent or the medium through which you send the liquid product of your farm to exchange for solid gold or its equivalent. The money goes to the many producers. The naturally best farms are frequently most remote from the centres of business. These are placed on almost an equal footing with those close by the centres. And frequently indeed they have the advantage of an abundance of cheap land, comparatively new, affording a supply of the best pasturage, which

the dairy needs. These farms especially will become benefited and increased in value by the cheese factory. So that soon, by increasing his hay crop and his stock of cows, the farmer must add to his barn room, and the old sheds will give place to new and larger ones, and then the old house will be repaired, or a new one built in its stead. With increased income, come increased improvements of the land and facilities for working it. The stones and rocks will be removed from the mowings and the ground prepared for the mowing machine; and the fields themselves will wear a new look. And the boys will come to love the place which heretofore has been associated in their minds with scanty fare and drudgery and exceeding hardship. The home will become more attractive with the increase of comforts and refinements; and thus the amount of human happiness as well as wealth will be increased.

This is the result of lightening the burden of toil by associated capital. And the wealth of the town itself will be increased. Every stump that you pull, every rock that you remove, every drain that you lay, every swamp that you clear up, adds to the wealth of the town. With improvement of farms and of homes will inevitably come improvement in schools and advancement in all public interests. As men become cultivated and refined they become magnanimous and public spirited. Churches grow, and immorality and irreligion diminish; men become better neighbors, better citizens and better men. Men that are naturally averse to effort and indifferent to the spirit of improvement and progress, are incited to effort and industry by the zeal and prosperity of their neighbors; a healthy spirit of emulation awakens them. Neighbor A will not be outdone by neighbor B.; his stock shall look as well; the yield of his dairy shall be as large; his veal shall sell as high, and his pigs shall be as large and as fat. This spirit of emulation is wealth; the want of it is poverty. Now I say, associated dairying places all on an equal footing; the small farmer can compete with the larger one as far as the quality of his cheese, or the quantity per cow are concerned. All this competition results in increased effort and consequently increased wealth to the individual farmer and to the community.

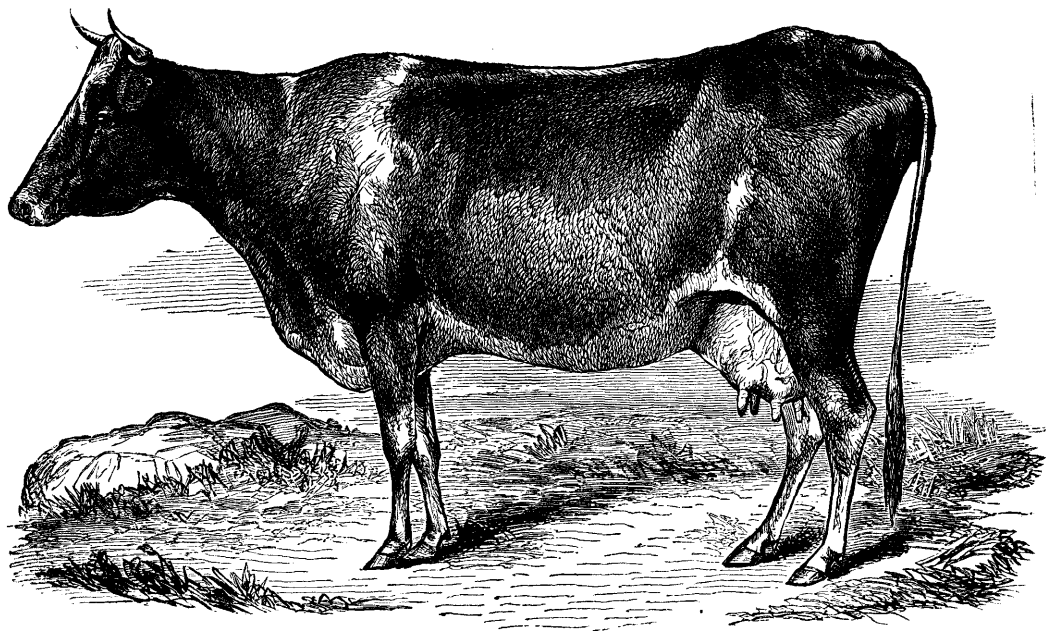
These are some of the arguments for, and the advantages of, the system of associated dairying. Let me briefly recapitulate. The argument for the cheese factory is this:

That it is in keeping with nearly all other branches of business

and industry ; that it affords our wives and daughters respite from hard toil, and opportunity for domestic, social, intellectual and religious improvement and recreation ; that by the factory system, in a pecuniary view, nothing is lost, but there is a saving rather ; that thereby you have a regular and reliable income ; and lastly, that it benefits almost equally the whole community, disseminating and increasing wealth over the whole town, rather than centralizing wealth in our villages and building up great fortunes for the few favored ones.

In presenting these considerations I have not gone much into details. I have not presented facts and figures. I have given you the cream of the facts and the essence of the figures. I think I can sustain every point I have made, every argument I have advanced with facts and figures. The details you can have at any time in a multitude of publications ; for the dairying business is having its literature. It is becoming indeed more and more every year a science of itself ; it is a prominent department in our agricultural boards and fairs ; is a branch in our agricultural colleges ; and associations, large and small, are formed and meetings held in its behalf.

But before I conclude I wish to notice a few objections which lie in the minds of many to the success of the cheese factory : And first, *the one great obstacle and almost bugbear in many minds is, that the BUSINESS IS BEING OVERDONE, or is in danger of being overdone ;* that the supply will be greater than the demand. Did you ever know the time when this cry was not raised against every business ? And yet cheese—first rate cheese—such, alone, as you can and ought to make, is and will be always in demand. Of such cheese there is not, with all the increased facilities for making, a full supply. The market is enlarging and the demand is increasing faster than it can be produced. You can make better cheese in these northern regions of sweet air, sweet water and sweet pastures, than they can make south or west. God and nature have given you the advantage in these regards. I met a man a few years since returning from the west to the green hills, the pure air, the sweet water, of his native Vermont. He looked bilious, cadaverous, and shaky generally. He declared that everything was bilious in the west. The pork, the cheese, the butter, the beef, the air and the water—everything was bilious. And oh ! how he seemed to expand and brighten as he touched the soil and tasted the water and breathed the air of the green hills again.



Thoroughbred Jersey Cow "Lady Milton," the property of James C. Converse, Esq., Southboro', Mass.



Now my friends it is so. To make the best butter and cheese you must have the sweetest feed, the purest water and air. Everything must be sweet and pure about the dairy. How can you have this amid the miasma of dense swamps and rich bottom lands. Everything else being the same—i. e. with the same skill, wisdom and experience in the manufacture, you always may lead the market in butter and cheese. And there will be never a danger of a glut in the market of the best quality of dairy products. More and more cheese, as well as butter, is getting to be and is felt to be a necessity. It has been considered a kind of luxury; but it is coming to be viewed as more than a luxury. It is understood to contain all, or nearly all, the essential elements of food for the entire physical system of bone, muscle, nerve and brain: that it is nearly all food, and consequently that it is economical as an article of common diet; that the poor as well as the opulent can afford its common use. You know how it is among us; our own little market is never supplied with good, ripe cheese. So it is, I doubt not, throughout the State. Instead of exporting it as we ought largely, we have to import it. Is not that the same folly as carrying coals to Newcastle, or as it would be to carry wheat to Wisconsin, or sugar and cotton to Mississippi? You have wealth in your streams and waterfalls; but still greater wealth, if you will use it aright, in the sweet pastures of your hills. Your distance from market is no objection. You are but a few miles from tide water, and thence by shipping anywhere you please. There is no reason why you should not make as good veal here, and get it into market nearly as cheap, and consequently make it pay nearly as well, as they do in central Massachusetts, and I know they make it pay there; and the better veal they make, the better they make it pay; and thus have done away with the barbarous custom of flinging the carcasses of your two or three days' old calves to the hogs and dogs.

But *again we hear it said, We have no factory.* Well, factories don't grow; they are built, and you can build one if necessary. Let every farmer of moderate means take a hundred dollar share, and pledge himself to stock his farm with cows and send his milk to the factory; and many who have small farms can afford to take the same share, for the cheese factory is comparatively a greater benefit to the small farmer with his three or four cows than to the larger one. There is no doubt if you are in earnest about it, that you can build a first class factory that shall be an ornament and an

honor to these towns and a source of steady income; and you can become a kind of radiating centre, as you ought to be and are in some things, to the county and region in this matter of associated dairying.

But have we after all cows enough to supply milk sufficiently to make profitable a cheese factory? One thing is doubtless true, the larger your factory the greater your profits; and you ought to aim to have the largest supply of milk possible throughout the season from April to December. You have cows enough within a circuit of five miles from these villages as the centre, to supply a large factory. It is estimated that already there are kept within those limits fourteen hundred cows which give milk, and within an easy distance about nine hundred. It is not too much to say, considering the many farms which are not one half or even one quarter stocked with cows, that the number of cows could be easily doubled and would be with a successful factory in operation at any point within these villages; so that easily from 2000 to 3000 cows might be kept within a convenient distance of any point in these villages as a centre.

But, the trouble, the expense, the change, the additional labor, &c.

Yes, if you have a dozen or twenty cows instead of two or three, which you mostly need for your own supply, you must expect some more labor in the barn-yard and the barn. You cannot afford to ride quite so much perhaps behind that fast horse of yours as you now do, and perhaps, *if the truth must be told, you cannot now afford to do it*; and that, really, that same horse is an expense to you. You must be up betimes in the morning, that your milk may be into the factory in season, and that will be a blessing to you; and then your boy must be on hand to start off with the milk, that you may have the whey for the hogs on his return, and Sally wants her letter taken to the office, and Betsey is expecting a letter in return, and Jane wants her bonnet at the milliner's, and mother thinks she will ride down with you to do a few chores, and neighbor Small-farm, whose milk you carry, has an errand for you at the store; and Mrs. Goodheart, whose milk you carry, wishes to send a few eggs and a chicken to poor widow Soldierman who gave her all to her country. And with these chores, by the time the team comes back the dew will be off the grass, and the hay must be opened, and the mowing machine must rattle through the tall grass; and so it goes. Well, you must not expect to be idle—much. And the expense,—Yes, cows, good cows, milking cows, broad and high

hipped, deep chested, fine headed, short and slender horned, slim necked, soft and thin and yellow skinned, broad and deep uddered, *and* GENTLE, so that your maid can help milk them; yes, they will cost something. But then, they will pay for themselves the first year if you manage well; but you had better take that brick out of your hat, and that cigar out of your mouth, and kill that dog, and raise a good calf in his place, and put a birch stick in plain sight to use on your boy, or whoever drives your cows to and from the pasture, if he strikes a cow or if he clubs or stones one, or if he hurries them to and from the pasture. And have your night pasture handy by, rich and sweet, and your ample piece of corn fodder, against the dry time—the Evergreen Sweet Corn is the best—an acre at least for every eight or ten cows, and then with sweet tin pails and sweet cans, and a sweet breath and sweet temper, which will sweeten all things, and which is very needful in dairying, you'll pay for your cows, you'll pay for your farm, you'll buy on new fields and new pastures. Sam, who had purposed to go west, will stay at home to help you; Jim, who has gone west, will come back and settle by your side, to his mother's joy, for she doted on Jim. You'll have your span of bays, not to idle on the park, but to do your work; and you'll want your carriage to take your wife and children to meeting with you, and to drive them to the fair. And you will have money in your pocket, and money in the bank, and some invested in charity as well as in bonds.

Farmers of Piscataquis and of Maine! I leave this important subject, thus imperfectly presented, with you. You may deem me an enthusiast on this subject, but I am indeed far from it. I believe, with the aid of the system of associated dairying, the best and most successful farmers among you will be benefited, while to the smaller and less successful farmers it will be a relief and a help which we cannot overstate.

But what is the use? The verdict against Ephraim has been in my thoughts: "He is joined to his idols, let him alone." Six contiguous farms up in Sangerville, six jolly farmers all in a row, keep eighteen cows and twenty-one horses. And those are splendid dairy farms. And that isn't so bad a case as that of the honored and Hon. President of our Agricultural Society—this is not a family secret, although I had it from his wife. He keeps one cow and six of the horse kind. I submit, if that isn't a bad example for the president of our agricultural society to set; and I submit

still further, whether he ought not to be disciplined, I mean agriculturally, for setting such a bad example. But, seriously, my friends, this fast horse mania is the one grand stone of stumbling in the way of successful dairying business in this region. Inaugurate the factory system if you can, and though fast horses and horse fairs and horse trots may still occasionally be the rage, the disease will be checked, and the hope will be that the raising of fast horses will become, as surely it ought to be, subordinate to the more legitimate, more profitable, and it seems to me the more fit and worthy business of the dairy.

I have wished that I could place this subject before you as it lay in my own mind, and that I could awaken an interest which would lead to action; and yet I acknowledge that I fear to urge in regard to it. Should you take action and organize an association and build a factory, many would be disappointed. Many who now think they do well enough, whose wives make good cheese which is sold readily at the highest market price, would very likely wish to plod on in the old way. And then you would be bothered with many little things; some conscienceless, irresponsible person watering his milk or skimming it; many little things of this nature, I say, *and yet* I do believe the day you should set a successful cheese factory in operation to accommodate farms that naturally centre in these villages, would be the day in which these towns would take the longest step ahead that they have taken for half a century.

T. S. GOLD, Esq., of Connecticut, was then introduced, who spoke upon the subject of

CURING MILK FOR MARKET.

Mr. President, Ladies and Gentlemen:—The subject which I have undertaken to present this evening is one which will not admit of either poetry or eloquence; neither do I possess the power, if I should attempt it, to present it in that form. It is merely the simple subject of curing and preparing milk for market, and as I have had considerable practical experience for the last two or three years in the business, I thought it might be interesting to you to know something of the manner in which it was done.

In the first place I will state my locality, the distance we send milk to market, and some other points of explanation. We are situated on the Housatonic Railroad, in the northwest corner of

Connecticut; we are 120 miles from New York, and locations forty miles above us, as far north as Pittsfield, Mass., send milk over the same road, making a distance of 160 miles, which milk is sent to New York on that line. The Harlem Railroad runs parallel to the Housatonic, about twenty miles from us, on the west. The farmers on that road have been engaged in the milk business for many years, and we have known of the increasing fertility of their farms under this system, for before they sent milk they were engaged in raising grain mostly. We have noticed the increased fertility of their farms, and their increased incomes from the milk business, and the general appearance of thrift and success which their farms and buildings exhibited, and we were anxious to establish a milk train upon our road. Three years ago it was established. We have the same facilities for sending milk to market that are enjoyed by persons living on the line of the Harlem Railroad, the Hudson River Railroad, the Erie Railroad, and the other railroads centering in New York. It is delivered by the railroad companies in the city at a cent and a half a quart, they returning the cans. It makes no difference whether you are 20 or 100 miles from market, the charge is the same upon those roads. A can of milk in the New York market is forty quarts; there are a few larger cans and a few smaller ones, holding only twenty or thirty quarts, but, practically, the milk goes to market in forty-quart cans, and by a can is understood that quantity. The milk that is drawn to-night and to-morrow morning leaves the dairy to-morrow afternoon and is delivered to customers in New York the next morning.

The manner of preparing this milk I will now describe. It is very simple, yet there are certain conditions which we find *must be* complied with. The milk pails and cans, and everything connected with them, must be perfectly sweet and clean; and we find that sal soda is the best and cheapest material to facilitate the washing of the cans and pails. Bought by the keg, it is very cheap, costing but a few cents a pound, and even at retail it is very cheap. A very small quantity of it dissolved in water is a superior substitute for soap in cleansing the dairy utensils. The cans, after they are washed and scalded, must be aired. I supposed it was an old wife's notion to put the milking pans out of doors in the sun all day, and after they were washed and scalded in the morning, we put the lids upon the cans, closed them up and set them aside. Something wrong! The milk was returned sour—a bad odor to it. An examination of the cans by an old dealer

in milk, immediately disclosed the cause. They become very offensive in a short time when closed up, even after being thoroughly washed and scalded. The proper position for the cans is inverted in a leaning position out of doors, against a fence, where they will have the sun, and a free circulation of air through them. Let them remain there until you want to use them, then there is no doubt that they are perfectly sweet and clean.

The milk, as fast as it is taken from the cow, is strained into cans, and when a can is nearly full it is set in a spring. We take as cold and fine a flowing spring as we can secure, and make a pit or tank in it of such depth that the water shall rise just to the top of the can, but not flow over it nor into it, and of sufficient size to accommodate the dairy. It is well enough, for a dairy of forty cows, to have a box or vat ten feet in length, and three feet in width, and of suitable depth just to hold the cans.

I may remark here upon the temperature of the water. It is desirable that the water should be as cold as you can have spring water; 40, 45 or 50 degrees are very desirable temperatures for spring water during the summer. But such a season as this has been is a sad trial to these springs. Many of them have failed, and in many of them the water has risen to that extreme temperature which is the highest that will cool milk so that it can be sent to market safely. Sixty degrees Fahrenheit is as high as our experience will allow us to use the water in a spring. If it goes up to that or above that during the day, we have to look out for bad returns from the milk. But with a temperature of 60 degrees and *an abundant flow of water*, there is little difficulty in sending the milk this distance.

I have said that the cans when filled, are placed in the spring. They are *not* filled full; if I said so it was a slip of the tongue. The cans draw together near the top—they are smaller—and if you fill them entirely, you leave an aperture of only about six inches across. It is much better not to fill them quite so high, so that the whole surface of the breadth of the can, which is about a foot in diameter, shall be exposed to the atmosphere. When taken out to be sent to market, they are filled. These cans, when placed in the spring, must *not* be covered. The spring is covered with a small house, just sufficient to shield it from the sun and rain, made of any rough boards. It is well to have a tree near by, if you can, to shade it, but that is not essential. The cans must be placed

uncovered in the spring, where they are to stand until the milk is ready to be sent to the railroad station.

Now comes a question upon which there is some disagreement. Shall this milk be stirred until it is cool, or shall it be allowed to stand perfectly quiet? I received my instructions from an excellent dairyman, who had sent milk with perfect safety, who advised me not to stir it at all, but to let it stand perfectly quiet. I pursued that course for a time, until some charged me with being somewhat dogged in my determination to adhere to that practice. I have somewhat changed my opinion, and I advise the stirring of the milk, moderately, until it is nearly or quite cool. I do not consider that it is essential to stir it until it is cool, because I know my man does not always stay there to do it. I direct him to stir the milk until it is cool, but I know he does not always do it. But if it is stirred until it is cool, no separation of the cream takes place in the milk; it is all mingled with it, and when presented on the table it is an entirely different article from the milk placed in pans on your shelves and the cream allowed to rise in the ordinary way. It is not skimmed milk at all, there is no separation of the cream from it; it is milk in its finest possible condition.

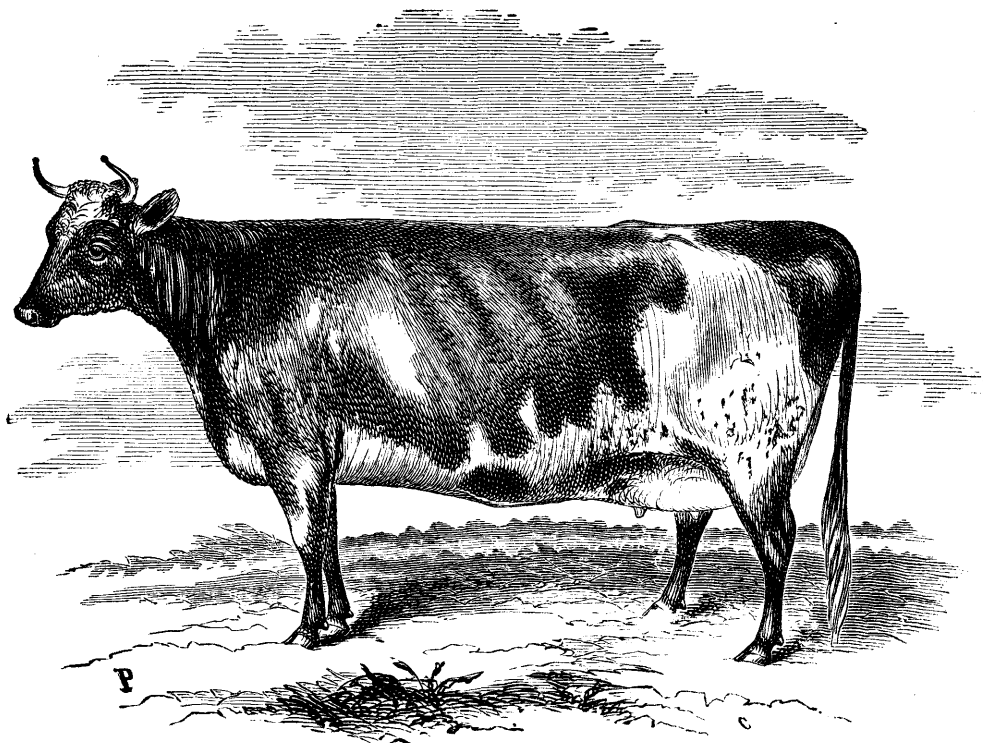
Wanting this appliance of a convenient spring, some cool their milk by letting it down into a cold well. Some put it in a tank of water kept near the house, and place ice in it among the cans. But there is no perfect substitute for a good flowing spring, with an abundance of cold water to flow around the cans and carry away the heat. There is no necessity for stirring the milk; it will "cure," as we call it, perfectly, and very little cream will rise; but as the temperature of the water rises, or the quantity of water is less, it becomes necessary to stir it, that the cooling may take place as perfectly and directly as possible. If the milk in your cans stands an inch above the water, and you do not stir it thoroughly, that milk will spoil. The water *must be higher than the milk in the cans*. I thought that was a very small matter, but you examine the temperature of that water in your vat, with five or six of those forty-quart cans of warm milk in it! It is milk warm on top, for the warmer portion rises; down below, it is cold still; but it is carrying upon the surface the heat of all those cans of milk, and this inch of milk on top, that is above the water, does not cool; it remains warm, while the portion below cools sufficiently. Now, mingling warm milk and cold milk must never be done. After the milk is thoroughly cooled, it may be

changed from can to can; it will bear almost any reasonable abuse; but if you strain your morning's milk into a partially filled can of night's milk, you spoil it.

Souring is not the only difficulty to which milk is subject. It is liable to receive a bad odor while it is in the process of curing if there are any bad odors about the building. It must be kept clean and sweet, and in a sweet place. No article is more sensitive than milk to bad odors.

Milk, also, at certain seasons of the year possesses peculiar properties that have to be controlled. When the cows, from the scanty pastures of spring and the dry hay of the barn, are first turned to the full flush of feed in June; a peculiar condition of the milk is induced, which must be carefully guarded against. We found that those milkmen in New York knew a great deal more about milk than we supposed they did. We supposed they knew very little about it, but they are mostly Germans, and very shrewd in the business. They understand the quality of the milk we send them perfectly well. When the cows have a flush of feed in June, the milk, unless it is prepared with extraordinary care, will be what is called "strong." It will have an animal odor so strongly developed that it is not fit for food. It is found that there is no way in which this animal odor can be so thoroughly corrected, and this peculiar fault of the milk cured, so well as by the addition of a small quantity of cold water at the time of milking. It is at a season of the year when dairymen would not naturally desire to add water, because there is a flush of milk in the market, his customers do not demand more milk than he can furnish, he has, ordinarily, more than he can sell; but in order to cure the milk with perfect satisfaction, it is desirable to add a small quantity of water.

I was sending my milk to a neighbor's spring to be cured, a distance of half a mile. It was sent to market perfectly pure, without any water in it, and complaint came that that milk was strong. I directed my man to put two quarts of cold water into one half of the milk that he carried to the spring, and take down the numbers on those cans so treated; and the neighbor who had the spring in charge, twelve hours after, when the milk was taken out, examined it, and selected those cans into which the water had been put, by the better condition of the milk. The experiment was repeated several times, and he invariably selected the cans that had the two quarts of cold water in them, as being entirely destitute of this disagreeable odor. The necessity for this passes away in a very



Ayshire Cow "Mimi Ist," owned by H. L. Stewart & Son, Middle Haddam, Conn.

short time, as the effects of this change from the dryer feed of the stable to the flush of feed of the pastures cease.

It may be interesting to you to know something of the prices which we obtain for milk. We were formerly engaged in the manufacture of cheese on our own farms. We were discussing the question of establishing associated dairies when the proposition was made to us to supply milk for New York. In the month of June and July, during the flush of milk, we get but three cents a quart, the milk-men paying their own freight. We now receive four cents, and we expect this month of September to get five cents and onwards during the autumn; during the winter, we get six. It is expected that a man who sends milk to market will supply at least half as much in winter as in summer. That necessitates a change of cows, and other arrangements different from the ordinary arrangements of the dairy. But in this explanation of the process of curing milk, I would advert to it as furnishing you an opportunity, if you please, to cure milk for your families that you will find of a very superior quality for any of those purposes for which you need milk, and which will enable you to keep it much longer than you can keep it in any other way. After it is once cured, in ordinary weather, it will keep three or four days, or a week, in ordinary temperature. It would not do it in the heat of this summer, but when well cured, in ordinary weather, it will keep sweet and perfect, and free from any bad odor or bad taste, for several days.

Those who have ice, put a lump of one or two pounds in each can when taken from the spring. If the distance to the station is two miles or more, (and some carry it five or even ten) a wet blanket is wrapped around the cans to keep them cool. The cars are furnished with ice placed in boxes at each end, so that the milk arrives in New York delightfully cool.

I do not think of any other point that would be of interest. If any gentleman wishes to ask any question I will endeavor to answer it.

QUESTION. If the cans were not full, would'nt they float? Milk is lighter than water.

Mr. GOLD. If they are not full they will always sink so far that the milk will be a little lower than the water, on account of the greater weight of the cans. The cans are heavily banded with iron, and will sink in the water; and they are of such shape that if they are only half full they will not turn over. They have a

greater proportion of the heavy metal at the bottom. You labor under a common mistake. Milk is not lighter than water; it is heavier.

QUESTION. Would it be well for farmers who make butter to cool their milk as soon as they get it, in order to get better cream?

Mr. GOLD. If it is stirred during this process the cream will not rise.

QUESTION. But if it is not stirred?

Mr. GOLD. I think the quality of the butter would be very much improved in hot weather, but I doubt whether the quantity would be increased by it.

QUESTION. Do you think it makes any difference in regard to cream rising, whether the milk is deep or shallow in the dish?

Mr. GOLD. I made some experiments upon that subject, and thought that the shallow system was the best; but some others have made experiments, and they claim that it does not make any difference. It is one of those points that is not yet settled, any more than the matter of stirring milk.

Mr. NORTON. I have experimented somewhat, and find that I get better cream from a deep dish. Less surface is exposed to the air, and the cream is sweeter and the butter better.

QUESTION. How much cash do you receive per cow, in the price you get for your milk?

Mr. GOLD. I do not want to speak of my own dairy, for I have not been so successful as some; but I can tell what some have received. One gentleman, who had nine cows, I believe, made out a clear gross receipt of over \$150 per cow. That was an extreme case. We consider that we are not doing reasonably well unless we get \$100 per cow.

QUESTION. He kept his cows well, I presume?

Mr. GOLD. Yes sir.

QUESTION. Were there many Jerseys among them?

Mr. GOLD. Those were native cows that this man had.

QUESTION. What kind of meal is best for cows?

Mr. GOLD. If you want quantity of milk, buckwheat and wheat bran; if you want quality, you must add Indian meal and cotton seed to those other things. The buckwheat and wheat bran system will make milk that, when there is abundance, the New York milkmen will reject. When milk is scarce as it is now, they will take almost anything in the shape of milk; but when it is abundant, they very soon cut off all those dairies that feed slops

extensively. Corn meal makes the quality of milk very superior, but it is liable to fatten the cows too fast, and shrink the quantity.

QUESTION. Can milk, cured in the way you have described, be as readily made into cheese as other milk?

MR. GOLD. We suppose so, and with increased advantage.

QUESTION. But no cream or butter can be readily got from it, if cured?

MR. GOLD. If it is not stirred the top of the can becomes very rich indeed. The bulk of the cream will rise to the top, and you can pour it off or dip it off.

QUESTION. But if thoroughly stirred there is no rise?

MR. GOLD. Very little if any separation.

QUESTION. Can the milk be churned into butter?

MR. GOLD. Yes sir; that is what is done with the surplus milk in New York. The milkmen churn it and sell the butter. They do a large business of that kind during June and July, when milk is abundant. At this season, during the scarcity of milk, we are directed, if we have any milk over, to keep it until the next day, and send it then.

QUESTION. What changes take place to prevent the souring of the milk in curing?

MR. GOLD. The speedy removal of the animal heat is all that we suppose has taken place before any decomposition has occurred. It may be carried half a mile, and in some cases has been carried two miles to the spring; but those farmers who have been subjected to that inconvenience do not have uniformly good success. It is only those who milk right by the spring house, and can put the cans directly into the spring, who can have uniformly good returns.

COL. SWEET. I wish to say a few words in relation to this subject. I agree with Mr. Gold perfectly. I have furnished milk to the Portland market for the last six years. Previous to that, I carried on the manufacture of butter and cheese in my own family, but my wife's health began to fail, and I sold my farm and moved to Paris, in the county of Oxford, near the Grand Trunk Railway, in order to sell milk. It was a number of years before I could get a sale for my milk. There was one man who monopolized the business. He was rich, and supplied the Portland market. He died about six years ago, and I then commenced sending milk to Portland. I know the difference in the labor and in the profit of manufacturing butter and cheese in the family and raising milk for

the market. Mr. Gurney described the difference in labor better than I can. As to the profit, I have found it much more profitable. I kept an exact account one year, and my cows averaged me over \$100 apiece. I never realized near that when I manufactured butter and cheese.

There is one thing, however, to be taken into consideration. I never could get the price for butter and cheese then that they brought during the war, and do now. I have hauled many a load of cheese to Portland, and sold it for eight cents a pound, and my cheese was called as good as any that was carried into the market. Mine brought as much as the Vermont cheese was sold for at that time.

In relation to feeding cows, I agree with Mr. Gold in every particular. To make my cows give the greatest quantity of milk, I feed them on shorts. If I want to enrich my milk, I find that the best article is cotton seed meal. I have given my cows corn meal, but I find that they fat up too much.

QUESTION. How is it with beans and oats?

Col. SWEET. I have never tried them, and cannot say. I have talked with men in Massachusetts who have produced milk for the Boston market, and they say they are excellent. Barley and oats some have told me are good. I tried them, but did not like them so well as I did shorts and cotton seed meal.

I admired the address of Mr. Gurney. I would say to you all, brother farmers, I firmly believe that it is for your interest to form an association here and get up a cheese factory. Within the last two years I have talked with a number of men in Worcester county, and they are all in favor of these factories. They say they make money faster and more easily than they ever did in the manufacture of butter and cheese in their families; and it relieves their wives and daughters of a great amount of hard labor. I am firmly of opinion that if you establish a cheese factory in this place, you will never regret it.

Prof. FERNALD. I am glad that, while collateral topics of interest have been taken up and presented in so interesting a manner, the leading idea of Rev. Mr. Gurney's address has not been lost sight of—that of the establishment of a cheese factory here in Foxcroft or Dover, that shall be a centre for all this region. I really wish that the experiment might be tried here, and I desire to advert for a moment to two points that were referred to by Mr. Gurney.

The first is, no danger of over-production. And allow me to say, that I would not attempt to say a word, after the able and masterly treatment which the subject has received, from my own observation, but I fall back as I did this morning, when alluding to this subject, upon the testimony of Mr. Willard, who is excellent authority upon any point connected with dairying. In regard to the danger of over-production, Mr. Willard stated that Great Britain fails to produce as much as she consumes, and consequently imports from those regions of the world from which cheese can be obtained—from Holland and the United States. In the United States at present, we produce more than we consume, and help to supply the English market; but the manufacture of cheese is not a business in which all parts of the world can compete. The dairy belt of the United States is practically limited to the region included between the parallels of 40 and 45 degrees, and between these parallels only about one-third of the country, from the Atlantic to the Pacific, is well adapted to dairy purposes, so that we can see at a glance that there is very little danger from outside competition.

When we consider the limited areas that have suitable natural advantages for the production of butter and cheese, and consider that the quantity consumed is annually increasing, and must constantly increase, it seems to me it is safe to calculate upon a sale for all that in any human probability can be produced in New England at remunerative prices; that there is no danger whatever, for a long time to come, to say the least, of over production.

Mr. Gurney referred to cheese as an article of diet. Its value in that regard has not been sufficiently appreciated. There is hardly any other product so rich in the muscle-forming elements as cheese; and I am glad to learn upon reliable testimony, that its use as an article of food is steadily increasing among the people of the United States. And here I would throw in the remark, that in producing cheese much can be done by selecting the proper food for the cows. The question was asked whether pea and bean meal would be good. When cheese is to be manufactured, the cows should be fed upon material rich in nitrogen, and all the leguminous plants, as they are termed, are rich in nitrogen. Clover, beans, peas, and all plants of that nature, are rich in nitrogen, and rich in the materials that go to make up cheese. For the production of butter, a different kind of food might be preferable.

A word as to the number of cows that are needed to make a

factory profitable. Mr. Willard stated that it was desirable that there should not be less than three hundred; that a factory, with the necessary expenses attending it, cannot be successfully carried on with a less number of cows to supply it than 300; with 500 it can be made very successful and remunerative; perhaps still more so with 800; nor has it been found to be good policy that the number much exceed 1000 or 1200, for beyond this the establishment becomes unwieldy; two factories with 800 each would probably do better than one with 1600 cows. Mr. Willard regards our region as very well adapted to dairy husbandry.

MR. D. H. THING. I have been deeply interested in the lecture on associated dairying. The subject has been so ably and thoroughly discussed that I wish to say but a single word, and that upon one point. There can be no doubt that one of the greatest benefits to be expected from this source is the good that will result to the wives and daughters of the farmers, by being relieved from the care and drudgery of dairying. Supposing for a moment that the time, care and labor now bestowed by the women of our State upon the making and care of butter and cheese should be expended in improving the minds of themselves and their families, in beautifying and adorning their homes, in cultivating a flower garden, in performing all those little acts and amenities of society which go to make existence here pleasant, how soon should we see a marked and decided improvement in the community. The farmer's life is a life of toil, but the life of the farmer's wife, who has the care of half a dozen or more cows, is a life of toil, drudgery and isolation. While our business calls us often *from* home, her's keeps her *at* home; and if she does leave home for a few days to attend any of our fairs or festivals, it is only to go home and work so much the harder for a week to get the machinery to running smoothly again, that she thinks she won't go again. You may hardly suppose it by my looks, but I have a good wife at home, and why she is not here, resting from her labors and enjoying herself like her truant husband, is what? Just these cows at home, and nothing else. They can't be put off till to-morrow, or next week; there is the milk to set every night and morning, the cream to be taken off, the pans and pails to wash, scour, scald and dry, the churning to be seen to, (the women don't churn in Kennebec, and I hope not in Piscataquis), the churn to be taken care of, butter to work every day, &c., &c. Now, don't tell me to hire a girl, especially a dairy-maid, for you must know that a girl now-a-days will turn up her

nose at any offer a married man could make her, to say the least. It seems to me we shall be driven to one of three things, Mormonism, no dairying, or associated dairying. The first we won't have, the second we cannot afford to have, the third I believe we can have if we will. Shall the experiment be tried in Maine, which is no longer an experiment in other States?

Farmers of Piscataquis County! suffer a word of exhortation in this matter. The subject has been ably presented, the reasons are cogent, you have one with you familiar with its workings, and ready to advise and to stir up the minds of all by way of remembrance. You have the fall and winter before you in which to prepare with deliberation for commencing active operations in the spring. Associated dairying has been a success wherever it has been tried. It is bound to be a success here whenever it is tried, for you have all the conditions requisite for success, and, therefore, the sooner you begin in earnest the better.

Adjourned to Thursday.

THIRD DAY.

THURSDAY, September 1.

Part of Thursday was occupied as a field day, embracing an excursion to Sebec Lake, from whence some climbed granite mountains, while some others examined the newly opened slate quarries, and various other objects of interest. The return included calls at farms, with observations of the soils, methods of husbandry, etc.

On assembling at the hall, the following lecture was delivered by Hon. SAMUEL WASSON, on

WATER AS AN AGRICULTURAL AGENT.

To be successful learners we must, divested of prejudice, be true and careful observers. The study of internal plant, or animal life, is especially one of observation, and in none of its various branches is this more true than in the topic now in hand—*water*—the action of which, as a farm help, it is proposed to discuss in its two-fold function—*as an agent of agriculture*, and *as an agent of power*. Wherever the deep-searching microscope is not an implement of husbandry, no conclusion is more common than that the nutritive value of a plant can be determined by its measure of water. For example, by such the turnip is regarded as “nothing but water.”

That we may start out fairly and not be misled in our summing

up, it is required to take an epitomized view of the composition, offices and curiosities of water, which covers three-fourths of the surface of the earth, forms three-fourths of our own bodies, a large part of every tree, shrub, plant, and flower, as well as an indispensable portion of the soil we till. This liquid is the result of a subtle union between the well known gases, oxygen and hydrogen. Experiments prove that hydrogen, while burning in the air, unites with the oxygen of the atmosphere and forms water; and that water consists of those two gaseous constituents only.

It is a curious fact that, notwithstanding its power to quench fire, a mixture of its component parts, *without chemical combination*, constitute a combustible and violently explosive substance; and that at the freezing point water contains 140° of latent or secret heat. It is more strange than curious that oxygen, so indispensable to animal life, should form eight-ninths, by weight, of a liquid in which few terrestrial animals can live but a few seconds of time. The extent with which it mingles with bodies, apparently the most solid, is very wonderful. The glittering opal, which beauty wears as an ornament, is only flint and water. The glaciers, those mountain mill-stones, a staunch and solid piece of framework as any January could freeze together, are but water in a solidified form. In every plaster of Paris statue, which an Italian carries through the streets for sale, there is one pound of water to four pounds of other material. The air we breathe contains five grains of water to each cubic foot of its bulk. The farmer, drawing green wood for fuel, hauls in every cord six barrels of water, and in burning it green, loses heat enough in evaporating the sap to boil about six hundred gallons of water. Even "solid men" are but the representatives each of about five and a half pailfulls of water, through which forty-five pounds of carbon and other elements are diffused.

Water is a powerful refractor of light, a good conductor of sound, an imperfect conductor of electricity, is elastic and compressible, although to so small a degree as to be of no consequence in practice. Thirty thousand pounds pressure to the inch will lessen its bulk one-twelfth. In 1650, its compressibility was first fairly shown by the *Florentine experiment*. Its bulk increases seventeen hundred times by conversion into steam, and about one-fifteenth at the moment of congelation or freezing, when its expansive force bursts the strongest vessels. It may be so agitated as to rend into fragments the boasted representative of man's inge-

nity and power. It is diffused through the atmosphere in the form of vapor. It is a powerful solvent, dissolving gases and a great variety of solid substances.

From the want of cohesion among the particles of water, they are incapable of assuming any particular form without assistance, and, consequently, water always takes the shape of the vessel which contains it. Water cannot remain in a state of quiet equilibrium unless every part of its surface is equidistant from the centre of the earth, or in what is generally called a water level, though that apparent plane is, in fact, not a plane, but partakes of the convexity of the earth. The study of this fluid, in its relation to animal and vegetable life, presents new points of interest. Its influence in tempering the climate, and adapting the seasons to the uses and conditions of mankind, is most wonderful. Strike from our State its lake area and web of rivers, and no brain is fertile enough to imagine the disastrous influence upon its habitual condition for thus deprived of the summer's heat, stored away in those waters to mitigate the winter's cold, the soil would become pinched with dreadful frosts, the mountains covered with eternal snow, and the valleys filled with frightful glaciers.

Sailors have from time immemorial, asserted the seeming paradox that a storm warms the sea, a fact now established by thermometrical observations, that the difference of temperature in the ocean before and after a storm, varies sometimes as much as two degrees. It is well known that along the Canadian border the temperature of the climate is much modified by the presence of those large lakes.

Man's agency in effecting climatic modifications is a lesson we've yet to learn, and how to make clouds more evenly distribute their showers—that to the denudation of the mountains, and the destruction of the evergreen forests is attributable the withholding of the summer rain, till

“The thirsty land is scorched and dreary,
O'er hill and valley and outstretched plain;
'Till the cattle, the tress and plants and flowers,
Searching for their food in vain,
Mutely appeal within those scorching hours—
God send thy rain!”

or a turn in the tide of extremes breaks the “cloud-ring,” and the very floodgates of the heavens are opened, and a deluge of waters let fall upon the face of the earth, until the unharvested fields be-

come an inland sea upon which the commerce of an empire might ride or be wrecked.

In the human system the demand for water is imperative. It is wanted in considerable quantities to supply the secretions, and to carry off effete matter from the system. If its waste was no more rapid than the solids a quart per day would supply the demand; but the system requires from three to six pounds daily, or even more. In extraordinary circumstances, as in the case of glass-blowers, two and a half, and sometimes three gallons have been consumed. The skin throws off, from a pound and a half to five pounds in twenty-four hours. More than half as much passes from the lungs, and from thirty to forty ounces are secreted by the kidneys. Without water no vital process in the system could be carried on for a single moment. Blood must be liquid or it could not circulate, and oxygen and hydrogen are very important elements in the composition of the organs as well as the blood. By it the temperature of the body is regulated and adjusted.

When pure, water has neither taste, smell, nor pungency. It is neither sour like vinegar, nor sweet like sugar, nor alkaline like soda. It irritates no nerve of sensation, nor disturbs the tenderest part of the animal frame. It penetrates unfelt into the subtlest tissues. It soothes and assuages, lessening inflammation, lulling pain, diluting unhealthy fluids, and washing waste materials from the sickly and changing frame.

“Voices from sick beds crave the healing shower.”

Water chemically pure, is one of the rarities in nature. Even that which comes directly from the clouds contains mineral, animal, and vegetable matter, bringing down numerous impurities, minute spores, and invisible germs of microscopic animals and plants. Snow contains ammoniacal impurities. Spring water contains the soluble salts of the soil through which it percolates. It “tastes of the ground,” we say. Lakes, rivers, and streams contain a vast deal of impurities in suspension or solution; vegetable and organic matter, muriates of potash, soda, and magnesia, carbonate and sulphate of lime and other substances. Even the waters furnished by the Hydrant Company of Syracuse, the Croton of New York, the Schuylkill of Philadelphia, or the Cochituate of Boston, contain from twenty to forty grains of solid matter to the gallon. Well water is often rich enough in plant-food to nourish vegetation perfectly. Bog, or swamp water frequently contains salts of iron. The Mississippi deposits upon its delta annually sediment that would

cover 122 square miles one foot deep. The Ganges discharges a volume 82 times greater than that of the Great Pyramid of Egypt. The turbid color, and the name of that immense estuary, the *Yellow Sea*, is taken from the mud, 2,000,000 cubic feet of which are poured into it every hour by the Hoang-Ho river. No wonder that river water has become a synonym of filth.

The animal economy demands pure water. It is ours to find it. Nature, in two ways has provided never failing supplies. The mariner on short allowance at sea practically illustrates the first way, the condensation of vapor, as he boils and freshens the salt sea water by inserting the nose of the coffee-pot into that of the steaming teakettle. In the *juices* of all natural food, animal or vegetable, is Nature's "other way" of providing healthful water.

It is said that "laboring men must have solid food." What is "solid food?" A comparison of the analysis of the body of a vegetable with that of an animal shows no excess of solids in either. The following selections from a reliable table giving the quantities of water in 100 pounds of each, will better impress this fact:

In beef	74 pounds.
potatoes	75 "
pork	76 "
apples	84 "
eggs	80 "
milk	87 "
codfish	79 "
carrots	82 "

From this it will be seen that five-sixths of the food usually eaten is water. In living plants it is usually perceptible as sap. But not only do fresh plants contain water; hay, seasoned wood, flour and meal, when seemingly dry, contain a quantity of invisible water which can be expelled by subjecting them to a heat of 212° for some hours. Dried clover contains about 17 per cent., beans 14 per cent., rye 13 per cent., corn 12 per cent., thoroughly seasoned wood about 10 per cent.

The large per cent. of this fluid found in all gustible and nutritious food is not fortuitous or accidental, but to supply some need or want in the system for which nothing else in Nature is a substitute, for there are very few animals, whatever their food may be, which do not drink water.

As combined in natural food it is perceptibly different from the

purest rain water, or any other, obtained outside of this natural organization. This, in regard to milk has been clearly demonstrated. Milk, regarded as the type of a perfect food by every nation, tribe or sect, excepting the "Sintoists" and "Buddhists" of Japan (whose religion prohibits its use, as well as that of butter, cheese and flesh), contains the same per cent. of water as the turnip, yet these two articles of aliment, or food, by the classification of most are assigned antipodal extremes, one being placed at the head, while to the other is given the foot of the nutritious table.

If the turnip is to be rejected by reason of its large quantity of water, what is to be said of the cabbage, which contains even more than the "watery turnip?" "Yet," says Dr. Voelcker, "the cabbage contains much nutritious matter, and is a valuable food for milch cows." Then the cucumber, the indigestibility of which is proverbial, contains more water even than the cabbage. If the indigestibility of the cucumber and cabbage is due to the excess of water, where in other edibles does the true mean end and the excess begin?

"*Worcester's Unabridged*" defines food to be "whatever supports the existence or promotes the growth." *Water does both.* Shipwrecked sailors have kept the lamp of life burning for a great length of time on water alone; but if supplied with solid food alone their tongues swell, their eyes are pressed out from their sockets, burning inflammation seizes the whole body, and a train of horrid sufferings burn out the existence. Without this indispensable fluid no nourishment can be given or received. Certain classes of food have their appropriate work—as to develop the brain, bone, or muscle—but water is a universal food, and a vehicle for all food to every part of the body.

With regard to the water of vegetation, the amount drawn out of the soil by the roots of growing plants, and thrown with power into the stalks, and by the leaves exhaled into the air, is very great. A sunflower evaporates $1\frac{1}{4}$ pints of water a day, and a cabbage about the same quantity. A wheat plant exhales 24 grains an hour. It is estimated that for every grain of solid matter added to the plant in its growth, it transpires on an average 213 grains of water. A corn plant, during its period of growth exhales 36 times its weight of water. Every square inch of leaf lifts 3-500 of an ounce every 24 hours, equal to 150 tons of water to one ton of grass, or 800 barrels to an acre of grass or grain. The immense quantity of water thus pumped up out of the soil is hardly conceivable.

This fluid called sap or juice, runs through the whole structure of the plant, carrying with it all the constituents of vegetable growth. In this stream of water are dissolved the carbon, nitrogen, potash, phosphates, with other elements or compounds of food demanded by the growing plant.

Vegetation, by an unknown process, takes out of the sap the carbonic acid, ammonia, and various salts, leaving the water to be thrown off by the leaves—for, says Prof. Johnson, “we have no proof of a *downward* flow of sap.” If food is thus conveyed into the vegetable body, why may it not be carried in the same way into the animal body? The natural laws which govern both are similar, if not identical. The boundaries of the two great kingdoms of plants and animals tread closely upon one another. Says a writer, “there is a closer affinity between the animals and vegetable organism than most of us are willing to admit,” whether we regard the theory of Darwin as tenable or untenable.

“We know that plants as well as animals *eat*; that they breathe, perspire, and are sensitive to the touch. We know that they have sexes, and a circulatory apparatus; that they sleep, although, unlike the sluggard, the first rays of the morning light awakens them, to join, it may be, although their voices are inaudible to the human ear, the songs of thanksgiving and praise that resound from the feathered vocalists. They send their messages of love through the ambient air that they perfume with *many* odors, employing the busy bee, which becomes the Cupid in the dominions of Flora and Pomona, inviting willing mates to connubial felicity, and thus they, too, ‘multiply, replenish, and adorn the earth.’”

Plants have, strictly speaking, no bony system, no stomachs, no digestive apparatus, no heart nor lungs, like animals, to propel and to aerate circulating fluid. Every plant which grows is made up of little cells, each cell having its especial life. These cells, similar to the compartments of a honey-comb, are filled with fluid. They are so small that in a cubic inch of wood there are often more than a million. These cells perform the offices of the stomach in the plant, receiving the fluid of which there is a constant influx from the roots. The digestion of plants may be due to chemical action, more wonderful than the force which produced an Andes or a Niagara, ever at work, obstructing those substances brought up in the sap, and applying them, by cell multiplication, to the growth of the plant. The food supplied to the plant is in a state of solution when absorbed by the roots, while, of the food con-

sumed by the animal body, from one-fourth to one-sixth of it is taken as a solid, and is dissolved by water after it enters the stomach. The difference in the preparation of food for the inmates of the "two kingdoms," is, that nature masticates the food for the vegetable world, while man compensates for his teeth in the chewing of his own food, unless he adopts the Americanized method of saving time by bolting it anaconda fashion. The juices of some plants are so impregnated with certain substances, as to be retained in the secretions. Turnips fed to cows, before milking, impart a disagreeable odor to the milk. Porgie chum, when fed to grass lands, poultry, swine or sheep, if putrefaction has set in, gives a fishy taste to the hay, eggs, or meat.

When ruminating animals are fed on dry hay, which contains but from 14 to 17 per cent. of water, from 70 to 73 per cent. more must be supplied to satisfy their cravings. If this supplied amount be from impure fountains, the impurities injuriously affect the digestion, growth and health, yet a majority of farmers are as careful to keep roots, containing wholesome water, from their cattle as they are to keep salt from their hens. That water acts an important part as an element of food, is indicated by the fact that animals when obtaining food naturally, as when at pastime, consume in the grasses a greater quantity than when subsisting on winter forage. It may be that a diluted food is required in summer to reduce the heat of the body as it is demanded in winter to increase the warmth of the same. Those not having the fear of the "Maine Law," say of the "extract of rye," that it keeps out the heat in summer and the cold in winter. This pure water *can do*, whether whiskey can or not.

View this subject from whichever side we may, the conclusion becomes inevitable, that vegetable water, whether in fruit, root, or tuber, is an indispensable constituent of winter forage. Just how it propels the machinery of animated nature, or promotes the growth, or adds to the structure of the body, or prepares the food, or preserves the health, may not be clearly obvious, but its importance no one will deny.

Gray, in speaking of the agency of water, says, "it may be studied under its solvent properties, chemical agency, mechanical agency, and as affording food. It dissolves and holds in solution a great variety of substances, mineral, vegetable, and animal, and is the great solvent in all nature's operations; when it passes through the soil it dissolves its soluble salts, such as lime, nitre,

potash, etc., and conveys them to the roots of plants, taking up the soluble parts of vegetable mould as fast as the chemical changes in the earth render them suited to the nourishment of plants. It also absorbs gaseous compounds, such as carbonic acid, ammonia, and air. As nourishment it constitutes a large portion of the juices of plants; the woody fibre contains the elements of water, oxygen and hydrogen. In the state of vapor it ministers to the growth and life of plants, which have the power of absorbing the water falling upon them. Dew, celebrated through all times and in every tongue for its sweet influence, presents to our view a beautiful illustration of the agency of water in nature's economy, and exhibits one of those amazing adaptations by which animate and inanimate nature is bound together."

Such in vegetable economy is the indispensable agency of water; it is the vital fluid of all plants, upon its proper use the perfection, quality, and quantity of all earth's productions depend, particularly those intended for man's use.

Water, in another way, subserves a valuable purpose in the preparation of food—that of *steaming* and *cooking*. The practice of steaming food, hay especially, is of comparatively recent date; but it has been shown to be a great economizer of coarse fodder. The steaming of hay and straw, and the boiling of roots and tubers render them more easily assimilable and palatable, by dissolving their constituents, and by diluting the feed with steam, or condensed vapor, itself pure water, which not only quenches thirst and supplies material for increased perspiration, but has a hygienic character as a conservator of health.

It is a well known fact, that of whatever may be given to barned animals in a raw or uncooked condition, more or less is voided in an undigested state, which is as directly lost as if it had never been passed through the animal. Oats, barley, and uncracked corn, seen so frequently in the excreta of the horse, have furnished no more nourishment than if that same amount had been thrown directly into the manure heap. A careful examination, and a more frequent use of the microscope, would reveal a deal of other elements of nutrition voided in the same undigested condition, and in the same manner wasted and lost. Digested food only is nutritious.

The woody fibre of hay, no inconsiderable part, is rejected in an undigested condition. How few have any correct idea regarding the quantity of this woody fibre in a ton of *late* cut hay. Such hay is passed through the animal machine, but the woody part comes

out of the grinding like oat-husks from the mill-stones. A great amount of the vital force of the animal has been expended in sifting out the digestible part, but a greater amount in the *extra* labor of expelling that which is indigestible. These "extras" are costly things, as many a man learns to his discomfiture, when he comes to "settle his bills." In the tie-up it is represented by a loss of flesh and weight. For an animal may work off its body in the labor of filling its belly. Thousands of animals by this extra labor, are made to "show their ribs" every winter.

Observations show that potatoes, turnips and other roots, when fed in a raw state, pass through the intestines unaffected as when swallowed. The unbroken grains of starch found in the excrements are evidences of this. Every thoughtful farmer knows that the larger proportion of nutriment enters the stomach in the form of starch, which, by mechanical and chemical action, is converted into sugar, &c., and all that remains unchanged is cast from the system as waste. Uncooked starch taken into the human stomach affords not a particle for nourishment.

Recent experiments prove that the stomach of graminivorous animals can fit for use but a part of the grains of starch, if consumed raw. As starch constitutes more than nine-tenths of all the carbonaceous principles of our grains and leguminous seeds, and is the most important, and often the only food of two-thirds of all mankind, the economy in utilizing this waste will be self-evident.

By steaming hay, the woody fibre otherwise lost, is, together with the whole bulk, converted into a soft and succulent condition, rendering the whole mass more easily acted upon by the gastric juice, and enabling the animal to appropriate its nutriment. Besides it restores the hay, by the infusion of water, to its normal condition of nutritious grass. By steaming, straw, cornstalks, pea and bean vines, with other coarse herbage, may be converted into valuable fodder.

Before the invention of clocks and watches, the flow of water through orifices was employed to measure time. These water clocks were often used by ancient orators, to show them when the time allotted for speaking had expired. The sinking water of our "*Clepsydra*" warns me that my time has nearly run out, and that but briefly can I consider my second proposition of *water as an agent of power*.

The great and pressing want of the agriculture of Maine, is a HOME MARKET, where a surplus may find an accessible demand with-

out that ruinous toll which transportation and middle men are taking. With the existing condition of things, much of what is written or spoken to encourage agriculture in our State, is like sowing seed in the wind. When it will pay, men will learn to farm, will heed fitly uttered thoughts, will prize the aids of science, will lend a helping and willing hand to elevate the standard of farming. To stop the consumptive tendency of our farming and ward off a further decline, we have but one hope, and one remedial agent—the “*water-cure.*”

With an inland surface of 3,000 square miles of water—with more than 1,000 lakes feeding innumerable outlets—with numberless streams, the most of which are to-day, as through all time past they have been, through courses circuitous or direct, over pitch and fall and cataract, tumbling, foaming, falling their immense water power wastefully to the sea. These neglected waters annually deliver one and a quarter trillions cubic feet per day, and in their passage to the sea pass over more than 3,000 mill privileges and factory sites, and in their descent yield 2,656,000 horse-powers, equivalent to the working energy of 34,000,000 men.

The present age has witnessed vast improvements in many of the outward things which concern life, from intercourse as rapid as lightning, to surgical operations without pain. But, to confine these millions of escaping “horse-powers,” that with the force of their own gravity they may act as useful agents of industry, would be the supremacy of achievement. While this gigantic motor is unemployed, our agriculture with all the refreshing showers of the early and latter rains will continue to languish, our farms become asylums to hide our poverty and solitude; our census returns continue to show a constant exodus of young men, the wave of emigration pouring itself through every avenue of business into the cities, or surging toward the wheat fields of the great West, or the gold mines of California and Montana. The market will continue to be glutted with farms, the owners of which desire to drift into fortunes elsewhere, and the agricultural improvement and growth of the State will become as fixed and stationary as the snags in the beds of the rivers that flow at our feet.

Reverse the order of things—when these neglected sites will be utilized, works constructed on a scale to employ the stout arms of willing laborers—then our farmers may stand at the door of the *bread-room* to weigh out to each his loaf, and our agricultural capa-

bilities will become attractive, and our homes will be supplied with pure and living streams of intelligence and comfort, tranquility and perpetuity.

Shall we fail to comprehend the situation, content to be simply hewers of wood and drawers of water, producing only the raw material for others to *fabricate*? Can we afford to disregard our natural resources, valuable only as they are made available?

If we would see immigration pour in upon us, our unoccupied lands become the homes of the industrious, manufactures established in every part of this inviting field, the harvests of the farmers increased far beyond our present conception of what is possible, let us see to it that no longer the waters of our rivers run on in crystal purity to the ocean without adding to our wealth and prosperity.

Col. SWETT delivered the following lecture on

FRUIT CULTURE.

In all the departments of cultivation, there is none more useful and pleasing than the cultivation of fruit, and our advantages for their production in this State are varied and great. Good fruit is one of the luxuries in which all may indulge with advantage. Fruits form a wholesome article of food, and tend to diminish the excessive use of many articles of diet, the too free use of which produces dyspepsia, fevers, jaundice, and many other ills; they have a cooling and gentle laxative effect, correcting bilious affections, and purifying the blood, which is the life of the whole system; they add a charm to social life, affording a delightful treat to friends, and a constant, harmless feast for all.

We have many excellent fruits, among which the apple is the most important; and every attentive and reflecting observer among our population, interested in the progress of fruit growing, has doubtless arrived at the conclusion, that if the natural resources of the State are ever developed the apple must become a great staple crop. The large demand for apples during the past few years, and the high price for choice fruit, have led many farmers to give more attention to the cultivation of fruit, and to the improvement of old orchards. The apple tree is as well adapted to the soil and climate of many parts of the State as any tree whatever. This is shown by the fact that in the older settled parts of the State apple seeds, by whatever means scattered, by the road-side, in pastures

and about rocks, have not only germinated, but have competed in growth with many forest trees. Of course, if we wish for choice fruit, the trees must be properly cared for. Let me then urge every one who has land, to plant thereon fruit trees which will furnish an Eden, where he may enjoy the results of his skill, industry and faith in Him who giveth seed time and harvest. Teach your children the arts of horticulture; it will benefit them; it will aid you to train them up in the way they should go; it will spread around home the strongest endearments.

Soil.

In order to be successful in the cultivation of fruit, it is necessary that a soil be selected that is congenial to the kind of fruit we wish to produce. Every tree and plant prefers its peculiar soil in which it flourishes best, requires less manure and cultivation, and produces better fruit than in one less congenial; yet so different are the various species, that almost every soil, from the peat bog to the sandy plain, is adapted to some kind of fruit. That which is best adapted to apples is a strong deep soil, mingled with slaty rocks impregnated with iron. A deep granite soil is also well adapted to apple trees. Fifty years ago they were planted on such soil; they grew well, and produced fruit in abundance.

I well remember when a boy, of being sent with a team to a man that had a large orchard to get a load of apples. He said I might have my choice of fruit for five cents per bushel. This man, a few years afterwards, concluded it was not profitable to be encumbered with so much fruit, and cut down a large portion of his trees. If instead of destroying them, he had cultivated and grafted his orchard, it would now be worth more than all the rest of the farm.

But our soil has deteriorated; it will not produce fruit trees as it would fifty years ago. They would then grow almost anywhere, and with little care. Now it is needful in the first place to select a deep, strong soil, one suited to the growth of the rock maple, raspberry and blackberry. If such a soil is well prepared and the trees properly planted and cared for, they will grow and bear well. In relation to the preparation of the soil, much has been said and written; but in my opinion less depends on the preparation of the soil where it is not too wet, than upon proper planting and after cultivation. The greatest danger from undue wetness is on flat lands, where stagnant water remains around the roots. If trees

are set on such lands it should first be thoroughly drained by deep open ditches, or by underdraining, and if the soil abounds in muck or clay, gravel or sand should be added to improve its texture, render it more dry and friable and furnish suitable food for the trees, as they will not do well either in pure vegetable mould or clay. In traveling through the country I often see apple trees standing on the lower side of ridges, near wet swales, that are thrifty and healthy, and produce fruit in abundance, and a severe drought appears to have little or no effect upon them.

Albion Ricker of Turner, informs me that in the lot he selected for his orchard there was a wet swale running through it, and he was at a stand what to do with that portion, but he concluded to dump a cart load of good loam where he planted each tree. These trees are now twelve years old, and the best in his orchard.

It is evident to all that our old orchards are leaving us, and much inquiry is made of the best way to replace them. My preference is very strong for native seedlings, grafted or budded near the ground. If I could not get such, I would obtain seedling trees, and after being planted three or four years I would graft in the limbs. If I could get nothing else, rather than go without I would buy a few Western New York trees, though I am not much in favor of them. Whatever kind of trees you think best, be sure to plant; let the old plant for posterity, and the young and middle aged for themselves also. Some may say that they cannot wait so long. This reminds me of a farmer who thought so, and therefore he would not plant; his son inherited the same view, but his grandson thought he would plant some trees, whether he lived to eat of the fruit or not his children might. Whether they did or not, the story does not say, but it does say that his grandfather drank some barrels of cider from that orchard.

There is a cloud of witnesses all about us who testify, "If I had only planted an orchard twenty years ago, and had taken care of it, I might now have a sufficient income for myself and my family.

There is nothing that will help sell a farm so well as a good thrifty orchard upon it. If you meet a shrewd man in pursuit of a farm, one who has the means to pay for a good one, and you name one to him, his first question is, has it a good thrifty orchard? Such farms are scarce in the market; the farmer who has a well cultivated and productive orchard is contented, and does not wish to sell, nor to emigrate west.

There are a few farmers in Maine who receive from \$500 to

\$1,500 per year for fruit, but those are far between. Mr. Shaw of Buckfield set 100 New York trees; the tenth year he raised 100 barrels; he refused \$1,000 for the orchard. Mr. Albion Ricker of Turner, I have been informed, raised \$1,000 worth of apples on twelve acres, the eighteenth year from the seed. John R. Pulsifer, Esq., of East Poland, has an orchard, not a very extensive one, that produces from \$800 to \$1,200 per year. There are said to be in Maine 70,000 farms; now take half that number, 35,000, if these produce on an average \$50 worth of apples a year it amounts to \$1,750,000, and this amount is not half it might easily be in fact. Look at the account of C. Butterfield of Sidney, given in the *Maine Farmer*, April 2, 1870. He says one man sold from one tree \$15 worth in one year, another sold \$60 worth from one tree the same year. Now let each of these 35,000 farms in Maine devote one acre of land to apple trees, plant sixty trees, have them produce one barrel each, at \$4 per barrel, this amounts to \$240 per acre, and for the whole it amounts to \$8,400,000, which sum at the present price of flour would furnish bread for every individual in the State of Maine.

Transplanting.

Many spoil their trees by tearing them up as they would a worthless shrub, splitting and breaking the roots; and in many nurseries the roots are cut short with a spade. Instead of such treatment the earth should first be loosened around the trees, they should then be gently taken up with all the roots possible; and by all means take them up before vegetation commences. Much more depends upon proper planting than many people suppose. I have seen men dig a hole as they would to set a post, crowd in the roots, fill up the hole with gravel or coarse lumps of earth, and leave it to die. There is a good lesson in a story related by S. W. Cole, in his *Fruit Book*, of a farmer dismissing a hand because he set only nine trees in a day, during his absence; the next day he set the balance of a hundred himself. When they bore fruit the nine set by the hired hand proved to be more valuable than the ninety-one set by himself.

Dig deep, broad holes; they should be one or two feet wider than the roots extend, and eighteen or twenty inches deep; fill in the centre with loam to the height at which you wish to set the heel of the tree; if the roots are broken off or split, first cut the ends with a *sharp* knife, place the tree in an upright position, spread

out the roots so that they have their natural position, guard against setting too deep, especially on cold and wet land. The roots being adjusted, place fine loam over them, filling closely under the heel of the tree and all about the roots so as to leave no cavity; tread gently, so that it come in close contact with the roots, and after covering to proper depth *add a mulching* of coarse manure, leaves, straw, or some substance which will help retain an even degree of moisture in the soil.

Cultivation and Manuring.

I suppose many farmers know more than they practice in regard to the care of trees after they are set. But in going about the country, we often see young trees set in poor, worn-out grass fields, struggling for existence, starved and sickly, and sometimes with their tops broken by cattle browsing upon them. Now let me say to all, you will never succeed in that way in obtaining a good orchard. You don't attempt such a method with your other crops; why should you with fruit? When you plant corn or potatoes, or anything else, you prepare the soil, and after planting you give some attention and care to the young growing crop. If you undertake to raise a good yoke of oxen, you select good calves, of the right breed, and follow them up with good feed and care.

Now to be successful in the cultivation of apples; in the first place select the kinds of fruit best adapted to a northern climate and soil; set them out as I have described. Some recommend plowing and manuring, others manuring and mulching; I prefer mulching; keep trees mulched, on such soil as I have described, as far as the roots extend, with straw, leaves or weeds, or anything that will decay into manure. By this treatment the trees will probably grow all that is profitable. If the trees do not grow as fast as they should, remove the mulching, work in manure around the roots, replace the mulching, being careful to keep weeds from growing around the trees as far as the roots extend. In this way I find no trouble in having trees grow as fast as I wish. It is true that by plowing and manuring you can get a more rapid growth; but they are more liable to being killed by sudden changes of our hard winters. Trees that are kept thrifty by a cultivation that can be followed up, are more hardy and much better able to endure a northern winter, and attain longer life and productiveness than trees that are pushed by high cultivation.

It is of as much importance that we give to our apple trees the food they require to produce wood and fruit yearly as to any other crop the farmer cultivates. Apple trees exhaust the soil of certain constituents required to make wood and fruit, and these can be best supplied, in most cases, by a compost of muck, mixed with lime and ashes. This should be turned over several times before applying, and be spread in the fall, as a top dressing, as far as the tops extend. When the trees get old, some stable manure may be mixed with the compost, and with good results.

Pruning.

Much depends upon properly pruning a young orchard. Good judgment and a fair share of mechanical ingenuity is needful. Commence the formation of branches for the top at about four feet above the ground. Avoid crotches, when it can be done, for when the trees are loaded with fruit they are apt to split down and spoil the tree. Shape the top in the way it should be, and when it is old it will not depart from it. Take out all cross limbs, and thin out inner limbs where it is necessary to admit more sunlight into the top. If this be done when the tree is young, it will prevent the production of needless wood, and the damage from cutting off large limbs. Small limbs may be cut off in June or July; larger ones in September or October. The spring of the year is not the time to trim an orchard. Cut off a limb in the spring and the sap will run out, the wound turn black, and soon commence to decay.

Selection of Fruit.

It is no more difficult to cultivate varieties which will produce good crops of fruit, good to cook, and to eat, and to sell at high prices, than such as will scarcely pay for gathering. I will name a few of those which have proved desirable in the section where I reside. For instance, the Baldwin, Roxbury Russet, Tolman's Sweet, and Peck's Pleasant. For late autumn, the Nodhead and Porter. For early autumn or late summer, I consider the Red Astrachan as preferable to any other one, being a very hardy tree, a good bearer, good for cooking and eating, and always saleable at a good price from its beauty. There are doubtless many others equally valuable, but I mention only a few leading sorts of Oxford county.

In conclusion, I wish to say a word in regard to gathering and marketing. The market value of fruit depends very greatly on the

care with which they are picked and assorted. Any carelessness in these respects greatly affects the price they bring. A little bruise disfigures the fruit and causes decay. To illustrate my views, I will relate a story as told to me. In a neighboring State two men had orchards adjoining each other, and the fruit was equally good in both. Mr. A, an honest and judicious man, picked his apples with extreme care, handled them with care, sorted the saleable ones into two grades. Those marked No. 1 were all first rate, and as good at the bottom of the barrel as on the top. His No. 2 were uniform in quality and a grade lower. They were o. 2. Mr. B gathered his with less care, and was not very particular about handling or sorting them. At different times the same purchaser bought both—but Mr. A received a dollar a barrel more than Mr. B did. On comparing notes afterwards the latter asked his neighbor how it came to pass that he got a dollar a barrel more than his own brought in the same market, and the reply was, “it was all in my knowing how.”

A motion was next made that reports from Farmers' Clubs be now heard; and Mr. Buck was called upon.

Mr. Buck of Orland. Three or four years ago, by the assistance of the gentleman from Hancock and one or two other members of the County Society, a club was formed in our place, and since that time, if I mistake not, we have held three successful town exhibitions. The first was a good exhibition for a first one; the second was much better, and the third was better still. It has been estimated that our farm products have increased a hundred per cent., or nearly that, within a radius of a few miles since the organization of the club. It has given an entirely new impetus to our efforts. Farming has got well up to where it should be in the estimation of those around us. Everybody who has a garden or only plants a small patch is vieing with his neighbors to see who shall make the best exhibit at the next fair. We can hardly tell how much we have done, but we have done a great deal. We certainly would not go back to the old routine. We would not give up our Farmers' Club on any consideration. And, more than that, our farmers think more, read more, and have learned to talk better; and that, it seems to me, is quite a gain. They are mostly behind any other classes in ability to speak in public. But we find scores of people dressed in homespun who now get up and express their ideas clearly and forcibly in regard to the differ-

ent modes of husbandry, and the different methods which should be pursued under different conditions.

For three successive years we have had, at the close of our exhibition, a Farmer's Supper, with beans and brown bread, pumpkin pies, vegetables, and whatever else farmers raise; the ladies gather together and we go and have a grand sit down; frequently we get some good speeches, so that the thing is well spiced, and we have really a good time.

Mr. WALKER of Topsham. We have held meetings once a week, and they have been very well attended, not only by the farmers of our town, but from the towns adjacent. We have had several addresses, and I do not know when so much interest has been taken in any matter as I have seen manifested in our region in agricultural matters since the organization of the club. At the outset we feared that we could not bring our friends out, but after one or two meetings we found everybody took a great interest in them. We filled the various churches—for the meetings were held one week in one church, and the next in another—and the discussions we regard as having been very beneficial indeed. We expect a very much better exhibition this year in consequence of the establishment of our Farmers' Club.

The CHAIRMAN. Have your meetings been continued through the summer?

Mr. WALKER. No, sir, they have not.

The CHAIRMAN. Have yours, Mr. Buck.

Mr. BUCK. Club meetings drag hard through the summer months; but when the evenings grow longer and farmers have a little more time, we hold meetings regularly; we do not hold them regularly through the summer. We have occasional lectures, sometimes connected with agriculture, and sometimes with other matters, for we want to make our club a nucleus for everything good we can bring into it. We discuss a variety of subjects. One night we took up the question of sheep-husbandry; and we have ventilated pretty thoroughly the cheese-factory question, and have almost come to the conclusion that a cheese factory is what we need and must have. Our farms have improved, our minds have improved, our hearts have improved, and we think we have improved all round.

The CHAIRMAN. I would inquire of Mr. Chamberlain if it is thought advisable to try to keep up meetings through the summer?

Mr. CHAMBERLAIN. It is not practicable here.

Mr. COMINS of Eddington. A Farmers' Club was started at East Eddington last fall, and we held meetings regularly until the roads became badly blocked by deep snows, and again towards spring, and kept them up until planting time; since which we have not held any, but we expect to resume in October. They have assisted us in thinking and comparing notes one with another, and that is what we farmers most need. We are very much isolated; we do not know how our neighbors succeed, nor how the farmer a few miles from us prepares his land, how he puts in his seed, how he manages his crops. We do not understand one another sufficiently, and I hope that these farmers' clubs, as well as the future meetings of the county societies, and especially such meetings as we have enjoyed during this session, will make the farming community better acquainted with each other, and enable them better to understand their whole duty as farmers.

Mr. WALKER of Sagadahoc. We had a very interesting discussion in our club in respect to the working of cows. I would like to have some gentlemen state their views on that subject. Will the Secretary give us his?

Secretary GOODALE. I have no experience in this matter, and my observation is little more than of a team which I have sometimes seen in the streets of Portland,—and which I have an impression belonged in Harpswell,—but I am not sure. Harpswell is a long, narrow town, nearly surrounded by the ocean, and is famed for fishing as well as for farming. Although situated in Cumberland County, it is more conveniently connected with the Sagadahoc County Agricultural Society. If the gentleman will look at the returns from that society, published in our volume of Transactions for 1857, he will find a statement from Thomas Alexander of Harpswell, who claimed and received a premium offered for cows "yielding greatest profits," and saying that his yoke, eight and nine years old, had performed the work on his farm in place of oxen, for five years past, were kind and docile, were not injured by the work for milking or breeding, had furnished him with milk for eleven months in the year, and during the best of feed gave about sixteen quarts each daily. When that statement came to me, I thought it rather strong—rather more a fish story than a farm story—that it was to be taken with some grains of salt—and I think so still, but inasmuch as the committee, who ought to be competent judges, awarded the premium and so acknowledged the claim, I ventured to publish it.

My *opinion* is that barren cows or heifers *can* be used for labor, and *perhaps sometimes* profitably, but if a cow gives milk, that is all which can be profitably looked for from her. It is very certain that if the food consumed goes to make milk, it *cannot* at the same time furnish force for labor. To expect a given amount of food to be consumed in milk-making *and also* to give strength for labor, is as reasonable as to expect the ashes from a given amount of coal or wood to give out another equal amount of heat if put in the grate in place of fresh fuel.

If the farming community falls into no greater errors of practice than by allowing cows to give milk and oxen to furnish labor, there will be little to complain of, or to mend.

Mr. LUCAS. I will state what I know about the working of cows. I can give an instance of a single pair which is owned in the town of Cambridge. They measured, when six years old, six feet four inches in girth. They were worked when a year old, and have continued to work up to this time, but they are not worked now so much as they were when they were younger. I think the owners left off working them in the place of oxen some two years since. I learn from them that they stood the hot weather much better than oxen, that they would do more work on a cold day than any yoke of oxen, haul more load than any oxen of their own or that were in the neighborhood, and in addition to that, give a great deal more milk! (Laughter.)

Mr. JEFFERDS. A cow which gives a good mess of milk has all she can do. It is more than I can do to feed so that she will give a large yield of milk and keep up her flesh at the same time. But I have seen cows work. I have seen a team of cows that had crossed the plains from the Mississippi to the Pacific, and had drawn a wagon with a family and all their cooking utensils, and had given milk all the way. They came through in as good condition as ox-teams that came, and I was told by those who had driven cows across the plains in teams that they stood the work better than oxen, and travelled better.

QUESTION. Did they give more milk?

Mr. JEFFERDS. They gave more milk—than oxen, and very little more. If we use cows for labor we must not expect much milk.

Adjourned to next day.

FOURTH DAY.

FRIDAY, September 2.

The Board met agreeably to adjournment.

Prof. GOODALE. I rise merely for the purpose of making a personal explanation, and asking of the members of the Board a practical question. I have thought that I could perform the duty which devolves upon me as a member of the Board of Agriculture, by quiet study in my laboratory and library, and by presenting the results of that study in some future report better than by making any remarks to which you might have the kindness or the patience to listen at this time.

In the course of the studies to which I have devoted the scanty leisure afforded by pressing college work, I have endeavored to translate and abridge a French treatise upon milk—a treatise which, from the exceeding care with which the experiments have been conducted, the faithfulness and accuracy with which they have been recorded, and the judgment with which the results have been interpreted, will prove a valuable contribution to our agricultural literature. In the course of this translation, and during study upon collateral subjects, I have fallen upon some grave questions. One of these has been already brought before you at the meeting in Lewiston, and I suggest it again for the purpose of assisting in its solution. You will remember that at that time there were many conflicting statements made in regard to curing hay, and this question was asked—how does it happen that hay will sometimes come out of a mow in good condition when put in as green as is the practice of some farmers.

Now you do not need a chemist to tell you that the phenomena of nature are characterized by uniformity; that if one man tries a given experiment with certain results, another man may repeat that experiment and he will obtain precisely similar results, provided there is no deviation in the conditions of the experiment. This fact is accepted by all. But it is not easy to understand, in all cases, the conditions under which experiments, especially farm experiments, are conducted, as for instance in this case of curing hay. The exact amount of moisture which the hay contains when put into the barn, and the degree of heat evolved in the mow, are conditions which must modify results obtained. The question of reconciling the discrepancies of statement in regard to curing hay, is one which can be answered by a series of careful observations

made by yourselves, and it is in regard to this that I wish to say a few words.

In hay cured as a good many of you say you are curing it, by placing it when it is almost green in the mow, a certain constituent of the green grass, or partially dried grass, coagulates. Let me make this plainer. This constituent is an albuminoid. It is something like the white of an egg, only it exists in very minute proportion; it lies in the interior of each cellule of the grass in such a thin film that you cannot detect it, even under the microscope, without the use of chemicals. But this albuminoid, which so closely resembles the white of an egg, will coagulate just like the white of an egg. When you cure hay in the mow, many of you say it heats. I believe that the albuminoid coagulates during this heating under favorable circumstances. But suppose moisture is present; you cannot expect that the coagulated albumin will remain free from putrescence; part of the hay must be decomposed; and hence some say that under these circumstances it becomes good for nothing; others say that most of the hay becomes of a superior character, and you lose only what is on top.

Now, what I ask is, first, an answer to this question at some period during the coming year,—How great is the amount of heat developed during this process of curing hay? And I will say that I am so anxious to have this question answered, that I will place at the disposal of any members of the Board, who will oblige me by using them, thermometers, for the purpose of obtaining some accurate and well-determined facts in regard to the exact temperature which the hay reaches during this process of curing; and those who are willing to conduct careful experiments will have placed at their disposal a self-registering thermometer. Experiments like this which I have suggested cannot be carried on in a laboratory. The chemist must have the assistance of practical men.

In closing, I will add that the woody fibre of grass, *before it reaches a certain degree of maturity*, may be changed by heat, so as to be digestible by stock. This is contrary to the view heretofore held by most agriculturists, but the experiments of Mr. Lawes have shown that a portion of the fibre, which was formerly said to be useful only for bulk, may be utilized as food.

The questions of curing hay, of determining the amount of heat developed during the process, and the effects of this heat, are all

of importance, and your coöperation in the matter will greatly facilitate their solution, and perhaps aid in giving a satisfactory answer.

The Chairman announced as the subject next in order, a discussion on Plows and Plowing.

Secretary GOODALE. I trust this matter will not pass without discussion. In his lecture, the gentleman from Androscoggin expressed the opinion, without any hesitation, that no plow made in Maine so fully subserved all the uses to be expected of a plow as some made elsewhere. I am inclined to think that there is more truth in it than is palatable. But there are many, both manufacturers and farmers, who would strongly dissent from such an expression, and I hope that any such, now here, will present their views freely, so that both may go out together.

Col. SWETT. I agree with the remarks of Mr. Goodale. For one I do not feel willing to have it go out that this Board assents to the idea that Mr. Gilbert advances. In the section of country where I live (Oxford county) we have had various plows; we have had the one manufactured by the Ames' Company of Boston, which Mr. Gilbert recommended; we have had the conical plow; we have had the sward plow, or the breaking-up plow; and so far as my experience goes, there are plows manufactured in the State of Maine which I consider far ahead of either of these. There is a plow manufactured at Paris called the Hersey plow, which invariably takes the premium at the fairs in my section, and has taken it over those to which I have referred at our State Fairs. The farmers prefer the Paris plow to either of the others. It is claimed that they pulverize the soil more than ours does. I cannot assent to that idea, neither do our farmers. I think the Paris plow and the Hersey plow are both worthy of recommendation to the farmers of Maine. I am not acquainted with the Collins' plow. If there can be a plow introduced into the State of Maine which is ahead of anything we have, I would be glad of it.

Mr. GOLD. It is the material of the Collins plow which particularly gives it its value. It is of cast-steel.

Col. SWETT. What makes that superior to the cast-iron plow is, that it will work in very fine soil or loam and not clog on the mould-board. That objection I have heard brought by the farmers on the Androscoggin river against the Paris plow and the Berwick plow. They tell me they have been in the habit of using a cast-steel plow which works admirably on that soil. But on the larger portion of

our upland soil there is no trouble with the Hersey plow or the Hussey plow, and I should prefer them, the Paris plow in particular, to any other which I have seen. It is the general opinion of the farmers in our section that the Paris plow is ahead of any other that has been introduced there.

Mr. Doe of York. The reputation of my county has been assailed by the gentleman from Androscoggin, in his dissertation upon plows and plowing, and I should be remiss did I not rise to defend it. But still in the main, I concur with his remarks. There are so many different views and opinions on the subject of plowing, that it is no wonder we disagree as to the implement to be used. If we want simply to invert the soil, to turn it upside down, there is no plow in the world that is better than the Hussey plow, manufactured in York county. That is my opinion. But some have another motive in plowing, and, I think, correctly. It is to break up the soil, to pulverize it, and leave it loose and light. And some people think the shingle method of plowing, letting one furrow lap over the other, is an advantage. Undoubtedly it is in some cases, and upon some kinds of soil. If it be heavy and tenacious, by letting one furrow lap upon the other a space is left under each furrow, so that the water and air can circulate through, and the sod sooner rots. There is no doubt about that.

The Berwick plow, when properly used, upon suitable soil, level and free from obstructions, will turn every furrow squarely and smoothly into its place, and the sod is completely inverted. Now this, in loose and porous soils, answers every object of plowing; everything is covered up. But in heavy, clayey, tenacious soils the object to be attained by plowing is not fully accomplished by leaving your furrows in that manner. So I think the Holbrook swivel plow,—I have never seen it tried except the last season,—is better adapted for that object than our Maine plows. It does not lay the furrow solid. It slides it over, in a rolling manner, tucking the edges down, so that your furrows instead of being left flat are left in a rolling form. The old sod is entirely covered up, and yet there is an open space for the air to circulate. On such soils the Holbrook plow makes better work, and fulfils my idea of plowing better than our plows in Maine; but upon rocky soil, or more porous soil, the Hussey plow answers every purpose fully as well as the Holbrook plow.

I may not be correct in my ideas of good plowing, but I believe that when the sod is inverted and all the old sward completely

covered and out of sight, but still with a space open under the furrow slice, it is better plowing than to have the sod merely inverted and lying flat. I would like to hear the opinion of farmers upon that point.

Col. SWETT. I had one of the Holbrook plows last year, and I consider it ahead of any swivel plow that I ever used. One point for which I prefer it is, the ease with which it may be held and managed. I consider that plow worthy of recommendation. I have seen as good work with it, on level sward ground, as I ever saw with any plow.

Mr. LUCAS. I think we ought to be careful how we express preference for one plow over another. We have several manufacturers in this State, and they make good plows, and such as farmers require. Suppose the Foxcroft plow, the Doc plow, and the Hussey plow were all here, and we went out to see them tried, would there be difference enough to make us feel safe in expressing a decided opinion in favor of one over the others?

In breaking up, the object is not so much to pulverize the soil as to invert the sod. We turn the sod underneath because we don't want it on top. We turn it over for the purpose of rotting it, that it may be afterwards converted to the uses of the plants we propose to put on that soil. We have other means of pulverizing the soil. Suppose we break up a piece of ground this month, and propose to let it be until spring. What is the object of that? It is that it may rot and be easily worked. We have harrows and cultivators to make that soil fine; hence, in this case, the plow is not needed as a pulverizer. My idea is, that the sod should be turned upside down, and there remain until we have occasion to use it for cropping purposes.

The objection to these steel and iron plows is the trouble and expense of repairing them. That used to be the difficulty with the old iron plows that were used forty or fifty years ago. It was quite an expense to get a new iron share, or to get the old one repaired, to say nothing about the bungling and imperfect manner in which the plow did the work. As I understand it, these steel plows, which are used almost exclusively in the west, have their shares as sharp as a knife, for the purpose of cutting the roots of the prairie grass. They sharpen their plows as we do our scythes. I have witnessed that several times. Those plows would not be adapted to our purposes. I do not know that that is the case with the Collins plow, however.

But my point is, that we should be careful how we express any opinion against the plows made in this State, for they are all good plows, as I understand, and our manufacturers would not tolerate any report from us based upon a want of knowledge of the real character of the things we are talking of.

Mr. WASSON. Right here and now, while the remarks of the two gentlemen who have preceded me are fresh in our recollection, I would like to say a word or two. We have, in those two gentlemen, the representatives of two extremes. My friend, Col. Swett, thinks it advisable that we should recommend some plow; Mr. Lucas represents the opposite wing, and thinks we should express no opinion whatever. If we adopt the former course, we place ourselves in a position which, during the entire life of the Board we have uniformly endeavored to avoid, namely, that of an advertising medium. In the infancy of the Board a resolution was adopted, wisely, as subsequent events have proved, not to take sides as partizans in favor of one or the other of competing interests. Since that day we have a new agency in the field, namely, the Farmers' Clubs. What we want now, is, if possible, to insert a connecting link between this Board, representing the farmers over the entire State, and these little clubs representing their several localities. It is perhaps a question now before us, Shall we hesitate to express an opinion? Is not that a part of our legitimate work? Believing, as I do, that of all the implements of husbandry the plow is the most important, I believe that we do injury to the interests we represent if we fail to express an opinion, which we may do without representing this plow or that. If we should attempt to advertise the plow of any party, we should find as great a diversity of opinion as we should if we should attempt to show what object is to be accomplished by plowing.

Let me illustrate my meaning. If I should submit to those present divers questions relative to plowing; as the object to be obtained—the best time to plow, the proper depth for plowing, and many others; I might get as many difficult answers as there are persons to reply. If, then, we could not agree upon fundamental principles and points, would it be wise for us to attempt to say what plow should be used?

Again, I believe that the object to be accomplished by the plow in Maine is in some respects unlike that to be accomplished by the plow in the Western States. We have here a hard, thin, cold,

granitic soil. We want something more of the plow than simply to destroy the sod, grass and weeds; we want something more than ordinary pulverization of the soil. As for the remark in the paper which was presented to us, that the manufacturers of plows in Maine have failed to make a plow that answers fully the wants of the farmers of the State, let us look at it a moment, and see if there is not more truth than poetry in the assertion. If the writer intended to say that the manufacturers of plows in Maine have failed to give to the farmers such a plow as they need, he has stated the simple truth. If he intended to say that they have given to us an inferior plow, as compared with manufacturers in other States, it might be somewhat questionable. I believe that by the remark, taking it in its full force, and with all the emphasis that you may place upon it, no injustice is done to the manufacturers of any plow in this State. It is simply saying to them, "No matter how nearly up to the point of perfection you have come, you have not yet arrived at that point; we want something in the plow that we have not yet found." I believe the plow is a long way from perfection, or from meeting the wants of the farmers of Maine, and I would not, for one, change the expression in that address. While it does no injustice whatever, I believe it will be productive, ultimately, and I hope speedily, of great good, by calling the attention of our manufacturers to this important question.

Mr. THING. If there is a plow manufactured in Maine that meets my requirements I have never seen it.

Mr. LUCE. The nature of the soil, and the smoothness or roughness of the land have a great deal to do with the working of a plow. I have used the Frye plow, and it works admirably on smooth land, but if you take rough lands, that plow does not work very well. There is no plow that will answer every purpose. A man having rough land wants a shorter plow than a man who has smooth land. On smooth land, I have seen the Frye plow run ten, fifteen or twenty rods without touching the handles.

The discussion on plows and plowing here terminated, and the board took up the question of

SHEEP HUSBANDRY.

Mr. GILBERT. Mr. Bodge, the member from Lincoln, being obliged to leave town early this morning, had no opportunity to present his paper, and left it in my hands, with the request that I would read it, which with your leave I will do.

SHEEP HUSBANDRY.—SHALL WE ABANDON IT?

BY JOHN BODGE.

It may seem presumptuous for me to offer any remarks upon this subject, especially if I take a position at variance with popular belief, or at least, differing from the general practice. I am aware that sheep raising is not fashionable now in Maine, and that it is almost impossible in many sections of the State to get up any interest in the subject, but that to my mind is no argument at all against this department of farming in our State—a branch of industry which although now temporarily under a cloud is yet to be, I firmly believe, one of the most popular and productive departments of farming practiced among us.

There are changes and tides in all the affairs of men—ups and downs, and it would be strange if this should prove an exception. One extreme follows another. Six to eight years ago sheep husbandry was on the high tide of popular favor. Everbody seemed crazy to possess sheep, and a flock of long wools, or fine wools, or mutton sheep, was the grand desideratum. Sheep talk was on every tongue, and rams and ewes, lambs and wethers were bought and sold, and coveted, almost without regard to price, and certainly without regard to reason. Who of you cannot remember some favorite Sweeptakes, Silverdrop or Green Mountain Boy, which were held and even were sold for fabulous prices. That was one extreme. Now, none so poor as to do them reverence, and they are tied up in an out of the way corner of the barn, turned into some distant pasture, or their skins have gone into the vats, and their carcasses to the dogs. This is the other extreme.

Now the question is, where is the mean, and are we not soon to reach the time when sheep husbandry followed and practised in an economical and sensible manner will prove to be profitable compared with other branches of farming?

To my mind it is useless to say that we must abandon it, for we cannot. Somebody must raise wool, and if we in New England do not do it who will? We must have the raw material for clothing—there is no substitute—and the hills of the Eastern States are the only localities that can produce it to perfection. We cannot compete with the West in producing corn, or wheat, or beef, but we can beat them in sheep growing. Let us not neglect our opportunities, and despise not the day of small things.

Shall we abandon sheep husbandry? No. And in my broken

and desultory manner let me tell you why we should not, and why, comparatively speaking, there is no kind of stock which will pay better for Maine farmers to raise than sheep.

In the first place, there is no stock so easily and cheaply kept as sheep; and with a season like the present, when the drought has parched out pastures, the grasshoppers have overrun our fields, and in some sections almost devoured every green thing, and when hay promises to be \$25 a ton and scarce at that, it is quite an item to have a kind of stock that is easily and cheaply kept, even if their profits are not large, providing they are sure, as I claim to be the fact with sheep.

Wool, in my section, is now about forty-two cents a pound, and our sheep average about three pounds per head. Lambs sell for from \$2.50 to \$3.00 apiece. It is easy to thus figure the annual profit. Compare this with the cost of keeping a cow, which is equal to seven or eight sheep, or of keeping a horse or colt which makes no such return, and you can easily see the comparative cost and value.

There is no kind of stock which get their living so early in the spring and so late in the fall as sheep. They go out with the early bare ground and do not come to the barn till the snows of winter have robed the fields and the face of nature in its wintry covering. It has been said, and with much truth, that the farmer pitches into the barn for six months and pitches out the other six months of the year. But it is not to the sheep, for they do not average over half that time at the barn. And the care necessary to be bestowed upon them is very small compared with other stock. A foddering twice or three times a day is all they need of labor for the whole winter except a few days in lambing time, when, to be successful, a few hours must be devoted to their care. Compare this with any other animal kept in the farm-yard, and see the great difference, all in favor of the sheep.

Then again, sheep are of positive value instead of detriment to any pasture or field upon which they feed. They eat plants in the pasture which other stock refuse, and thus act as pruners for the dairy pasture, if turned in occasionally. And if you have a mowing field overrun with weeds, what so good as a flock of sheep for a few days to cleanse it. But their great value upon a field or pasture arises from the fact that they remove nothing from the soil, that is, they do not impoverish it. On the contrary, they leave it richer than they find it. If we wish to recuperate an old turf-

bound, run out grass field we pasture it a couple of years with sheep, and its entire complexion is changed, and a heavy crop of grass is the result. Of what other kind of stock can we say as much?

It may be said that the returns from sheep raising are small in amount and slow of realization. Granted; but they are sure and regular. We get it every year in the form of wool as interest, and lambs which are the increase, leaving the principal untouched. It is a semi-annual dividend, and no income tax or internal revenue bills to pay. It is not the rushing, noisy, turbulent stream, swollen in spring time and dry during the drouth, that produces the best effects. It fills the pond and overruns the dam for the time, but is not to be depended upon to drive the machinery of the mills steadily. Rather, it is the deep, quiet stream fed by tiny rills from never-failing springs, which is to be relied upon. The pond at its outlet is always full, and the whirr of machinery driven by its power is never silent through drouth or freshet. So with branches of farming. It is not that branch which *may* pay large returns that is the safe one for the farmer, it is the one which is *sure*, though the income is small and gradual. Hence I say sheep husbandry must not be abandoned. It is a sure, safe, and reliable occupation.

Secretary GOODALE. If we have the time at our command, it seems to me we might well devote a portion of it to a discussion of this subject. As the writer of the paper well says, in substance, "there is a tide in the affairs of men," and it is certainly true that at this time it is dead low water in the matter of sheep husbandry, but I think with him we should not for this reason allow ourselves to abandon this branch of farming. There are various considerations connected with it which do not attach to any other branch; and while I cannot assent to all the propositions laid down in his paper, there are others which I deem of great importance.

Perhaps it ought to be known, that the gentleman who wrote that paper lives in a section of the State where sheep do not, in all cases, require so long attention during the winter as they do here. I doubt if a majority of the farmers in the State of Maine could say with truth that they have to attend to their sheep only a quarter part of the year. I understand the statement of the paper to be that sheep require fodder only three months out of the twelve. It is true, that along the seaboard there are places where

sheep are not attended to through the whole winter, but it is where nature furnishes thickets of dwarf evergreens, shrubs and bushes which serve them for shelter, and where they have access to rocks covered with algæ and various salt water plants and get a great deal of food from these marine plants and mosses. So that while he may be correct as to the length of time they sometimes receive attention in his section, I do not believe the statement would hold true in regard to the interior of the State, where they certainly have to be attended to more than three months during the year.

Then, again, I doubt if his position is tenable, that we can compete with the West in growing wool. There is no doubt that wool can be grown much cheaper in some other sections of the United States than here. I believe that there are men who were born and brought up in the State of Maine, owning sheep now by thousands in other and distant parts of the United States, who, notwithstanding the distance, can afford to send their wool to this market and sell it cheaper than we can. But for other and abundantly good reasons we ought not to abandon sheep husbandry. We can afford to raise sheep, because, in addition to the direct returns in wool and lambs, they furnish us a means of fertilizing our farms, for there is truth in the Spanish proverb, that the sheep carries a golden foot. Your land can be greatly improved by sheep; but that we can compete with the West in raising wool I do not believe.

I have seen Mr. Gold upon his farm and among his sheep, and I would be glad to have his views on this subject, and more particularly because, as I before remarked, the county in which he lives bears a very close resemblance to considerable portions of Maine.

Mr. GOLD. Sheep husbandry is a favorite topic with me, and one in which I have always been deeply interested. It is impossible, however, to raise the best sheep, or even good sheep, with the slight amount of care which the gentleman in his paper represents. It is impossible to raise nice South Downs, or nice Cotswolds, or nice Merinoes, except with very excellent care. In that case we believe them to be still paying farm stock, notwithstanding the great depression that now exists with regard to sheep husbandry.

But the highest proof that I would present of the importance of sheep raising as one of the branches of husbandry, is the fact that in Great Britain, with its enormous population, its high-priced land, and everything, as we suppose, that operates against the

successful prosecution of sheep husbandry, and in Saxony, with its still more dense population, the number of sheep raised is vastly greater than in any other part of the world. There, where agriculture is carried to the highest degree of perfection, and all the products of the soil are utilized to the fullest extent, we find more sheep than anywhere else. I lay it down as a proposition, that in the future development of our New England agriculture, the sheep must play a prominent part; and it is as necessary in that light as the cow, the horse, or the hog. Each has its proper place; and as a destroyer of weeds, and as a consumer of certain products of the farm that otherwise would go to waste, the sheep comes in as an indispensable aid to us. In addition to the consumption of certain food that would otherwise go to waste, the sheep is said to have a golden foot. The effect upon certain light lands of the tread of a flock of sheep, in addition to the manure which they deposit, is found to be invaluable. It is put forth as a proposition, that Great Britain could not raise as much grain as she does if her sheep were entirely driven from the soil; that it is with the aid of sheep that Great Britain has attained to such enormous productiveness in the growth of grain and other staples. The tread of sheep upon certain light lands is found to be an indispensable means of bringing them to their highest degree of fertility.

The causes of the decline of sheep husbandry have been numerous. We frequently go to extremes. We are in haste to get rich. The Merino brings big prices, and we rush into the raising of Merinoes, and get a kind of sheep not fully adapted to our wants. As a wool-bearing sheep, that is undoubtedly the best we could have; but our numerous villages, and our farmers, located far from the butcher's stalls, demand a different kind of sheep; and when the mutton of the South Down and the Cotswold is found to be not only the most healthful, but the most palatable and the most economical meat we can furnish, there is a strong argument in favor of the culture of sheep. And such is the fact. There is no way in which the farmer can furnish himself and his family with so healthful and so palatable flesh, during the summer and autumn months, as by the culture of a flock of mutton sheep. He may enjoy in this way what would be a great luxury to others, and at a very cheap rate.

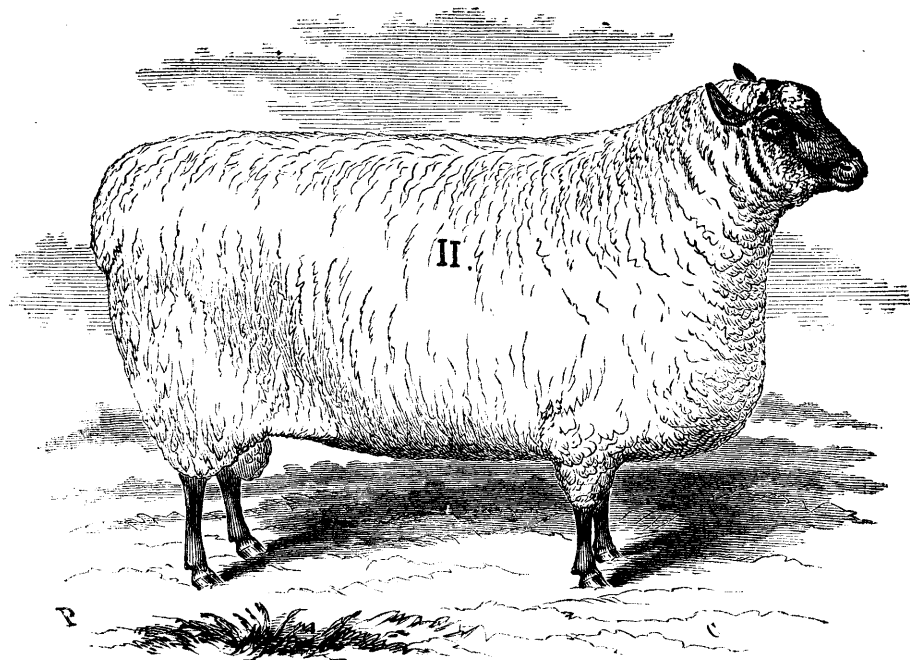
With regard to the merits of the different kinds of sheep. I have spoken of the Merino as the wool-bearing sheep. If we wish

to raise wool alone, we should take the Merino. They multiply rapidly, they live to an extreme old age, furnish an abundance of wool, and bear close stocking upon pastures and close herding in the yard. The South Downs are larger, more symmetrical in form, and give us the rosiest, plumpest carcass, with the least amount of offal. The wool is comparatively light. It is of just that quality that our mothers used to choose to spin to make stockings, and other articles of that kind. It will shrink very little, and may be woven or spun into the most durable articles of wear for common farmers' use.

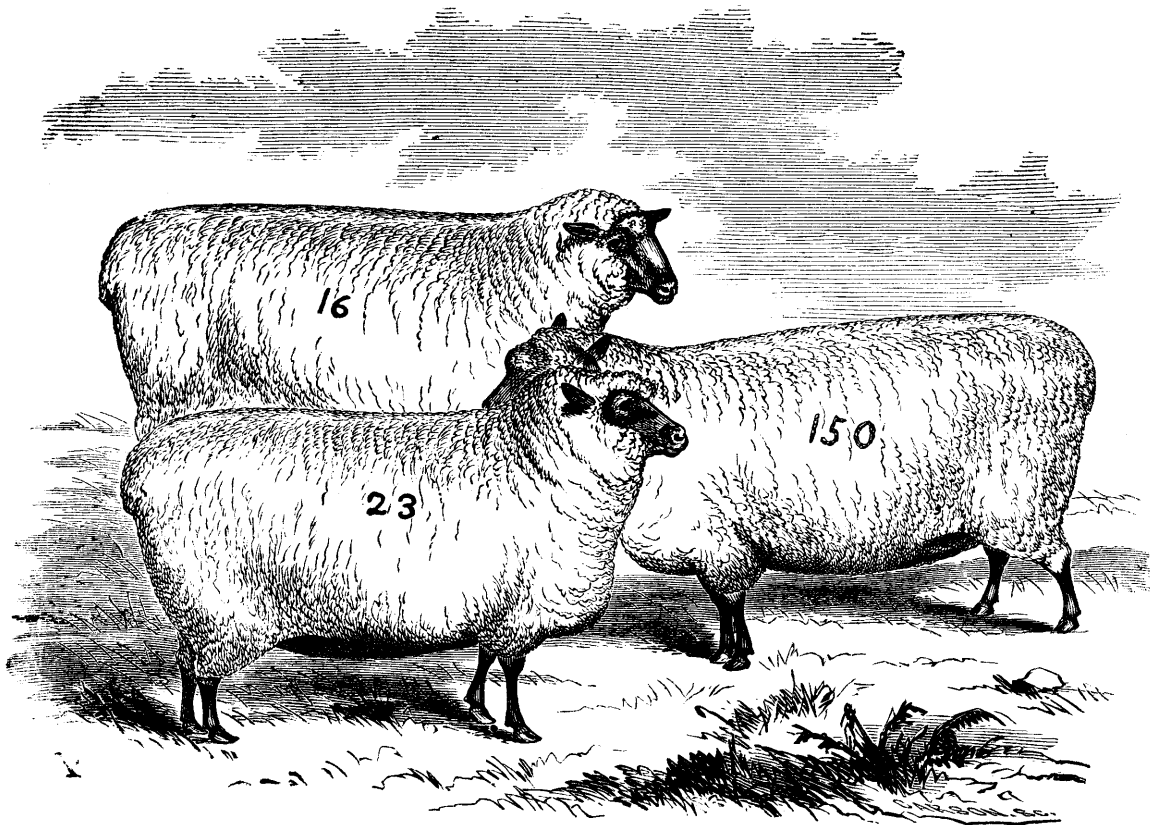
The long wool of the Cotswolds at present possesses a peculiar value for certain kinds of manufactures, and is bringing a price even in advance of the finer kinds of wool. The manufacture of the combing wools, as they are called, into muslin delaines and worsteds, is very large, but we can hardly expect that it will always continue. The fleeces are very heavy. Eight to ten pounds is not an uncommon weight of fleece with that class of sheep. The carcasses are also very heavy. You would hardly keep seven Cotswolds, or even five, where you would keep a cow. You want more room and better pastures for the sheep. The Cotswold is eminently a sheep for rich, abundant pastures, while the South Down and Merino will range upon the hills, clean up your grain fields, keep down the bushes and weeds that sprout in your pastures, gather the manure from the banks of the streams and on the lowlands and spread it just where it is needed, upon the highlands. The sheep is very peculiar in its choice of the places where it spends the night. It always goes upon some elevated portion of the field; hence the droppings are left in the most favorable position to prevent their being wasted. All these little things come into account, and make the sheep the renovators of our old fields, and make them one of the means of improving our farms.

There is another argument. You have a certain amount invested in land. Suppose it be \$10,000. With cattle and horses you get a certain income from that. Now, if by dovetailing in a few sheep without materially increasing your expenses, and consuming but a small part of the valuable products of the farm in the way of grain and hay, you can keep twenty or fifty sheep, and derive an income of \$300 from that flock, you see you have not got to charge any interest upon your capital, or very little. Aside from what it costs you in labor, and in the direct furnishing of grain and hay, it may be counted as clear profit; and although, at present, a farm

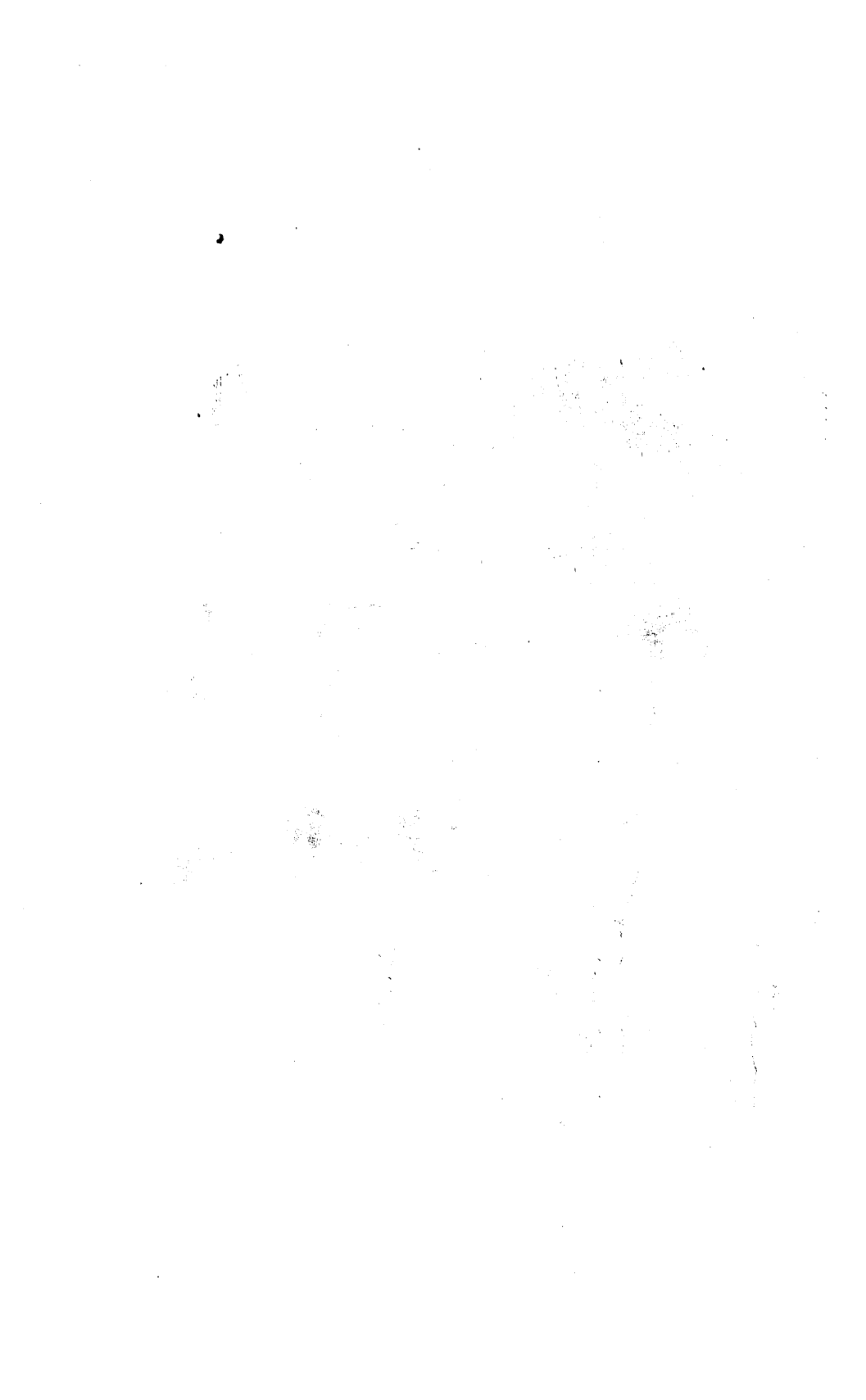




South Down Ram "No. 11," imported and owned by H. L. Stewart & Son,
Middle Haddam, Conn.



South Down Ewes, imported and owned by H. L. Stewart & Son, Middle Haddam, Conn.



could hardly be devoted solely to sheep with profit, I think that the devotion of a part of it to sheep must still be considered profitable.

One great enemy that we have to contend with, and which in Connecticut is admitted to be the cause of the great decline in sheep husbandry, is the immense number of dogs which we have. We have dog laws there, but they are not sufficient to protect the farmer, and in many cases the discouragements which those who have attempted to keep small flocks have met with from this cause, have caused sheep husbandry to decline. But I must say, that that has had very little influence with me. I have kept from 50 to 500 sheep for twenty-five years, and I have lost but two or three by dogs in the whole time; so that I do not consider that as very much of an argument against this branch of husbandry.

But just so surely as sheep husbandry has gone into decline, I believe that just so surely it will be in as much favor again as ever, and that those men who have sold their flocks to go to the trying-kettle will be round looking for sheep again, and that those who will continue to breed sheep, of the right kind, and good sheep, (for it costs no more to breed good sheep than bad) will surely meet their reward. They will again be in demand.

Secretary GOODALE. Have you ever had any experience in regard to the value of sheep in eradicating from our fields and pastures what we call "white weed," or the "white daisy," as you call it?

Mr. GOLD. Yes, sir, I have a case on my own farm, where it has succeeded to my full satisfaction. I had a field of five acres, which was perfectly white with these daisies. It had been given up to them for years. About five years ago I put my sheep upon the pasture early in the spring, and kept them there until the last of June. They kept off every daisy; there was not one blossom upon the whole field. The next year I put them in in the same way, and kept them there until about the same time. The result has been, that scarcely a daisy has appeared in the field since. There is no difficulty in eradicating the daisy completely by confining the sheep upon the fields where it grows. The same may be said of other weeds. The rag-weed, which springs up in your fields after harvesting, is greedily consumed by sheep. If cut and dried it forms an admirable article for winter fodder for them, in part. And so I might say of many other weeds.

Mr. GOODALE. Have you had any experience in enriching lands by putting on a large stock of sheep, and feeding them?

Mr. GOLD. I have often heard it recommended, but have never practiced it. I believe there is no more certain way to enrich lands than by that method. I have known lands to be enriched by feeding horses and mules in that manner, where they were waiting to be shipped. The result has been wonderful in bringing up those pastures to a remarkable degree of fertility. The same result would follow from feeding sheep or any other animals in that way.

QUESTION. Would it not be an economical way of doing it, in comparison with purchasing manure?

Mr. GOLD. In purchasing grain, for food, I have estimated its manurial value as a large item to be taken into account, in deciding the question whether I could afford to buy it or not. If I could purchase grain, the manurial value of which is half what it costs me, I should certainly take that into account. In purchasing cotton-seed meal, bran, and some articles of that kind, it is clearly the case that you get one-half or two-thirds, even, of the cost of the article in its manurial value; you know the products which you sell, and they do not carry it off. If you economize and save your manures you get it upon your farm. In many cases there is no cheaper way to procure manures than to buy them in this way.

QUESTION. Have you had any experience in pasturing different kinds of cattle together, as sheep, cattle and horses?

Mr. GOLD. My practice has been usually to confine the sheep by themselves. There are some farmers, however, who advocate pasturing the different classes of stock together. Mr. Blakeslee, of Watertown, an old farmer, who has kept a great many sheep and cattle, turns a few Devon heifers with every flock of sheep, and says that no dog will touch them. They lie together, become familiar with each other, thrive together, and the cattle will not allow a dog to come near. That is his statement; but as a general rule, if there are many sheep kept in a cow pasture, they will make it too short for the cows.

QUESTION. What would be the effect of a few sheep, say one to each animal?

Mr. GOLD. The sheep would get excessively fat. You could not fatten them any better than by adopting that practice.

QUESTION. Will sheep destroy thistles?

Mr. GOLD. Sheep do not destroy thistles. Thistles are inclined to increase in sheep pastures, both the common thistle and the

Canada thistle. Cows and horses, by treading and breaking them somewhat keep them down, but they increase in sheep pastures.

Mr. BRACKETT. What do you call the common thistle, as distinguished from the Canada thistle?

Mr. GOLD. The Canada thistle is a perennial plant, smaller than the other, and spreads by its roots. The common thistle is an annual, grows one year and dies the next. It has a tall, straight stalk, sometimes six feet high, and with a hundred heads upon it.

Mr. BRACKETT. The Canada thistle is the more common one with us.

QUESTION. Is it what some call the bull thistle?

Mr. GOLD. Yes, sir, they are sometimes called by that name.

Mr. BRACKETT. In reference to dogs killing sheep, I would say, that in conversation with the member from Lincoln he said that the great objection to raising sheep in his section was, that so many were killed by dogs. He told me that seventy-five had been killed by dogs in his town this year.

Mr. GOLD. I would remark, that as a protection against dogs, I always keep one or two light bells upon every flock. It has proved in my case almost a perfect protection. That or something else. My neighbors' flocks have been badly worried by dogs, while mine have been protected.

Mr. WASSON. I will say that in my locality, it would be utterly impossible for me to keep a flock of sheep if I should take the bells off from them.

Mr. LUCE of Bangor. Sheep husbandry is at a low ebb, nevertheless it is undoubtedly true that the mutton sheep is one of the greatest sources of fertility to the soil and of income to the holder, of any stock that we have. The Secretary very well remarked that we cannot compete with the far west, nor with foreign countries in the raising of wool; but there is one thing that every farmer needs, and the whole community as well, and that is, a wholesome, palatable, convenient meat. There is nothing, so far as the farmer is concerned, that compares with mutton in this respect, because he can at any time kill a sheep, and a neighbor always stands ready to take a part if he wants to dispose of it. In order to make the best mutton, sheep require considerable care. Notwithstanding what the gentleman from Lincoln says, I have found that the best way to grow sheep was to keep them on ordinary feed until they are past two years old, and then I separate the sheep intended for market from the rest of the flock. I com-

mence early in the fall, when the feed begins to fail, by giving them a little grain, and when the grass is gone, I give them roots. There is considerable expense involved in feeding sheep for market, but I have always found it to pay well in the end. It costs me from eight to ten dollars to feed a sheep during the winter and spring months, and I have so far succeeded in getting from \$15 to \$20 a head when fat.

In regard to breeds, I am not here to advertise any particular breed. I have always made this a point:—to consider what breed gave the best returns. That is commonly thought to be an important consideration; but it is not considered so much as it should be. Although the wool amounts to quite an item, still, the meat is the great consideration.

QUESTION. What breed do you think the best?

Mr. LUCE. I have used the South Down. I have readily sold the meat for twenty-five cents a pound—that is, the hind quarters—in the latter part of the fall and winter.

QUESTION. How do they compare with the other breeds as to early maturity, and readiness to take on flesh?

Mr. LUCE. I have never found anything to excel them, and, so far as I have heard that is the general opinion. I seldom kill a lot of lambs that do not average twelve pounds to the hind quarter. I only sell the hind quarters. And I will say to anybody who will raise a *good* article of mutton, or anything else, the more you sell, the better market you will have.

FARMERS' CLUBS.

The CHAIRMAN. It has been suggested that the time remaining to us may be profitably devoted to learning from delegates and others present in regard to Farmers' Clubs,—what they have done and are doing, and what are their prospects of usefulness.

Mr. LELAND. The club in this place, called the Village Farmers' Club, was set in operation last fall, through the labors of Mr. Chamberlain. The meetings through the winter were exceedingly interesting. You have heard Messrs. Gurney, Lebroke, Robinson and others, and can judge whether we have the necessary ability to insure success. You have not heard all our talkers, however, and perhaps I ought to add that our club includes both sexes. Women have as much at stake in farm and home improvements as men have. Our discussions have not been confined wholly to strictly agricultural topics, but have embraced a wider range.

And then again, believing that something more was needed to infuse the proper degree of life and activity into our organization, and overcome the inertia of too many of us than the mere discussion of abstract propositions, Mr. Chamberlain made a suggestion which we adopted, viz: to put our homes and our farms and their surroundings into friendly competition with each other for premiums of honor, to be awarded after three years' effort to improve them. At the outset we sketched such a plan of such improvements as our homes seemed to call for and admit of, such as renovation of old orchards and setting new ones, cultivation of small fruits and horticulture generally, planting wind screens, the raising of nursery trees, cranberry culture, fish culture and bee culture; reclaiming bog lands, underdraining wet lands, removing obstructions to machine labor, preparation of composts and use of commercial fertilizers, improvement of domestic animals, improvement of buildings, and arrangement of fixtures so as to lighten household labors, and bringing of water into them; roadside improvements, &c., &c.

This plan struck the members very favorably. They almost unanimously went into it, and many who had not attended the meetings, or only seldom, associated themselves with us in this work. Then the club chose a general committee to take the matter in charge, and also several branch committees, one on horticulture, one on domestic animals, one on improvement of buildings and so on. These committees commenced their field work in June. They went to the places of each, noted down the existing condition of things, and what improvements were contemplated. In all cases they found a real earnestness and determination to do more than they had done before, and they found one or more who were engaged in some one at least of all the different ways or methods of improvement to which I have alluded. Some have little and some have no money to put in, but these are not less determined to accomplish, by activity and energy, as much as others who have capital. And I want it distinctly understood that our plan is not to have the improvements estimated by their money value, but by the degree of judicious care and economy and thoroughness with which they are accomplished; because if the awards were to be made according to the money invested in the improvements, the poor could not compete successfully with the rich.

The several committees are to visit the different places at least

twice each season, report at the close of each year, and make a final report at the end of three years, when the awards are to be made—not, as I said, in money premiums, but awards of different degrees of honor, the one accomplishing most and best in proportion to means, in any given department, to rank No. 1, and so on. This plan has worked admirably thus far with us, and I believe something of the kind could be done by a great many other clubs, with the very best results.

Mr. LEE of Foxcroft. I will add a word while the club in this place is under consideration. The great difficulty here, as I suppose it is in other localities, is to get people interested. There are a few hearty, noble souls who have started our club and carry it on; our friend Leland is one of them. I propose that the farmers, as the evenings get longer, start meetings in the various school districts. That is the only way in which we can sufficiently interest the farmers at a distance from the centre. If the farmers in the back localities will first get up neighborhood associations, they will soon attend the meetings of the village club; and in order to accomplish this, we must institute a system of visiting; take our wives and daughters and our sons, and meet from house to house in the various districts, pass round the apples and cider, and have a good time generally. By that means we can secure the attendance of the young. We have not succeeded thus far in getting many of our young men into the Farmers' Clubs. We have a few farmers in each school district who are interested in this matter. Let them constitute themselves *visiting* members, and hold meetings for discussions upon agricultural matters in the various districts, changing from house to house, and they will thus create an interest which will strengthen and build up the more central Village Farmers' Club.

Hon. ASA SMITH of Mattawamkeag. Within the limits of our society, the North Penobscot, we have not made much progress in establishing Farmers' Clubs. We have no large villages, consequently it is hard to get a Farmers' Club into successful operation. We have a club at Lincoln, formed a year ago, which has held meetings, but what progress they are making I cannot tell, for I live thirteen miles distant and have not been able to attend. Almost the only opportunities we have to exchange views and become acquainted with each other are at our annual meetings and fairs. We are so much scattered that we cannot conveniently get together, except at those two seasons. Our fairs are generally

well attended, and have done a great deal of good. They have improved our stock and our crops to a great extent, and have been a source of benefit in many ways.

Mr. E. G. PHELPS of Oxford. Our Farmers' Club was organized about the middle of October last. Col. Swett and Hon. Sidney Perham took an interest in the matter, and we started a club and had a good attendance for eight or ten meetings; but on the appearance of a member of this board, we increased in number, and we found a growing interest taken in the club.

We met every week, alternately at Oxford, at South Paris, and at Paris Hill, and got up quite an interest. The meetings have done a great deal of good. We adjourned in April, until the first Monday in October.

We have arranged to try experiments in fertilizing, and other ways, and we hope to have an exhibition of the results at the fair this fall. As is well known, the season has been remarkably dry and hot, and many farmers feel rather discouraged, but nevertheless, we expect to see a gratifying exhibition of the fruits of their skill and labor at the fair.

I had the pleasure of attending the session of this Board last winter at Lewiston, and I am happy now to be here and to receive instruction from the lectures and discussions to which I have listened. I will endeavor to carry back the information I have received, and distribute it among our farmers.

The CHAIRMAN. Do you succeed in drawing out the practical farmers?

Mr. PHELPS. Yes, sir. The best farmers in the town attend. They came some distance, and took a deep interest in the club; not all of them are scientific men, but they are practical and intelligent in regard to farming. They have laid before us the results of their experiments, their reflections and their labors, and there has thus been much good gathered from one another.

The CHAIRMAN. Have the topics discussed been of a local or a general character?

Mr. PHELPS. Mostly general; such as have been discussed here: plowing, the raising of fruit, grass, fertilizers, &c.

Col. SWETT. In order to show the working of Farmers' Clubs in different towns in our county, I will relate a few instances which have come under my own observation.

In the first place, I will say that in expending a portion of the State bounty, as we were instructed by the Board to do, for the

establishment of Farmers' Clubs, we engaged Hon. Sidney Perham to travel through the county and organize clubs. He did so. A club was formed in East Sumner. I have met with them, and they are doing a good work. In that vicinity they are entirely destitute of lawyers. The town of Sumner has not a lawyer in it, and very few paupers. The practical farmers are there enlisted and constitute the club. A gentleman told me that there were some who, when they first went to the club it was difficult even to get into the room, who were now willing to take a front seat, and get up and tell what they knew. They had proved themselves to be good debaters, men who could interest large assemblies. They have a prosperous club. It adjourned last spring, to meet in October. I expect great advantage and profit from the establishment of that club. They are preparing for a town show, at which they say they are going to outdo the county exhibition.

There is another at East Hebron. It is connected with West Minot, and is in prosperous operation.

There is another at North Waterford, which is doing a good work.

The subjects discussed have been of a general character, such as the best kind of stock for us to raise in the county of Oxford, the best method of producing hay or grass, the advantages of underdraining, fruit culture, &c. We are not favored in most of our towns with talented agricultural ministers, lawyers and doctors, as they are in this place; therefore we draw out the talent of unlettered farmers and practical men. I am satisfied that the Farmers' Clubs are doing a good work in the county of Oxford.

I must not forget to mention the club at Bethel, which is one of the oldest in the State, and the banner club of Oxford county. Their practice is to meet from house to house, and their success has been remarkable. Some of their exhibitions, which I have attended, equaled the county shows.

Mr. PHELPS. I once inquired of a member of that club what was the secret of their success, and he told me it was due to the assistance of the ladies.

D. G. PHILBRICK of Mt. Vernon. The Mt. Vernon and Vienna Farmers' and Mechanics' Club was formed in October, 1869. Officers chosen for one year. Met regularly on the evening of Saturday of each week. Meetings tolerably well attended, and a speaking ability developed which was not supposed to exist. Practical subjects were discussed with an earnestness and willingness which

showed that their importance was appreciated. Interesting and instructive lectures were given by D. H. Thing and Ezra Kempton of our own club, and R. P. Thompson of Jay. Although we have but just got fairly under way, we feel that good has been accomplished, and that we have before us a career of usefulness not only to ourselves but to the community. We have already learned that we have in our midst talent enough to run a club, and we are resolved to let our light shine.

Mr. D. H. THING. There are several other clubs in the county of Kennebec. There are two in Winthrop. The one at East Winthrop I visited twice. It is very prosperous, and I wish it to be distinctly understood to what I attribute their prosperity. In the first place, they admit ladies to membership, as every club should; and, next, their professional men, their mechanics, and all the leading men in the community, take an interest in it. One evening when I spoke there, the Baptist church was well filled.

There is a club at Winthrop village, which I intended to visit, but did not, as ill health kept me at home until the travelling was too bad.

I assisted in forming a club at Wayne. The President tells me that they prospered well until they saw fit to adjourn over until fall.

The President of the club at Winthrop met with an accident soon after the club was organized, which disabled him for the winter, and which proved a severe loss to the club, but after a few weeks they continued their meetings, and kept them up through the winter. They consider it now established on a permanent basis.

There are several other clubs in the county which I have not visited. So far as I know, every club deems itself well on the road to success. But I have never known a club that has succeeded as it ought to, unless both the leading men in the community and the ladies have participated in its deliberations, or, at least, were present at its meetings. When I learn of one that has been successful without ladies, I shall believe that that community is at least twenty-five years behind the present standard of civilization.

Col. SWETT. Brother Thing must not consider us twenty-five years behind the times. We extend an invitation to ladies to attend all our clubs, and we have their presence.

Mr. G. E. BRACKETT. In Waldo county we have seven clubs—in Belfast, Montville, Monroe, Prospect, Unity, Brooks, Westport. Six of these were organized last fall, the other has been organized

about three years, and is doing a very good work. All adjourned over during the summer.

They all promise well. Whether they will endure for many years I cannot say; but if only one out of ten of the clubs lately formed in Maine becomes a permanent institution we shall have gained a great deal.

Mr. E. B. STACKPOLE of Kenduskeag. I am not well informed respecting the farmers' clubs out of the limits of the West Penobscot Society. That society secured the services of Mr. Wasson, which resulted in setting four clubs in motion last year, and they have progressed harmoniously and well. Our meetings are not largely attended by young men. The very men we want most to get there seem least inclined to attend. Our old men, our men of experience, are very much interested. We have exceedingly interesting meetings in the club to which I belong, and I am told it is so in others. We labor under a difficulty already referred to in other clubs, in not having the women interested with us. Our meetings have been held at stated places, but I think a better way would be to hold them from house to house. In that way we might interest both the females and the young men, especially those who are engaged in agriculture.

In addition to the four clubs organized by Mr. Wasson, Hon. Hannibal Hamlin organized one in Levant, and subsequently another was started in Corinth.

Mr. DOE. Farmers' clubs in York county are not so numerous as I could wish. Where they have been in operation the best results have followed. The northern part of the county is more exclusively an agricultural section than any other. Clubs were formed there three or four years ago, and one has been so successful that their fairs now present a very respectable competition with the county fairs; in some departments they exceed the county shows.

Last year our county society engaged the services of Gov. Brown to lecture in various parts of the county and assist in forming clubs. I understand the audiences were large at Limerick, North Berwick and other places, and the prospects very flattering. The club formed at Saco is a branch of the York Institute, previously established and in successful operation, and has by this connection not only the use of its rooms, but also of its library, a large proportion of which consists of works on agriculture, together with

its geological and mineralogical collections, its birds, shells, and numerous objects in various branches of natural history.

The interest that has been awakened in the agricultural community has been such that I am firmly convinced that it is the duty of this board, and of all others interested in the agricultural progress of the State, by all possible means to encourage the formation of these clubs.

Mr. GILBERT of Androscoggin. There have been several clubs in Androscoggin for a number of years. The oldest club in the State, so far as I know, is in that county. Those which have been organized for a considerable length of time, have reaped rich results. There has been very evident progress, in many directions. I think there are none of those active members who would wish to dissolve the organization. They are live clubs, and will continue.

Last fall, through the influence of the Board of Agriculture, an effort was made to organize more clubs. They were organized. The success of all these clubs was not as great as we could desire, still, we hope for and do not doubt that we shall reap good results. At any rate, there are some there who intend to work for them; and if our work is crowned with success you may hear from Androscoggin again.

Rev. J. H. GURNEY. I certainly am convinced of the usefulness of these clubs. From what I have known of them, and from what little I have seen in this place, I think not half as much has been done here during the winter as should be. It is hard getting the members to take hold with the interest we know they ought to feel, and it is hard to keep up a continued interest. But they are exceedingly useful in exciting to inquiry and discussion, and bringing out facts and experience. They occupy the same relation to the farming business as our meetings for social conference do to religious services. They bring out individuals to give their experience, to state what they have done, and what they have failed to do, what they ought to do, and what they have tried to do. For this reason it is very important they should be kept up. An important inquiry is, How shall they be kept up? One good way would be to have papers prepared, as you do here. It seems to me that is indispensable. If some individuals will prepare papers on the several questions to be discussed, and give to the work the best strength of their minds, and do it well, they may make them exceedingly interesting, and draw out and interest others; but to gather here and have a general talk, on no point in particular, with

no individual to lead off, will only lead to failure. We have tried it here, and have succeeded. We have had some very interesting papers read from various individuals. Besides this we hope to see good results from the competition in regard to improvements in buildings, and in other respects, about which Mr. Leland has told you.

I am deeply interested in agriculture. I am not a practical farmer, as I said before, but the son of a farmer, and *a born farmer*. I have been so much exercised upon that point sometimes, that I have doubted whether I have not mistaken my calling. I am personally so much interested in practical agriculture and in seeing every branch of farming prosper, that I have sometimes queried whether I had not got off the track and spoiled a good farmer, as I hope I might have made, to make a poor minister. But I certainly think it is one of the noblest of human occupations, and is coming to be more and more a profession, and certainly one of the noblest of all professions. Every farmer ought to aim to make his business more and more honorable, more and more a profession. In all his common farming he ought to strive to act up to his ideal. Every one has his ideal of what ought to be done on the farm, and we ought to strive every day and every year more and more to realize that ideal. That is one of the ends of these agricultural institutions, to aid us, by the experience of others, to realize our own ideal more perfectly, to enable us to accomplish more, and bring this science of agriculture to perfection. I hope we shall be benefitted by the meeting of this board here at this time.

Mr. LUCAS. I am not aware of the presence of any delegate from farmers' clubs in the county of Somerset. I do not know how many there are, but there are at least two in successful operation; one at Anson, the doings of which may be seen all over the State. The meetings were continued through the winter and into the spring.

There is another in the town of Norridgewock, which has pursued about the same course, but their discussions have not been published, and hence the public are not in possession of what has been done there, as they are of the proceedings of the other. The Anson club, I understand from a former member of the board, has been of vast benefit to the community in the vicinity of which Anson is the centre. I presume there is a club at Skowhegan, but do not know certainly.

Mr. CHAMBERLAIN. We would be glad to hear from Mr. Gold on

this subject, either in regard to his views generally, or of any personal experience he may have had.

Mr. GOLD. Perhaps you may be interested in learning the history of the club of which I am a member, and which was established more than twenty-five years ago, and may therefore be considered as having attained its majority, and entitled to speak of what it has done.

The Farmers' Club at West Cornwall, Conn., was established in 1843, and has renewed its organization, and held meetings every winter, since that time. The population is quite scattered, as there is no central village, and the farms being mostly devoted to grazing, are rarely less than one hundred acres. Surely there must have been some feeling that they were benefitted to induce the citizens of such a region to gather regularly every winter for the purpose of discussing matters pertaining to their calling. Novelty has long since ceased to attract, and a feeling that it is an institution that must be sustained is an influence that induces many, whose years draw them closely about their own firesides, to relinquish this indulgence and face the keen blasts which sweep over those hills.

The organization is very simple. Meetings are held only in winter evenings. In the spring the club adjourns to the call of the President or Secretary. At the first autumnal meeting the club is organized by the choice of a President, Vice President and Secretary. Meetings are held at the houses of the members, as arranged at the previous meeting, or called by the President or Secretary. The meetings are free to all, and are held in remote as well as central locations, to accommodate all; but wherever sickness or other family circumstances make it inconvenient, the parties are not expected to invite the club.

The club is maintained by the farmers, but merchants, mechanics and professional men unite in the discussions. Old and young, male and female, are alike attendants. As soon as the company is generally assembled, the men gather in a room set apart for their use and discuss the topic for the evening, the selection of which is usually left with the person at whose house the club meets. Matters of household economy, and other subjects of general interest, are discussed by the whole company. At nine o'clock the discussion regularly closes. We have but one by-law, and that a very good one,—“No member is allowed to occupy more than ten minutes in speaking, except with the permission of

the club. After the discussion, subjects are offered, and the time and place of meeting arranged.

Meetings are usually held once a fortnight, but the rule is not inflexible, and the state of the travelling, and matters of public or private interest, are allowed influence. The moon, too, though not controlling the time of planting or harvesting, is here consulted, for her light, though borrowed and cold, cheers and enlightens the country roads and by-paths. Upon adjournment the formality of the club is over, and an hour is spent in a social way. Some slight entertainment of fruit or nuts, or of the good wife's culinary skill, is presented, and the party breaks up at an early hour.

By taking the wives and children one element of strength, numbers, is secured, which would otherwise be wanting in so scattered a community, and a social feeling is promoted. Farmers greatly neglect to cultivate and exercise this faculty, and our rural communities are everywhere suffering from this cause. Unless recreation and amusement are furnished to the young folks on the farm and connected with it, they will seek it wherever it can be found. Too many neighborhoods once thriving and populous and deriving their support from the soil, now almost uninhabited, point to some influence as the cause of this decay. It has not been so much because the *labors* of the farm were distasteful to them, as the lack of social opportunities that has driven so many young men from the farm to other employments and caused so many families to emigrate to other sections where they hoped to secure greater social advantages.

Sometimes formal papers are presented by some member of the club, or a lecture is given in some public hall.

There is no admission fee, or annual tax, and no treasurer. Funds are only raised as wanted for special objects. The distribution of seeds, or cuttings, or plants is conducted in the most informal manner. The twenty-fifth anniversary was celebrated in December, 1868. There were invited guests from abroad; there was a most liberal entertainment and larger gathering than usual, while reminiscences of the past formed a fruitful theme for all the speakers.

And now surely it is time to look for some fruit.

The progress made in the region embraced in this club, in draining and clearing fields, in planting orchards, in the improvement of farm buildings, fences and dwellings, in the stock of the farm and general culture and management, will bear comparison with

any other rural district of New England. The Farmer's Club has been one of the influences that has wrought this change.

Resolutions were then passed, tendering the thanks of the Board to the citizens of Foxcroft and Dover for numerous favors received; to the gentlemen who had so acceptably lectured, to the resident member for his unwearied labors, all tending to render the session one of great profit and satisfaction. They were appropriately responded to by Messrs. Lebroke and Chamberlain. After brief closing remarks by the chairman, the Board finally adjourned, to meet early in January, at the call of the Secretary.

EFFECTS OF DESTRUCTION OF FORESTS.

Read before the Farmers' Club connected with the York Institute, Saco.

By CHARLES H. GRANGER.

In discussing the subject of the destruction of forests, and the evils resulting therefrom, by producing a change of climate, and diminishing the number and amount of rainfalls, thus lessening the supplies to the natural irrigation of the soil; also by too great a denudation of the land, causing it to receive an excess of heat from the sun's rays, thereby drying up the springs and streams, and causing incalculable injury to agricultural operations, it will not be necessary to deal with many statistical facts and details, but only with the broad scientific principles which originate and govern all natural laws.

It must be apparent to the most careless observer that for a long period of years, and to an unprecedented extent at the present time, there has been going on and is still progressing an immense destruction of our forests. Possessed with the demon of *greedy gain*, men put in the axe and cut down the trees without a thought beyond the interests of the present time, and whether the evils arising from their removal will not far exceed in the not distant future, any supposed present advantages.

It is presumed that all will admit that *the* most important interest in the world is the production of food; for, without a sufficient supply of that first necessity, all civilization would cease. Cities, and in fact whole regions of country would be deserted; and, as history informs us has already more than once taken place, whole nations would make a general exodus, and become nomadic, scattering over the face of the earth in search of the necessary means of subsistence. This being true then, it must be evident that agriculture must take the precedence, in importance and interest, of every other pursuit.

Thence follows the inquiry, how can the best and most natural conditions, on which the successful prosecution of agriculture depends, be preserved; and what may be done to violate those conditions, and throw obstacles in the way of that pursuit? First, then, what are some of those obvious conditions? According to the etymology of the word agriculture, it imports the cultivation

of fields, or the ground. In order to do this, it is of course absolutely necessary to denude the soil; that is, the trees *must* be cut down and destroyed. This, however, is no argument in favor of that kind of destruction, against which it is designed to speak. For it may be safely asserted that if only so much soil in the United States were *judiciously* denuded, and the trees destroyed, as would produce not only food enough to support *one hundred million* inhabitants, and still afford a large surplus for exportation, there would remain still, in immense forests and scattered groves and thickets, an amount of trees sufficiently abundant to subserve all those natural purposes for which they were undoubtedly intended.

After the field has been prepared and tilled, manured and planted, there come two all important conditions, temperature and moisture of the soil,—that is, there must be neither too much, nor too little, but just enough of sunshine, which supplies light and heat, and of rainfalls which supply the moisture. A great excess of either of these conditions tends very greatly to diminish the results of the husbandman's labor, if it does not render that labor entirely unavailing. In proof, witness the effects of a season of severe drouth, and also one of cold drenching.

The temperature of the soil is affected by various causes. First the surfaces of the open fields are heated by the full and unobstructed rays of the sun. The heat thus derived penetrates to a greater or less degree according to the nature of the soil. Then again, temperature is affected by the winds from various quarters, which either assist the sun's rays, or cool the surface by dispersing and carrying off the natural radiations of heat. Still further, we have an artificial cause of increased warm temperature, in *drainage*. By a series of careful experiments, it has been with certainty ascertained, that drained land is considerably warmer than undrained. And still another cause of a modification of the temperature of the soil in the open fields, is the *proximity of forests of tall trees*. In the absence of the sunlight during cold storms, these forests protect the bare soil and the vegetable growths from the cold northerly and easterly winds; and, since trees are bad conductors of heat, they give out an equally beneficial cooling radiation, during the heated seasons, and under the rays of the noonday sun. These indisputable facts, it will be observed, intimately connect the subject matter of this paper with Temperature, the first of the two important conditions above mentioned.

The second equally important condition, Moisture, must be supplied from springs, rivulets and brooks; and by frequent showers of rain, which reinforce the springs, and are indispensable to vegetation. Now it is a well known fact that in the long continued absence of rainfalls, the springs and brooks often dry up, and the amount of water in rivers and ponds, and even lakes, is very sensibly diminished. That being true, we are led by it to the unavoidable conclusion that the rainfalls are the sole and original source of that greatest of human blessings—water.

Now, then, our attention must be turned directly upon the rainfalls themselves, in order to discover if possible the conditions under which they are produced, and by what causes they are prevented. And here several queries arise. Are the rainfalls accidental, or are they governed by if not definite, at least partially explainable laws? Does the Maker of all things send the showers in accordance with variable purposes, and through a special will; or, has he established certain immutable laws of cause and effect, governed by which the showers fall when the causes exist, and cease to fall when they are absent?

If we accept the theory of accident, or of special will, then we have nothing further to do with the matter, except to endeavor to deserve, and to wait patiently for His exhibitions of beneficent power. On the contrary, if we accept the idea of definite and fixed laws of cause and effect, and can discover why rain falls in one locality and not in another, cannot man by supplying the causes at least assist in the production of showers; or by removing the causes can he not do much to prevent the desirable amount of rainfalls? The only method by which we can arrive at the correct answer to these queries, must be by consulting the results of long experience, and judging of the facts thus gathered according to well known philosophical truths and scientific principles.

What then is rain, and how are the showers made to fall upon the earth? Something more than three quarters of the surface of the globe is covered with water, seen in the oceans and seas. The land, raised above the water, is interlaced in every direction, with rivers, and covered with innumerable lakes and ponds. It is also reasonable to presume that to an unknown depth under the surface the crust of the earth is perforated by a net-work of running streams, and filled with immense fountains of water. All the water upon the surface of the globe is to a certain extent subjected to the force of the sun's rays, which force takes it up, in infinitely

small particles, by what is commonly called evaporation. However dry the atmosphere may appear to be, it is always more or less filled with insensible moisture. If during the greatest heat of summer one fills a pitcher with ice-water, the outer surface of the pitcher will be immediately covered with drops of water. This is nothing more than the condensation of the insensible moisture, and is produced by the coldness of the ice-water. Now, the moisture taken up by the evaporating force of the sun's rays, not only from the oceans and rivers, but from the surface of the solid earth, is immense in amount; and according to its degrees of density is seen in the form of clouds. These clouds are light when compared with the air, and float in it at different heights, according to their different degrees of rarification, and are visible or invisible in proportion to their density:

Now, again, these clouds, which are really water in a vaporous state, are carried by the winds, and distributed everywhere above the surface of the earth; and in order to become rain, and to fall in showers, certain conditions of temperature are necessary. Clouds are of two kinds, the cumulus and the cirrus,—that is, the first are formed of those vapors which at a certain height become vesicular, and the second of those which become frozen. All other clouds are merely modifications of these two. There is no doubt but that electricity has a great influence in the production of storms; but this element may at present be dispensed with, as it is desirable to present only the simplest idea of a rain-cloud. The two abovementioned kinds of clouds then are supposed to be absolutely necessary, to produce the showers, and that it cannot take place without their conjunction and coöperation. When, therefore, the vesicular vapors come in contact with the frozen vapors, the instant result is condensation and the consequent rainfall.

We must now mention two other conditions affecting the formation of rain, or at least its occurrence in certain localities. These are the cold and the warm radiations from the earth. The warm radiations take place from level and sandy, treeless plains; and according to the theory which we shall endeavor to prove, there should be but few or no rainfalls upon them. On the other hand, the cold radiations rise from high wooded mountains, and heavily wooded plains. According to the theory again, there should be frequent and abundant rains in these localities. It is but fair in this connection to state, however, that there is a variety of opinions with regard to cold radiations, among scientific men; and also

with regard to the precise method in which the forests influence the production of rainfalls. Humboldt thought that the dense woods gave out what he called "a frigorific, or cooling radiation," which condensed the vaporous clouds; while others supposed that the tall trees attracted the frozen, or ice-clouds, and that the warm vaporous clouds mixing with them became at once condensed and formed the rainfall. But let this question be settled as it may, it is still proved by universal observation, that rainfalls are more frequent and abundant over wooded districts and vast forests than over open fields and plains.

If this be true then, it must be evident that the forests perform a most important part in the supply of water, without which the entire surface of the earth would be a parched and barren waste, upon which no living thing could exist. In the development of a subject in which so great a variety of elements are silently and invisibly operating upon each other, it is very difficult, if not impossible, to determine the laws which govern them. We are therefore obliged to make deductions and draw inferences from various observations, more or less carefully made and conducted.

If we cast our mental vision over the whole surface of the globe, wherever man has been known to exist, we find a very great difference in the soils and climates of its various parts. While some consist of vast deserts of sand, dry and almost treeless, others are again luxuriantly clothed with woods and forests, and the densest vegetable growths. While some are vast wastes of cold, verdureless rocks, others are formed of gently rolling hills and plains, divided by valleys, through which run numberless streams and rivers. Now if we specify some of these countries, with reference to our subject, we shall find facts in abundance to corroborate the theory that trees *do* influence, in a powerful manner, the rainfalls over the whole earth, thus supplying the indispensable amount of water; and that wherever the forests have been destroyed, the lakes and ponds have fallen off, and the springs and streams have dried up, and the lands have become sterile and uninhabitable.

If we go back in point of time, we find that in the reign of the Roman Emperor, Tiberius, Syria and Barbary were among the most fertile regions of the world, and were heavily clothed with forests. Those forests having been utterly destroyed, those regions are at the present day wastes of sand and desolation. In ancient times the river Scamander, which entered the Mediterranean on the north

coast of Sicily, was navigable, and remained so up to the Christian era. Mount Ida, from which it then received its waters, was thickly covered with cedars. The cedars having all been cut down, the river gradually dried up and is now no longer in existence. The inundations of the Eurphrates once threatened the city of Babylon; but at the present time its banks, as well as those of the Ganges, are only deserts and marshes, with scarcely a remnant of their former fertility. The land of Canaan, which the Bible tells us was the most fertile in the world, is now devoid of water and vegetation; and all this the direct result of the destruction of the forests.

Cæsar tells us, in his commentaries, that Gaul, which he was obliged to penetrate in the prosecution of his wars, was thickly wooded and extremely fertile, and that the climate was soft and pleasant. But the woods, in the progress of civilization and during long wars, having been destroyed, vast territories have become mere swamps and deserts. In modern France, Brittany, Champagne and Poitou were the sites of immense forests. These forests having been destroyed, those regions are now desert wastes, and have been abandoned.

But if we look at our own times and country, we shall find evidences of the same results, though happily not in their full extent. Those who have made this matter the subject of their observations tell us that the supplies of rain over wide regions of the United States are gradually diminishing, and that the climate is perceptibly changing on account of the cutting away of the forests. They also tell us that the mean height of our great rivers, especially the Mississippi, is now much lessened. We all know that inundations are now much more frequent and disastrous; and this is occasioned by the baking of the earth after denudation, which causes the water of heavy rain storms to run instantly to the great rivers, instead of soaking into the soil.

But now, remarking that hundreds of examples might be cited, all tending to prove the correctness of our theory, and the vast importance of forests in producing and preserving the necessary moisture of the soil, we will pass on to the consideration of some other characteristics of trees, still having reference to our subject. Trees give out moisture, and all beneath them being shut out from the full heat of the sun by their foliage, the consequent coolness assists condensation, and by partially preventing evaporation keeps the ground constantly moist, and thus contributes to the ponds and streams. Trees are also said to distil water in great

abundance from mists and fogs. In some of the smaller West India islands, the only means the inhabitants have of procuring water, is from tall trees which being constantly enveloped in fogs distil by dripping, enough to supply their wants.

But the limits of a paper like this forbid a more minute and extended examination of this part of the subject at the present time. In conclusion then, it may perhaps be desirable to suggest a remedy for the present immense and unnecessary destruction of forests. Some extent of destruction is admitted to be necessary for purposes of cultivation of the soil, and some for building and other purposes. And further, there is accidental loss by the extensive conflagrations which ravage large sections of the country. Now if there be added to these losses the felling of large tracts for mere commercial purposes, and through a rabid greed for money-making, it will readily be seen that the day is not far distant when the inhabited regions near the sea coast, and far into the interior will be as bare of trees and as waste a country as at this day are the shores of the Mediterranean. The remedy for the present evils and the preventive of so undesirable a result, must be found in a judicious use of the necessity of cutting down; and in what is still better, the planting of new forests. Many instances might be cited to show the effects of replanting, and of the natural re-growing of trees. We shall name only two. The city of New Valencia, in South America, was formerly situated about a mile and a half from a beautiful lake which was densely surrounded with trees. In course of time the trees were entirely swept away; and after another lapse of time, the city was found to be *four miles and a half* from this lake. During still another lapse, the trees grew up again, and in about twenty-two years the waters of the lake, which had receded from the city three miles, returned again to their former limits. Will it be possible to find a stronger corroboration of our theory? Again, in Egypt of late years the palm-tree has been extensively planted and cultivated; and the remarkable result is the falling of frequent rains where none were formerly known to fall. Many more cases might be mentioned, but these are sufficient to prove the efficacy of the suggested replanting. The method by which this shall be brought about, and the inquiry whether any legislation will be necessary, must be the subject of future consideration.

What, now, are the conclusions to which our arguments lead us?

First, that forests hold a most important place in the economy of the earth's surface; that they have a powerful influence in the production of rainfalls; that they protect the soil from the great heat of the sun, and distilling water from fogs and mists, they give a constant supply to the springs and ponds, which in their turn supply the streams and rivers; that without trees the whole earth would be a parched and barren waste; and that according to the present laws of nature the forests are among the very first causes which render the earth habitable.

Next and lastly, that the progress of the present immense destruction of our forests ought to be checked; and that the necessary losses should be repaired by a system of replanting, supported perhaps by proper and wholesome legislation.

In response to frequent inquiries regarding the operations and experiments conducted on the farm connected with the State College of Agriculture, and the Mechanic Arts, and to the courses of study pursued at this institution, we present the following :

REPORT OF FARM SUPERINTENDENT.

EXPERIMENTS.

In our last report we gave an account of a trial of gypsum, ashes, salt, sulphate of ammonia, nitrate of soda, Cumberland superphosphate and Croasdale's superphosphate, on grass land. The plots thus treated did not this year differ in appearance from the plots that had no fertilizer applied to them. Whether this was owing to the blighting effect of the drought or to the exhaustion of their fertilizing effects, time will determine.

Early in the spring we sowed upon two adjacent plots of grass ground ashes obtained at a furnace where edgings are burned, and common stove ashes, mostly soft wood. The furnace ashes appeared to do no good, while the effect of the stove ashes was very marked. The furnace had a strong draft, and the ashes had been subjected to an intense heat.

A very wet piece of land was broken up the middle of June, and hen manure, ashes and stable manure were applied to the surface and harrowed in. Grass seed was sown and the land rolled. Yellow-eyed beans were then planted in drills 27 inches apart. The beans planted upon the hen manure yielded well, those upon the ashes, fairly, and those upon the stable manure, poorly. The grass set thick and grew finely. Where wet land cannot be made to produce good grass by top-dressing this may be a good method of reclaiming it. The crop of beans will do much towards paying the expense.

FEEDING SWINE.

November 15, 1869, four Chester pigs of an average weight of 42 pounds, were placed in two separate pens. Those in pen No. 1 were fed on whole corn one month and gained 35 pounds. Those in pen No. 2 were fed on uncooked meal and gained 47 pounds. A little more than one bushel was fed to each pen. From December 15th to January 15th the two pigs in No. 1 were fed on meal

and gained $57\frac{1}{2}$ pounds. Those in No. 2 were fed on whole corn and gained $52\frac{1}{2}$ pounds. A little less than $2\frac{1}{2}$ bushels were fed to each pen. We called 54 pounds of corn one bushel and equal to 50 pounds of meal.

From January 15th to February 16th the pigs in No. 1 were fed on meal thoroughly scalded, and generally fed warm, and those in No. 2 on raw meal. Equal quantities of meal and swill were given to each, and the gain in each pen was just the same, viz: $75\frac{1}{2}$ pounds. During the 32 days 150 pounds of meal were fed to each pen. From February 16th to March 18th the two pigs in No. 1 fed on raw meal, gained 100 pounds; the two in No. 2, fed on scalded meal, $108\frac{1}{2}$ pounds; and the two in No. 3, fed on an equal weight of raw barley meal 89 pounds.

This last trial would appear to show a gain of $8\frac{1}{2}$ per cent. in favor of scalded meal, but one of the pigs in No. 1 had for two months been gradually falling behind the others. During the last 30 days he gained only $46\frac{1}{2}$ pounds, while his mate gained $53\frac{1}{2}$ pounds, or only three-quarters of a pound less than the average of the two fed on scalded meal. The pigs fed on barley meal $15\frac{1}{4}$ pounds less than the average gain of the others. Calling this gain worth 12 cents per pound, $15\frac{1}{4}$ pounds would be worth \$1.83, and as 300 pounds of meal were fed to each pen, we have as the result of this trial, 50 pounds of corn meal worth $30\frac{1}{2}$ cents more than 50 pounds of barley meal.

During the 31 days ending April 18th, the two pigs fed on scalded meal gained $99\frac{1}{2}$ pounds, the two on raw meal 122 pounds, and the two fed on an equal weight of barley meal 95 pounds. This result makes barley meal comparatively a little more valuable than last month's trial.

During the next month, ending May 19th, raw meal was compared with fermented meal. Two pigs fed on raw, sweet meal, gained 71 pounds, and the two fed on sour meal $47\frac{1}{2}$ pounds.

In the above detailed experiments we have asked four questions and obtained the four following answers, viz: 1st, Should corn be ground? Answer, yes. 2d, Should meal be scalded and fed warm, even in the winter? No. 3d, Should it be fermented? An emphatic no. 4th, How does barley meal compare in value with corn meal? The two months' trial make 50 pounds of barley meal to 50 pounds of corn meal as 85 to 100.

Experiments made with another breed, or at a different age, or at some other season of the year, may give a different result. We

find, however, that the result in regard to the comparative value of scalded and raw meal is not materially different from that obtained from a well conducted experiment by Mr. Joseph How of Methuen, Mass., as given in the Patent Office Agricultural Report for 1849, p. 240. Mr. How makes the value of scalded meal to that of raw meal, as feed for swine, as $91\frac{2}{3}$ to 100. Our three months' trial makes scalded meal fed warm, to raw meal fed cold, as $95\frac{1}{2}$ to 100.

In feeding whole corn and meal we find the value of corn to that of meal to be $83\frac{3}{4}$ to 100.

We shall soon try by experiment to ascertain the comparative value of raw meal and cooked meal fed *cold*. In our experiments last winter we intended to have the cooked meal fed to the swine blood-warm.

*Experiment with 61 varieties of Potatoes at the College Farm, Orono.
Experiment Conducted by George O. Weston and B. F. Watson
of the College.*

Time of planting May 28th. Eight hills of each variety. Time of digging September 16th. No rust or rot. Rows 3 feet apart, hills 18 inches. Potatoes of medium size cut into four pieces, and one piece in a hill. Soil rather heavy clay-loam, manured last fall on greensward, with 15 loads of stable manure to the acre. Broken up about the middle of May. Potatoes covered with a horse-hoe. Weeded the last of June. Hoed with a horse-hoe the first of July. Drought severe. Tops green when dug.

Variety.	Time of Blooming	Yield.			
		Large.		Small.	
		lbs.	oz.	lbs.	oz.
Andes		12	10	2	4
Bermuda.....	July..... 30,	7	8	.....	14
Black Diamond.....		1	7	4	7
Breese's Prolific.....	30,	3	.....	6	6
Buckeye.....	18,	4	6	2	8
Buckley Seedling.....	30,	5	6	2	6
Calico.....		5	15	4	1
Callao.....		5	4	3	14
Central City.....	30,	5	12	6	4
Chenery.....		4	.....	5	14
Cinnamon Garnet.....	23,	9	7	3	7
Chamberlain's Seedling.....	20,	7	4	1	.....
Colebrook's Seedling.....	August... 3,	15	1	3	11
Concord.....	July..... 30,	4	8	3	5
Cowhorn Seedlings No. 1.....	30,	3	12	3	.....
Cuzco.....		10	10	3	12
Dana's Seedling.....	August... 3,	11	8	2	14

Experiment—(Continued.)

Variety.	Time of Blooming.	Yield.			
		Large.		Small.	
		lbs.	oz.	lbs.	oz.
Dover Seedling	August... 3,	9	14	6	.....
Dover.....	3,	8	.....	4	.....
Early Golden.....	8,	5	7	4	4
“ Henry.....	July..... 30,	9	2	1	10
“ June.....	.....	1	11	4	3
“ Prince.....	.....	3	.....	2	9
“ Peachblow.....	18,	13	4	4	.....
“ Rose Seedling No. 1.....	.....	3	12	3	14
“ Stevens.....	.....	11	6	4	10
Excelsior.....	July..... 30,	3	14	3	18
Fluke.....	30,	6	.....	2	4
Garnet Chili.....	18,	6	14	1	12
Gleason.....	August... 3,	5	3	2	14
Johnson.....	.....	7	5	2	1
Goodrich Seedling V.....	July..... 30,	12	8	1	6
Goodrich Seedling W.....	.....	5	12	3	.....
Goodrich Seedling Y.....	August... 8,	5	2	3	4
Goodrich Seedling Z.....	July..... 30,	4	12	1	10
Harrison.....	.....	7	.....	6	2
Jackson White.....	30,	11	.....	2	11
Jones' Seedling.....	23,	6	10	1	12
King of the Earlies.....	.....	3	1	3	1
Lapstone Kidney.....	30,	5	13	3	9
Orono.....	20,	5	3	5	7
Pale Blush Pinkeye.....	30,	5	1	3	1
Patterson's Irish Blue.....	30,	.....	.....	13	9
Patterson's Blue.....	23,	5	8	5	4
Pinkeye Rustycot.....	August... 6,	6	6	2	.....
Prairie Seedling.....	.....	8	3	2	5
Prince Albert.....	July..... 30,	4	2	2	13
Rochester Seedling.....	30,	3	1	2	7
Rock.....	30,	3	12	3	8
Shaw.....	30,	8	3	1	10
Seedling of Garnet Chili.....	30,	5	1	8	.....
Titicaca.....	30,	6	3	2	.....
Union.....	30,	10	4	3	12
Utica Pinkeye.....	30,	4	4	4	4
Vanderveer.....	August... 3,	4	.....	3	7
Western Chief.....	July..... 18,	4	10	2	8
White Mountain.....	30,	5	5	5	5
White Chili.....	30,	1	8	5	10
Willard's Seedling.....	30,	10	8	2	4
White Rock.....	30,	2	3	4	15
Worcester Seedling.....	.....	2	4	6	2

In our field culture the Orono, Chamberlain's Seedling, Prince Albert, and Excelsior potatoes were compared. Of these the Oronos and Chamberlains yielded best and were best for table use. The Excelsior is too late a potato for this climate. A potato that will not ripen in four months cannot supplant the Orono. The Chamberlain Seedling appears to be as good a potato as the Orono, which is very high praise, and being a recent *seedling* it may be less liable to rust and rot. The Prince Albert is not so good for table use as

the Orono, and is more liable to rot. We shall next year plant the Chamberlain for further trial.

ALSIKE CLOVER.

In the spring of 1868 we received from Calvin Chamberlain, Esq., of Foxcroft, some Alsike clover seed, which was sown in one corner of a large field laid down to grass at that time. The other clover seed sown in the field mostly died out the first winter. The Alsike has yielded two fine crops, and from its appearance last fall promises to yield another. If we can procure the seed we shall try this clover on a larger scale next spring. It bids fair to be a valuable acquisition, especially on clayey land.

STOCK.

Short Horn. John Bull 3d, 4 years old; 1 heifer 3 years old; 1 bull calf 8 months old.

Jersey. Champion, 4 years old.

Grades. 11 cows, 1 2-years old heifer, 7 yearlings and 4 calves.

It is desirable that at an early day additions be made to the stock on the farm, so that all the pure breeds of cattle of acknowledged value be represented.

HORSES.

Four team horses. Two of these will be in the woods the coming winter, and two remain on the farm.

SHEEP.

Fifty grades, having a large infusion of South Down blood, are to be wintered.

SWINE.

Ten Chester County Whites. The better we become acquainted with the Chester hogs bred by Dr. Cutter of Warren, Mass., the more highly we prize them. They are not "coarse" hogs as some of this breed are. They grow rapidly and fatten easily. Great care must be had to keep the breeders from becoming too fat.

During the past summer our hogs have had early each morning a feed of fresh cut grass. Even the fattening hogs relished this feed, and it was undoubtedly greatly conducive to their health during hot weather.

The pasture being poor, we commenced feeding the cows on green barley the last of July. The first day of August the first load of green corn was cut, and that feed was continued till the last of September. We cannot estimate the absolute or relative value of this crop less than we did last year. It was the most profitable of all our crops, and at the present high price of hay worth about \$200 per acre.

Mr. Joseph How of Methuen, Mass., in the Patent Office Report for 1849, concludes after quite a careful experiment, that green corn fodder is as good feed for milch cows as good hay. One half an acre of this corn was planted the first of June and one half the 15th of June. Another year we shall plant one-third the first of June, one third the middle and one third the last of the month.

CROPS.

The severe drought very much injured all the field crops excepting potatoes. The crop of hay was about ten tons less than last year. The Swedes were more than half destroyed by the drouth and insects. The yield of potatoes was quite good and the quality excellent. The mangolds yielded fairly, as did also the English turnips. There was about two-thirds of a crop of barley. Apples were abundant. All the garden vegetables grew well.

NURSERIES.

The large apple nursery is flourishing. The following shrubs and roots were received from Mr. S. L. Goodale in May last, for ornamental purposes, and have nearly all grown finely, viz: 25 Tartarian and Siberian Honeysuckles; 25 Philadelphus Grandiflora, 12 Weigela Rosea, 6 Weigela Amabilis, 5 Purple-leaved Barberry, 3 Clethra Alnifolia, 6 Deutzia Gracilis, 12 Prairie Roses, 4 Grafted Rhododendrons, 4 Catawbiense Rhododendrons, 4 Kalmia Latifolia, 4 Chinese Peonies.

Several varieties of raspberries and grapes were received at the same time.

One hundred and fifty seedling pears and a large variety of forest plants were received in May and planted in the nursery. These were injured on the way here, and a large part died. The 100 Norway maples are, however, nearly all alive, and about two-thirds of the pears.

The raspberries and blackberries set out last year, have grown well; the black caps astonishingly.

AGRICULTURAL IMPLEMENTS.

During the past year two new mowing machines have been placed upon the farm, chiefly at the expense of the manufacturers, viz: the Clipper and the Young Warrior. These were quite carefully compared with our No. 1 Buckeye, purchased four years ago. We had no means of determining the exact amount of draft required by each machine, and as the Young Warrior cut only four feet two inches, its draft could not be well compared with our larger machines. These machines were all used by three men of experience and good judgment, who had used almost all the mowing machines in the market. These men preferred the Clipper to our Buckeye. They thought that the Clipper, with a cutter-bar five feet long, was easier for the team than the four feet eight inch Buckeye. The cutter-bar of the Clipper, sliding upon a shoe, moved over the inequalities of the surface much more steadily than those of the Buckeye and Young Warrior resting upon a small wheel. Whether in very thick and tangled grass the shoe would clog worse than a wheel we cannot tell, as we had but little such grass to try them in. Where there was a yield of a ton and a half to the acre the Clipper worked finely. A special advantage that the Clipper has over the other two, is in the attachment by which the driver can at will, while the machine is in motion, raise or lower the guards of the cutter-bar. He may let them drop down to a horizontal position, or bring them up to quite an angle with the surface, and enable the cutter-bar to slide easily over any sods or other similar obstructions. This advantage was very apparent while mowing a piece of ground top-dressed last spring with manure poorly pulverized.

In the Young Warrior the guards are only $2\frac{3}{8}$ inches apart, and the sections are the same width, while the guards of the Buckeye are $3\frac{1}{2}$ inches apart.

The Young Warrior cuts more evenly than it is possible from their very construction for either of the other machines to cut. Greater simplicity and strength, and lighter draft are claimed for it. Each machine, however, did its work well, and that machine is sure to be liked best in the end which is most durable and has the lightest draft. Our mowers all went into the field prejudiced in favor of the Clipper and against the Young Warrior. After a thorough trial the answer of one of them in reply to the question which he liked best, was, "I like both best." The large light-

made wheels of the Clipper, with wrought iron spokes, were liked by all, as were also its steel guards.

French's Cultivator is only the common cultivator with inch square steel teeth set corner-wise, and bent towards the point so as to hook forward. Judge French has been complained of for claiming a patent for so simple an invention. But simple as it is, the improvement is very great. No cultivator that we have seen compares with it for usefulness on land that is not rocky and contains twitch grass. When shut up it could at the time of weeding be run between the rows of fodder corn which were only 27 inches apart. If this cultivator cost fifty dollars instead of twelve we could not on this farm afford to do without it. As soon as the rows of potatoes could be seen it was run between them, and as it worked up near the rows they were easily weeded, and the ground left in fine condition for Chandler's Horse-Hoe, which followed when the potatoes were the right height. Some other farmers in this neighborhood tried this cultivator and were much pleased with it. Mr. Gregory, while lecturing here in the fall highly recommended it.

Shares' Harrow and Nishwitz's Pulverizer were quite carefully tried and their work compared. For pulverizing simply, Nishwitz's is superior. On land newly broken up and somewhat lumpy Nishwitz's did the best, but on land plowed last fall and more compact, where we wished to kill twitch grass, Shares' harrow was much the best.

Both of these implements, as well as French's cultivator, loosen the soil and make it lighter, like the plow, instead of making it more compact like the old-fashioned harrow. The old harrow is destined to be used less and less.

The subsoil plow was used on about an acre of the potato ground. No difference could be seen in the potatoes while growing or when dug.

A very good cheese vat with the accompanying apparatus, the gift in part of William Ralph & Co., of Utica, N. Y., was in use here during a part of July and August. Hon. X. A. Willard instructed the students in regard to its use, and a few of them became quite familiar with the process of cooking the curd and making Cheddar cheese. The vat is very convenient and complete in its arrangements, but in order to make its use economical and bring out its real merits, the milk of a larger number of cows than we had on the farm should be used. The vat would have accom-

modated fifty cows or more, and one man could have done the work. As an educator, however, rendering the students familiar with the method of making factory cheese, it is indispensable.

THE LABOR SYSTEM.

On looking over my account-book I find the sum of the charges against fifteen students who have been here quite constantly during the past year, amounts to \$1,939.41. Of this sum they have paid in work \$800.91. One hundred dollars of this was paid for digging the cellar of the laboratory; about \$60 for surveying and ditching where we under-drained; \$25 for carrying the mail; and various other sums should be charged either to the construction account or to the general account. In earning this large sum of money I question whether any one of these students interrupted materially his college studies. It is often true that the most industrious, faithful laborers on the farm are the best students. One desirable result attained here and observable to all, is, that labor is made honorable. One of the best scholars in his class has assisted our washer-woman regularly every Monday afternoon, using the washing machine. He did it with entire cheerfulness, and had no thought of losing caste by doing it. A son of one of the most wealthy farmers in the State has with the same cheerfulness and in the most faithful manner assisted regularly in milking the cows.

The money earned by labor or the information obtained by it is not, however, the object of primary importance with the students. We wish it to be fully understood by all, that students come here to obtain, in the words of our organic act, "a liberal education." This is, and should be the leading, primary object. But subsidiary to this comes in the labor plan, and if it does not interfere with the leading object, is there not a great gain in it? It is needless to ask such a question of poor parents struggling to educate their sons, or of any man of experience who has considered well the value of industrious habits, and the pernicious effect of so educating young men that they often come to esteem manual labor degrading.

CATALOGUE
OF THE
TRUSTEES AND FACULTY
OF THE
STATE COLLEGE OF AGRICULTURE AND THE
MECHANIC ARTS,
Its Design, Courses of Study, Etc.
ORONO, ME.....JANUARY, 1871.

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DESIGN OF THE INSTITUTION.

It is the design of the Maine State College of Agriculture and the Mechanic Arts to give to the young men of the State who may desire it, at a moderate cost, the advantages of a thorough, liberal and practical education. It proposes to do this by means of the most approved methods of instruction, by giving to every young man who pursues the course of study, an opportunity practically to apply the lessons he learns in the classroom, and by furnishing him facilities for defraying expenses by his own labor.

By the act of Congress donating public lands for the endowment and maintenance of such Colleges, it is provided that the leading object of such an Institution shall be, "without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to Agriculture and the Mechanic Arts."

While the course of study fully meets this requisition, and is especially adapted to prepare the student for agricultural and mechanical pursuits, it is designed that it shall be also sufficiently comprehensive, and of such a character as to secure to the student the discipline of mind and practical experience necessary for entering upon other callings or professions.

CONDITIONS OF ADMISSION.

Candidates for admission to the Freshman Class must be not less than fifteen years of age, and must pass a satisfactory examination in Arithmetic, Geography, English Grammar, History of the United States, and Algebra as far as Quadratic Equations.

Candidates for advanced standing must sustain a satisfactory examination in the preparatory branches, and in all the studies previously pursued by the class they propose to enter.*

Satisfactory testimonials of good moral character and industrious habits will be rigidly exacted.

COURSE OF STUDY—FIRST YEAR.

FIRST TERM—Algebra, Robinson. History, Willson. Physical Geography, Guyot. Rhetoric, Haven.

SECOND TERM—Algebra, Robinson. History, Willson (first half term). Botany, Gray (second half term). Physical Geography, Guyot. Book-keeping. Rhetoric, Haven.

THIRD TERM—Geometry. Botany (Analysis), Gray. Horticulture. Natural Philosophy. Rhetoric, Haven.

Lectures on Anatomy and Physiology, Meteorology, Physical Geography, Natural Philosophy, Structural Botany and Practical Agriculture; English Composition and Declamation will be regular exercises throughout the year.

SECOND YEAR.

FIRST TERM—Geometry, Loomis. Botany, Gray, Darlington, Johnson. Chemical Physics, Silliman. Drainage, Waring. Rhetoric.

SECOND TERM—Trigonometry, Loomis. French. Chemistry, (General). Elements of Agriculture. Rhetoric,

THIRD TERM—Surveying and Navigation, Loomis. French. Chemistry (Analytical). Dairy Farming. Rhetoric.

*To accommodate those wishing to join the present Freshman class at the commencement of the second term, there will be an examination on Tuesday, January 24th, 1871. Candidates proposing to enter at that time should confer at once with Professor Fernald, and learn definitely of the course of study pursued by the class during the fall.

Lectures on Botany, Chemical Physics, Drainage, Chemistry, Dairy Farming and practical Agriculture; English Composition and Declamation will be regular exercises throughout the year.

THIRD YEAR.

FIRST TERM—Spherical Trigonometry, Loomis. Conic Sections, Loomis. French (first half term). German (second half term). Chemistry (Qualitative Analysis). Mineralogy (Determinative). Agriculture. Market Farming and Gardening. Logic.

SECOND TERM—Mechanics (with lectures on Applied Mechanics). Industrial Drawing. German. Chemistry (Quantitative Analysis). Agriculture, Cultivation of the Cereals. Logic.

THIRD TERM—Civil Engineering. Industrial Drawing. German. Comparative Anatomy and Zoology. Chemistry Applied, Metallurgy, Commercial Products, or Agriculture. Logic.

Lectures on Chemistry, Mineralogy, Market Farming and Gardening, including the culture of the small fruits, the cultivation of Grasses and the Cereals, Applied Mechanics, Comparative Anatomy, Zoology and Sheep Husbandry. Regular exercises in English Composition and Original Declamation throughout the year.

GENERAL STATEMENT OF THE COURSE. The regular course will occupy four years, and there will be three terms in a year of thirteen weeks each. The essential features of the course are indicated by the following outlines of study:

English Language and Literature, Mathematics, including Algebra, Geometry, Trigonometry, Surveying, Navigation, Mechanics and Civil Engineering, Chemical Physics, General and Agricultural Chemistry, Laboratory Practice, Animal and Vegetable Physiology, Systematic Botany, Horticulture, Anatomy, Veterinary Art, Entomology, Draining, Stock-Breeding, Book-keeping, Mineralogy, Geology, Zoology, Political Economy, History, Moral and Intellectual Philosophy, Military Science and Tactics.

The French and German languages will also form a part of the regular course.

SELECT COURSE. A select course will be arranged in due time, that, if persons of suitable age and acquirements, who cannot avail themselves of the complete course, desire to pursue some one or more of the branches of study related to Agriculture, Horticulture or Mechanics, they may be received for a less time than that required for the full course.

SPECIAL FEATURES OF THE COURSE. The prominence given to the Natural Sciences, and the practical element associated with nearly all departments of study, cannot fail to render the course especially valuable.

Nearly a year will be devoted to Botany and Horticulture, commencing early in spring and continuing till late in autumn. This course will embrace a thorough drill in Botanical Analysis; the study of plants as to their relative importance and geographical distribution; the study of those having commercial or medical value; of those which are cultivated for ornament, and also those which are detrimental, as weeds and poisonous plants. In the gardens to be provided, the student will learn practically the operations and processes in the department of Horticulture.

A year and a half will be devoted to Chemical Physics and Chemistry, commencing with the first term of the second year. The course in Chemistry proper will include General, Analytical, and Agricultural Chemistry. Under Analytical Chemistry will be taken up General Analysis, Use of Blow-pipe, Analysis of Minerals, Analysis of Soils, Ashes of Plants, Fertilizers and Farm Products.

Each student will devote two hours a day to Analysis, under the direction of the Professor of Chemistry, thus acquiring facility in conducting experiments, and securing a practical knowledge of the methods employed in chemical investigations.

Under Agricultural Chemistry will be considered Composition of Soils, Relations of Air and Moisture to Vegetable Growth, Food of Plants, Chemical Changes during Vegetable Growth, Chemistry of Farm Processes, Methods of Improving Soils, and various other topics which may properly be treated of under this department.

Other departments of science will be studied and taught, so far as may be, with special reference to their practical bearing, or their relations to Agriculture and the useful arts.

LABOR.

It is a peculiarity of the College, that it makes provision for labor, thus combining practice with theory, manual labor with scientific culture. Students in this Institution are required to labor a certain portion of each day, not exceeding three hours, for five days in the week.

The labor is designed to be, in the fullest sense possible, educational. To illustrate, when the members of a class are pursuing Botany, they will work in the gardens and orchards, under the direction of the Professor of Horticulture, thus rendering themselves familiar with the various forms of hand labor, and the various processes necessary for the successful prosecution of this art; and when they have become proficient in this department, their places will be supplied by others, and they will engage in some other form of labor until every student shall become familiar with all the forms of labor upon the farm and in the gardens and workshops.

Students will learn the use of tools and acquire a fitness for mechanical pursuits, under competent instructors, in the workshops to be provided for the study and practice of the Mechanic Arts.

LOCATION.

The College has a pleasant and healthful location intermediate between the villages of Orono and Upper Stillwater, and about a mile from each. Stillwater river, a tributary of the Penobscot, flows a short distance in front of the buildings, forming the western boundary of the College farm, and adding much to the beauty of the surrounding scenery.

The European and North American Railroad, over which trains pass several times each day, has a station at the village of Orono. The College is within nine miles of the city of Bangor, and is consequently easily accessible from all parts of the State.

FARM AND BUILDINGS.

The College Farm contains three hundred and seventy acres of land of high natural productiveness and of great diversity of soil, and is, therefore, well adapted for the experimental purposes of the Institution.

The building which has been used as a Dormitory for the two years past, contains eighteen rooms, and affords excellent accommodations for a limited number of students. Some of the lower rooms of this building are appropriated to general and class purposes.

The new Dormitory, now in process of erection, will be completed before next autumn, and will contain forty-six rooms. The Boarding House, also in process of erection, near the other College buildings, will be open to students at the commencement of the next term. With these new buildings, the Institution will furnish desirable accommodations for one hundred and twenty-five students.

The Chemical Laboratory is essentially completed and contains two apparatus rooms, a lecture room, a cabinet, a library and weighing room, a recitation room, and rooms for analytical and other purposes, and is in all respects admirably adapted to the wants of the Chemical and Mineralogical departments.

APPARATUS. The College is furnished with new and valuable apparatus for the departments of Physical Geography, Natural Philosophy and Chemistry, and for Surveying and Civil Engineering, to which additions will be made as the exigencies of the several departments require.

LIBRARY. The Library already contains several hundred volumes, some of which have been obtained by purchase, while others have been kindly donated to the College. It is earnestly hoped that so important an auxiliary in the education of those who are to be students in the College will not be disregarded by the people of the State, but that liberal contributions will be made to it, not only of agricultural and scientific works, but also of works of interest to the general reader.

READING ROOM. The Reading Room is supplied with a limited number of newspapers and periodicals. Grateful acknowledgement is herewith made for the following named papers, generously sent by the proprietors to the College:

The Sunrise, Presque Isle; The Piscataquis Observer, Dover; The American Sentinel, Bath; The Maine Farmer, Augusta; The Maine Standard, Augusta; The Aroostook Times, Houlton; The New England Farmer, Boston, Mass.; The Country Gentleman, Albany, N. Y.; Moore's Rural New Yorker, New York City; The Boston Daily Advertiser is sent by Hon. S. H. Dale, Bangor; The New York Tribune is furnished by S. Johnson, A. M.; La Semaine Agricole, by subscription.

The following scientific journals are furnished by subscription to the Reading Room, viz :

The Chemical News, Silliman's Journal, The Gas Light Journal, Journal of the Royal Agricultural Society (England), Boston Journal of Chemistry and the Bowdoin Scientific Review.

CABINET. A room in the Chemical Laboratory has been fitted up with cases for Minerals, and a few hundred specimens have been presented to the College. All specimens thus donated will be properly credited and placed on exhibition. Rocks illustrating the different geological formations and minerals found within the State, are particularly solicited.

LITERARY SOCIETY. A flourishing society has been organized by the students of the College, which holds weekly meetings for declamations, discussions, and other literary exercises.

PUBLIC WORSHIP. All students are required to attend daily prayers at the College, and public worship on the Sabbath at some one of the neighboring churches, unless excused by the President.

EXPENSES, AND MEANS OF DEFRAYING THEM.

Tuition is free to students from all parts of the State. Those from other States will be charged twelve dollars per term. Room rent is free, and each room is furnished with a bedstead, mattress, table, sink, and four chairs. All other bedding and furniture must be supplied by the students, who will also furnish their own lights. Three dollars per week will be charged for board, and fifty cents per week for washing and fuel. These bills, with those for incidental expenses, are payable at or before the close of each term.

Students receive compensation for their labor according to their industry, faithfulness and efficiency, the educational character of the labor being also taken into account. The average amount paid will be about twenty-five cents for three hours' labor.

The terms are so arranged that the long vacation occurs in the winter, that students may have an opportunity to teach during that time. By means of the amount thus

earned, together with the allowance for labor, the industrious and economical student can cancel the greater part of his College expenses.

GENERAL STATEMENT.

Students are required to make their own beds and sweep their own rooms.

Each student is required, at the commencement of his College course to deposit with the Treasurer of the College, a bond for \$100, signed by responsible sureties, to secure the payment of his board bill, and any incidental charges

Strict conformity to College regulations and requirements is the only condition of continued membership of the College.

Candidates for the next class should make early application.

CALENDAR.

1870. Aug. 25—Thursday, First Term commenced.
 “ Nov. 22—Tuesday, Examination. First Term closes.
 Vacation of nine weeks.
1871. Jan. 24—Tuesday, Examination for advanced standing.
 “ Jan. 26—Thursday, Second Term commences.
 “ April 25 and 26—Tuesday and Wednesday, Examination. Second Term closes.
 Vacation of one week.
 “ May 4—Thursday, Third Term commences.
 “ July 24—Monday Evening, Junior Exhibition.
 “ Aug. 1—Tuesday Evening, Prize Declamation of Sophomore Class.
 “ Aug. 1 and 2—Tuesday and Wednesday, Examination. Third Term closes.
 Vacation of four weeks.
 “ Aug. 29—Tuesday, Examination for admission to College.
 “ Aug. 31—Thursday, First Term commences.
 “ Nov. 28 and 29—Tuesday and Wednesday, Examination. First Term closes.

FOOT AND MOUTH DISEASE IN CATTLE.

In the summer of 1839 there appeared in Great Britain an epizootic disease among cattle, that is to say, a disease which, had it affected the human race, would be called an *epidemic*; and which has since been known as the "Foot and Mouth" disease. Somewhat similar cases had been previously known, but only sporadic, occurring occasionally and at such intervals as to give no general cause for alarm. But at the time abovementioned it spread with rapidity, and prevailed so extensively during that and the two following years (1840-1) that we are told scarcely a single parish escaped throughout the kingdom. Nor was it confined to cattle, but affected sheep and swine, poultry, rabbits, cats and deer. At the same time, as well as somewhat before and after, influenza, catarrhs and sore throats prevailed much among horses. Neither temperature nor weather seemed much to influence it. It visited all localities alike. Prof. Sewell, of the Veterinary College, writes at that time, "as far as situation, nature of the soil and general features and aspects of the country are described no exemption from the disease is recorded, whether mountainous or hilly, flat, wooded or open, dry or wet."

Although not usually fatal, many beasts died, but greater loss ensued from the debility which the disease produced or left behind. In some cases the symptoms were slight and the animals recovered without severe illness and without medical treatment; in others the symptoms were severe and attended with much suffering and danger.

During the thirty years following, the same disease has appeared there several times as an epizootic, but in no case with such severity or wide-spread prevalence as to create general alarm, and during the early part of 1869 little was heard of it beyond its existence in the sporadic form in a few places in England and Scotland. At the beginning of summer, however, there was a sudden augmentation of the disease; and as this was coincident with the malady assuming an epizootic form on the continent of Europe, many believed the rapid increase in England to have been owing to importation of diseased animals. Official inquiry, however, did not confirm that opinion. It appeared, however, that the outbreak on the continent was quite as remarkable as that in Great

Britain. "Countries which had been free from the disease for many years were visited, and it may be said that from the shores of the German Ocean and the Baltic to those of the Black Sea scarcely a single country escaped."

The wide-spread prevalence of this disease* both in Great Britain and on the Continent of Europe, induced the authorities here to adopt precautionary measures against its introduction into the United States; and strict regulations issued from the Treasury Department, to be enforced by Custom House officers.

We know, from personal experience that these were rigidly adhered to at Portland, and undoubtedly equal care has been exercised at many other ports of entry. But the disease has appeared in this country; and its introduction is said to be traced to the importation of two sick animals from Liverpool into Canada in August last. From these it has spread in various directions and to a wide extent. About the middle of November a drove of cattle, bought in Albany, N. Y., were taken in the cars to Poughkeepsie, and being thence driven East left it in their path and carried it into Connecticut. It appears also to have been carried to Brighton, Mass., by Canadian cattle, whence it has spread into many towns in Massachusetts and New Hampshire.

It remains to be seen whether the climatic and other conditions in this country, at this time, or at any future time, are as favorable to its development as in Europe; and inasmuch as cattle diseases have been usually less rife here than abroad, we may, not unreasonably, hope for a larger degree of immunity. Thus far we have escaped the Rinderpest, or cattle plague. Pleuro Pneumonia has existed in the swill-milk stables near New York city for many years, and although few animals leave these stables except to be slaughtered, or in charge of the scavenger, yet some have left, and its spread in this way has been neither so rapid nor extensive as might have been anticipated. About ten years ago the same disease was directly imported into Massachusetts from Europe, but the efforts made for its suppression, although, costly, were

* The (London) Veterinarian for December, speaking of this disease, says: "At the date of our report for the month of October, fifty-three counties in Great Britain were returned as having 3,092 centres of infection of this disease, while at the corresponding date for November we find that, although reports have been received from fifty-four counties, the centres of the malady have been lessened by 248. This diminution affords encouragement for hope that the malady is again on the wane."

successful, and to a degree which might not have been so readily attained under conditions similar to those which prevail abroad.

But I should be remiss in the discharge of my duty did I not promptly advise the farmers of Maine of the fact of the introduction of this new cattle disease, and lay before them such information regarding its character, symptoms and treatment as I have been able to obtain, together with suggestions in regard to precautions and preventive measures.

Character of the Disease.

According to most foreign authorities the Foot and Mouth disease is constitutional in its nature, rather than local, although manifesting itself locally in a peculiar manner. It is known to veterinary practitioners as *eczema epizootica*, or *epizootic aphtha*. In the human subject, aphthous patches upon the mucous membrane of the mouth are indicative of great constitutional debility. They are supposed to be accompanied by the growth of a microscopic fungus, discernible in most cases under a good objective. It is however, not strictly proper to speak of this appearance as a disease; it is the sign of a disease; the accompaniment and not the cause.

According to the same authorities, the nature of the "Foot and Mouth" disease is that of a low fever, often exhibiting typhoid characteristics, great debility quickly supervening, together with, at times, a tendency to putridity. Premising that, in this as in other diseases, the appearances vary somewhat in different cases, as for instance, that sometimes the feet and sometimes the mouth is first or more seriously affected, etc., it may be said that the earliest symptoms, generally, are a dull and listless appearance, staring coat, cold extremities, and perhaps a shivering fit. Soon, however, a reaction follows; the skin, limbs and mouth become hot; in cows the secretion of milk diminishes and the udder becomes hot and tender, the pulse quickens and sometimes the tongue swells. Very soon come shivering and frothing at the mouth, which also becomes lined with watery blisters, and these also appear on the lips and tongue, and on the teats of cows. The food is frequently dropped out unmasticated, as if chewing were too painful to be endured. The little vesicles, or blisters, also appear between the hoofs; and the disease in the feet sometimes becomes so bad that not only is great pain caused by the inflammation, but the hoofs exfoliate and drop off.

After two or three days the blisters about the mouth gradually become opaque and at length burst and discharge an irritating watery fluid which increases the soreness; the cuticle comes off, leaving raw sores and shreds of loose skin. After some time these sores scab over and a healthy appearance gradually returns. Usually, during the first few days the malady increases in severity, after which amendment generally commences, and the beast slowly recovers. In mild cases it not unfrequently happens that the first observed symptoms are a soreness of the feet, lameness, or a slavering of the mouth, which, after some days, passes away without serious prostration of strength or loss of flesh. It is more likely to be severe with milch cows than with other stock, and somewhat in proportion to the time which has elapsed since calving; those recently calved suffering most. Sometimes the complaint becomes complicated with inflammation of some organ—as for instance, the lungs, in which case the danger is much greater. In milch cows the udder is often affected with tumors or abscesses constituting something very like what is commonly called garget. Those recently calved usually suffer most. *In no case should the milk from cows laboring under this malady, however slight the attack, be used for food, as serious consequences have ensued from its use.*

Treatment.

The treatment which has been bestowed upon this disease has varied with the opinions held concerning it; some of it may be fairly deemed barbarous; in other cases it has been guided by a more or less accurate knowledge of the pathology of the disease. From the best information at command, there can be little doubt that *good nursing* is of more avail than medicine, although the latter *may be judiciously* used with advantage. The disease is one which will run its course like small pox or measles in man. If there be costiveness mild aperients, *but not active purgatives*, may be given in the early stages, as for instance, a moderate dose of epsom salts. Neither bleeding nor other depleting measures should be resorted to. Astringents may be applied to the mouth. For an astringent and so-called healing application, a solution of tannin in glycerin, one part of the former in six of the latter, would probably be found best; a very little being occasionally applied to the mouth with a feather or soft brush; but as this may not always be easily procured, a cheap substitute may be found by dissolving alum in water at the rate of one pound in two

gallons ; or white vitriol (sulphate of zinc), a pound in three gallons. Either of these solutions (or both alternately), may be used for washing the mouth, and may be applied by means of a soft sponge, or rag tied to a handle, and used as a swab. The same may be applied to the udder, and if it becomes seriously inflamed a warm bran or flaxseed poultice may be applied. In severe cases it sometimes becomes necessary to draw the milk by means of tubes inserted into the teats. The diseased animals should be kept in a dry, comfortable place, suitably ventilated, and receive good nursing, the utmost attention being paid to cleanliness. If unable to masticate their usual food it should be chopped very fine and well moistened until quite soft, and if this does not serve the purpose, mashes of coarse-ground wheat and bran, or flaxseed tea or other similar diet may be administered.

To the feet may be applied a wash made by dissolving blue vitriol (sulphate of copper) in water, one pound to two gallons. They should be kept as clean as possible, and this is greatly facilitated by keeping the animals on a clean smooth floor, and the litter frequently changed. Neglect in this respect is liable to be followed by ulceration and loss of hoof. If matter forms beneath the hoof, all loosened horn should be carefully pared away, and if much inflamed, a bran poultice should be applied for a day or two, and then the above named wash used. Some veterinary surgeons use the solution of blue vitriol for the feet double the above strength, or two ounces to the pint, and follow it with an application of tar.*

So far as I have learned regarding the progress of epizootic aphtha in this country, it has thus far generally assumed a rather

* After the above was in type, I find the following from Prof. Low, V. S., of Cornell University, in the Journal of the New York State Agricultural Society :

“The sores on the feet require powerful applications. The parts must first be thoroughly cleansed by drawing a coarse rag through between the claws to detach any shreds of dead cuticle, and expose a fresh sensitive surface. To this may be applied, with a feather or soft brush, either strong carbolic acid, or a solution of one part of sulphuric acid in three parts of water. This done, a strip of strong cotton, fifteen to eighteen inches long, is covered with tar to the extent of three inches in its middle part, drawn up between the claws so as to apply the tar to the diseased surface, and finally tied round the fetlock. This has the double effect of protecting the cleansed surface from contact with filth, and maintaining applied to it a stimulant and antiseptic dressing which greatly facilitates healing. One such dressing is usually enough. In dressing the hind feet I have found great help from the use of a strong round wooden bar, passed beneath the leg in front of the hock joint, and held by a man at each end so as to raise

mild type, and in a majority of cases has readily yielded to judicious treatment. Recovery is usually to as good health as before the attack, in which respect this disease differs widely from pleuro pneumonia, for in the latter the beasts which survive and attain a measure of health, ever afterwards carry incurable organic unsoundness of the lungs, and oftentimes extensive adhesions of the lungs to the pleura.

Dr. E. F. Thayer, an intelligent veterinary surgeon, and one of the Massachusetts Cattle Commissioners, informs me that, thus far, he has known it very severe in only one herd, of which two died and six others are so lame, or have the udder so disorganized that they might as well be dead. This herd had been highly fed for the production of winter milk, and the treatment was more energetic than judicious.

The term of incubation, or length of time which elapses after receiving the contagion, before the disease manifests itself, is frequently not more than forty-eight hours, but varies from two to six days, and is sometimes first noticed in the mouth, while others become lame before the mouth is much affected. In favorable

the leg and carry the foot backward. The leg is thus easily held, and the person applying the dressing is saved from all danger."

Prof. Low also gives the following as the best application to the mouth :

Carbolic acid (crystals)..... 1 dram.
Water..... 1 pint.

And for dressing the sores on the teats, the following :

Carbolic acid..... $\frac{1}{2}$ a dram.
Glycerine..... 10 ounces.

"The milk must be drawn off carefully, and if the sores are extensive, by means of a silver milk tube, introduced with great care, and moved round until all the milk has escaped. Inflammation of the udder may necessitate that it be fomented with warm water for an hour twice daily, and afterwards rubbed with an ointment composed of

Extract of belladonna..... 1 dram.
Lard 1 ounce.

"Should it remain swollen and hard after inflammation has subsided, it should be rubbed daily with iodine ointment. If matter forms, it is of importance to open the sac with a sharp knife or lancet, and obviate the danger of its bursting into the milk ducts."

He speaks of all cloven footed animals as about equally susceptible to the disease. "To other animals it appears to be communicated mainly or solely by the contact of the morbid discharges with their mucuous membranes, or by inoculation."

"To man it is frequently conveyed by drinking the warm milk, or by handling the mouths, teats or feet with raw or wounded hands. All *young animals* feeding upon milk are, like children, liable to diarrhoea."

cases they begin to mend in five or six days, and in a fortnight more the milk may be considered healthy.

Although exceedingly contagious, there is no evidence that it is infectious, all the facts going to show that actual contact with the virus, or germs of the disease is required to communicate it. But it must be remembered that these are exceedingly abundant, both in the copious saliva from the mouth, in the matter which exudes from sores on the udder, and from the feet, and even in the excrements; that they may be conveyed with great ease, in a thousand ways, and to considerable distance, perhaps, by the shoes of attendants, the feet of dogs, or by any object to which the morbid discharges have become attached. Consequently too great caution cannot be observed, nor too great care taken, to *thoroughly disinfect* whatever has become contaminated.

Since we can do little for any which may become affected, (beyond conducting its course to a favorable issue by judicious management,) we should do all in our power to prevent its entrance into the State. If it becomes once introduced and domesticated among us, as it has in foreign countries, the losses to which we may at any time be liable in the future, by reason of temporary loss of milk, and by permanent injury to the udders of cows, by the loss of flesh in fattening beasts, and the loss of labor of working oxen by reason of lameness, afford but a sad prospect to the farmers of Maine, whose dependence is so largely upon a successful cattle husbandry.

The Governor of the State appointed Commissioners on the 13th inst., under the act relative to contagious diseases in cattle, and they have issued a circular to municipal authorities, common carriers and others, cautioning all, and directing town officers to use their utmost endeavors to prevent its gaining an entrance into the State. (See appendix.) If, notwithstanding these efforts, it should come in, every herd in which it appears should be thoroughly isolated, and its spread prevented by all practicable means.

Prevention, Arrest and Disinfection.

Dr. Dewar of Kircaldy, sometime since proposed a method of cure for this malady which has been highly commended by those who have tried it; and which, whatever its merits as a curative measure, furnishes undoubtedly *the surest means of prevention, and of arresting its spread when once introduced into a herd*, which is

yet known. This is the employment of sulphurous acid gas, in other words, simple fumigation with sulphur. It is of easy application and trifling cost; *care and judgment are, however, required.* Let some bits of brimstone be burned on live coals contained in a suitable vessel or dish, (so as to avoid all risk of communicating fire,) and the fumes allowed to mix with the air of the building, penetrating every crevice, and filling the coats of animals.

It was formerly thought that these fumes were highly deleterious; but such is not the case unless inhaled in excess. It would indeed be easy to induce complete suffocation; but the air may be so far impregnated with sulphurous acid as to be very disagreeable and uncomfortable to breathe, and no harm ensue, but great good. An ounce or two is enough to burn at once for a barn of from six to twelve or twenty cattle, and the operation should be repeated regularly twice a day. The fumes should pervade all parts of the room equally, and not be stronger than the attendant can bear with moderate discomfort.

The use of sulphites, in case of cattle disease, the efficacy of which depends on the same agent, namely, sulphurous acid, was spoken of in my report of 1868, pages 226, 228; and of this fumigation method, I may say that, while I have no personal knowledge of its efficacy in the foot and mouth disease, yet from what is stated of its success, upon what appears to be reliable testimony, in connection with what is known of its use in arresting other epidemics, I have no hesitation in commending its employment; in this respect fully agreeing with the remarks of a writer in the (English) *Country Gentleman's Magazine*, who says: "Our belief in the value of this means of 'combatting' epidemic illness, is materially strengthened by the expression of those who have for years habitually resorted to it, as a refuge, during the prevalence of familiar scourges, such as measles, scarletina, whooping cough, typhus fever, &c., by the remarkable and hitherto unwonted immunity from such which not only individuals, but families and even communities have enjoyed, coincidently, to speak cautiously, with its intelligent and stated employment; from the reports which have reached the discoverer from all parts of the world, as to the, at least, modifying influence which it seemed to shed over intractable prevailing maladies; and last, not least, from the willingly accorded opinion of many of the

'heads' of the medical profession, that there is something more than mere probability in favor of the inferences which, we think, may fairly be deduced from the whole history of the experiment. It has a rival in carbolic acid, the virtues of which are, within certain limits, incontestible, but for the purpose at present under consideration, the one is, from its intrinsic condition, as circumscribed in its operation as a caged lion, whereas the sphere of the sulphur agent we believe to be boundless; and it possesses the unique attribute of being always ready with the command of 'go and he goeth,' in discharge of the benignant errand which it is not less fully competent to accomplish."

The reader of the above quotation should not be misled by the comparison of carbolic acid to a "caged lion" to underrate its efficacy. It is true that, while it cannot penetrate every crevice so easily as the sulphurous acid gas can, it is perfectly effective to the full extent to which it can be applied, and it can be applied as easily as any liquid whatever; consequently its scope is very wide, and wherever it can be easily obtained, it may be used to good advantage especially to disinfect clothing, cattle cars, yards, floors, excrements, &c.*

Having devoted some pages in my last report (1869), to the agricultural uses of carbolic acid (see pp. 301-8), it needs here only to be added, that caution must be used in its employment, that is to say, it should be greatly diluted. I may also add, that Dr. Thayer informs me that he has a high opinion of its virtue as a curative agent (when properly diluted, using for a mouth-wash a solution of one ounce in a gallon of water) in the malady now under consideration.

It is matter for rejoicing that veterinary science has made so much progress as it has, through the labors of eminent pathologists and therapeutists, towards the prevention and mastery of the diseases to which our domestic animals are liable. Most of the diseases which are epizootic are also zymotic in their nature; and all such are, to a very large extent certainly, if not wholly,

* I am informed that manufacturers now supply a crude article, containing forty per cent of carbolic acid, for a dollar a gallon or less, at wholesale. One gallon, of the strength named, would be sufficient to mix with forty gallons of water for disinfecting purposes; consequently it is a cheap as well as an effective agent for the purpose, and possesses a decided advantage over chloride of lime, chloride of zinc, copperas and other efficient disinfectants.

under the control of these two agents, to wit: sulphurous acid and carbohc acid, and when farmers generally become familiar with their uses and applications we may count with much confidence upon comparative immunity from such maladies as have ravaged other countries.

S. L. GOODALE,
Secretary Board of Agriculture.

AUGUSTA, January 18, 1871.

INDEX.

	PAGE.
Agricultural Organizations and Industrial Fairs.....	5
Alsike Clover.....	107
Barometer, indications of.....	153
Boys on the Farm.....	53
Catalogue of College of Agriculture and Mechanic Arts.....	425
Cows for Labor.....	378
Chemistry of Feeding Animals.....	173
Country Roads; their Construction, Maintenance and Value.....	223
Contagious Disease in Cattle.....	431
Cutting and Curing Hay.....	108, 113, 155
Climatic Influence of Forests.....	68
Cultivation a means of improving Soils.....	268
Curing Milk for Market.....	348
Cruelty to Animals.....	322
Dairying, advantages of Association.....	334
Distribution of Rains.....	126
Drainage.....	98, 146
Drainage of Roads.....	227
Farmers' Clubs as Educational Institutions.....	38
Farmers' Clubs, Reports from.....	376, 396
Fences, Law of.....	305
Fires for clearing Lands, Law of.....	320
Feeding Animals, Chemistry of.....	173
Foot and Mouth Disease in Cattle.....	431
Forests, effects of Destruction of.....	408
Grass Crop.....	96
Grasses—Varieties.....	100
Highways, Law of.....	315
Hay, Cutting and Curing.....	108, 113
Homes, our, where and what to make.....	59
Improved Stock of early introduction.....	14
Law for the Farmer. Mr. Lebroke's Address.....	305
Marine Manures.....	32
Organization of Farmers' Clubs.....	43
Our Homes, where and what to make them.....	59
Orchard Grass.....	104
Pounds and Trespass.....	310
Permanent Roads.....	229
Plows and Plowing.....	275, 382
Preparation of Soil for Grass.....	97, 161

	PAGE.
Report of College Farm Superintendent.....	416
Roads, their Construction, Maintenance and Value.....	223
Road Law.....	315
Rains, Distribution of.....	126
Sheep Husbandry.....	386
Sheep as Eradicators of Weeds.....	393
Sheep for Pastures.....	115
Soils, improvement of, by Cultivation.....	268
Shade Trees.....	93
Success, what constitutes.....	258
Second bloom of timothy.....	110
Temperature influenced by Screens.....	70
Trees affecting Health.....	85
Time to cut Hay.....	108
Under-draining.....	146
Utility of Farmers' Clubs.....	41
Varieties of Grasses.....	100
Water as an Agricultural Agent.....	389
Women, influence of.....	56

APPENDIX.

TO WHOM IT MAY CONCERN,

Including City and Town Authorities, Common Carriers, Cattle Drovers, and all others.

The undersigned, lately appointed by the Governor of Maine Commissioners on Contagious Diseases among cattle, under the statute relative thereto, approved March 19, 1862, hereby announce to the mayors and aldermen of cities and the selectmen of towns, to all common carriers, drovers and others, that a highly contagious disease among cattle known as *Eczema Epizootica*, or "FOOT AND MOUTH" disease, has been introduced into this country from Europe by way of Canada, that many cases exist in New York, Connecticut, Massachusetts and New Hampshire, and that it is spreading rapidly. There is also reason to fear that it already exists in a latent form or may be soon introduced into Maine.

This disease is not usually fatal, but where it has prevailed abroad it is dreaded fully as much as Pleuro Pneumonia, because of its more rapid spread and speedily prostrating effects. It is the most contagious disease known among cattle, being communicated with great facility either by contact of healthy with diseased animals, or with any object which has been contaminated by them, or by being placed in yards or conveyed in cars previously occupied by sick ones, or by being driven over roads previously trodden by diseased beasts. The infection is also conveyed by the clothing of attendants unless first disinfected.

In view of these facts, we urge upon the municipal authorities of all cities and towns in this State, that, should occasion arise, you perform your duties as prescribed in chapter 132 of the public laws of this State for 1862,* according to the spirit and intent thereof, and in the most prompt and efficient manner.

The isolation of diseased cattle, and of such as have been exposed to infection, should be immediate and complete, and should

* Chapter 14 Revised Statutes, *new edition*, (1871,) sections 37 to 54.

be accompanied with a thorough disinfection of all contaminated yards and buildings; and, in order to prevent its spread by traveling, they should, whenever practicable, be isolated upon the premises where the disease first appears.

It is believed that no occasion exists for the slaughter and burial of animals affected by the so-called "Foot and Mouth" disease, inasmuch as it is rarely fatal; the losses arising from it being due chiefly to the prostration of strength, loss of flesh, diminution and poisoning of the milk, and the time and care required in nursing. You are accordingly cautioned against incurring unnecessary expense by adopting measures which might be needful for the extirpation of a more fatal disease, but would not be called for by the prevalence of "Foot and Mouth" disease.

The municipal authorities of all cities and towns situated on the borders of the State are recommended to exert all the powers possessed by them, either as conservators of the public safety, or by virtue of Sections 4 and 5 of the above named Statute, or by any other enactment, to prevent the entrance of cattle from without the borders of the State so long as the present danger exists.

All common carriers, drovers, and all other persons are hereby prohibited, under penalty of law, from transporting or driving from place to place within the State, any cattle affected by, or which may have been exposed to infection from the so-called "Foot and Mouth" disease, until this prohibition be rescinded.

While the Commissioners deprecate anything approaching a panic, they believe that the facts justify serious apprehension, and the utmost caution. At the same time, they trust that, by being forewarned and informed regarding this dangerous and insidious disease, it may either be wholly kept out, or, by prompt, energetic, united action on the part of municipal authorities, seconded by the hearty coöperation of the people, that it may be extirpated before inflicting serious losses.

The cattle husbandry of Maine is the most prominent feature of its agriculture, and whatever seriously threatens its prosperity, thereby endangering a supply of wholesome meat and milk for the food of its inhabitants is matter of primary public importance.

S. L. GOODALE, } *State Commissioners*
 JOSEPH PERCIVAL, } *on Contagious Diseases*
 JAS. C. WESTON, } *in Cattle.*

STATE OF MAINE, }
 Augusta, Jan. 13, 1871. }

STATUTE RELATIVE TO CONTAGIOUS DISEASES.

The portions of this act deemed most appropriate in the case of foot and mouth disease are here appended :

SECT. 1. The selectmen of towns and the mayor and aldermen of cities in case of the existence in this state of * * * * * any * contagious disease among cattle, shall cause the cattle in their respective towns and cities which are infected, or which have been exposed to infection, to be secured * * in some suitable place or places, within such city or town, and kept isolated; and when taken from the possession of their owners, to be maintained, one-fifth of the expense thereof to be paid by the town or city wherein the animal is kept, and four-fifths at the expense of the state, such isolation to continue so long as the existence of such disease or other circumstance renders the same necessary; or they may, at their discretion, direct the owners thereof to isolate such cattle upon their own* premises, and any damage or loss sustained thereby shall be paid as aforesaid.

(Sect. 2 provides for slaughter and burial when necessary. Sect. 3 provides for appraisal of any so killed.)

SECT. 4. Said selectmen and mayor and aldermen are hereby authorized to prohibit the departure of cattle from any enclosure, or to exclude cattle therefrom.

SECT. 5. Said selectmen and mayor and aldermen may make such regulations in writing to regulate or prohibit the passage from, to or through their respective towns or cities, or from place to place within the same, of any neat cattle, and may arrest and detain, at the cost of the owners thereof, all cattle found passing in violation of such regulations, and may take all other necessary measures for the enforcement of such prohibition, and also for preventing the spread of any such disease among the cattle in their respective towns and cities, and the immediate vicinity thereof.

SECT. 6. The regulations made by selectmen and mayor and aldermen in pursuance of the foregoing section shall be recorded upon the records of their towns and cities respectively, and shall be published in such towns and cities in such manner as may be provided in such regulations.

SECT. 7. Any person who shall sell or dispose of any animal which is infected or known to have been exposed to infection within one year after such exposure, without the knowledge and consent of said selectmen or mayor and aldermen, shall be punished by fine not exceeding five hundred dollars, or by imprisonment not exceeding one year.

SECT. 8. Any person disobeying the orders of the selectmen or mayor and aldermen, made in conformity with the fourth section of this act, or driving or transporting any neat cattle contrary to the regulations made, recorded and published as aforesaid, shall be punished by fine not exceeding five hundred dollars, or by imprisonment not exceeding one year.

SECT. 9. Whoever knows or has reason to suspect the existence of any fatal, contagious disease among the cattle in his possession or under his care,

* This method is deemed much the preferable one in case of Foot and Mouth disease.

shall forthwith give notice to the selectmen of the town or mayor and aldermen of the city where such cattle may be kept, and for failure so to do, shall be punished by a fine not exceeding five hundred dollars, or by imprisonment not exceeding one year.*

SECT. 10. Any town or city whose officers shall neglect or refuse to carry into effect the provisions of sections one, two, three, four, five, six and seven, shall forfeit a sum not exceeding five hundred dollars for each day's neglect.

(Section 11 relates to appraisals. Section 12 authorizes municipal officers, when necessary, to establish quarantine grounds and buildings.)

SECT. 13. Whenever such disease shall exist in any town or city in this state, it shall be the duty of the selectmen of such town or mayor and aldermen of such city, forthwith to give notice thereof to the governor and secretary of the board of agriculture; *provided however*, that if commissioners shall have been appointed, as hereinafter provided, such notice shall be given forthwith to said commissioners.

SECT. 14. The governor is hereby authorized, whenever in his opinion the public good requires, to appoint commissioners who shall have full power to make all necessary regulations, and to issue summary orders relative thereto, for the treatment and extirpation of any contagious disease among cattle, and may direct the selectmen of towns and mayor and aldermen of cities to enforce and carry into effect all such regulations as may from time to time be made for that end; and any such officer or person refusing or neglecting to enforce, carry out or comply with any regulation of the commissioners shall be punished by fine not exceeding five hundred dollars, or by imprisonment not exceeding one year for every offense.

SECT. 15. When said commissioners shall make and publish any regulations concerning the extirpation or treatment of cattle infected with, or which have been exposed to, the disease known as lung murrain or pleuro pneumonia, or other contagious disease, such regulations shall supersede the regulations made by the selectmen of towns and mayors and aldermen of cities, upon the same subject matter, and the operation of the regulations made by such selectmen and mayors and aldermen shall be suspended during the time those made by the commissioners, as aforesaid, shall be in force. And said selectmen and mayors and aldermen shall carry out and enforce all orders and directions of said commissioners to them directed as they shall from time to time issue.

SECT. 16. All losses and damages sustained in consequence of the execution of the orders of said commissioners, shall be appraised as provided in the third section of this act, and paid as provided in the first section, and such necessary expenses as may be incurred by reason of said orders shall be paid in the same manner.

(Section 17 directs commissioners to keep record of doings and to report, etc. Section 18 authorizes the governor to terminate the commission at his discretion.)

* The Foot and Mouth disease not being usually "fatal," this penalty may not attach if notice be not given; but it would be well for owners of sick cattle to conform to the requirement.